Program and Abstracts

September 17-18, 2015

Rajabhat Maha Sarakham University, Maha Sarakham (Thailand)

In Cooperation with

Roi Et Rajabhat University (Thailand)
Vidyasirimedhi Institute of Science and Technology (Thailand)
Institute for Research and Development of New Technologies (Vietnam)
Vobra Special Pet foods, BV, Veghel (Netherlands)
University of Technology Sydney (Australia)
National University of Laos (Laos)
Waseda University (Japan)
Shinshu University (Japan)
Jena University (Germany)
Vinh University (Vietnam)
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizers</td>
<td>III</td>
</tr>
<tr>
<td>Committees</td>
<td>IV</td>
</tr>
<tr>
<td>Reviewers</td>
<td>V</td>
</tr>
<tr>
<td>Welcome Speech and Opening Address</td>
<td>VII</td>
</tr>
<tr>
<td>Keynote Speakers</td>
<td>X</td>
</tr>
<tr>
<td>Invited Speakers</td>
<td>XII</td>
</tr>
<tr>
<td>Invited Speakers Abstract</td>
<td>XX</td>
</tr>
<tr>
<td>Conference Program</td>
<td>XXVII</td>
</tr>
<tr>
<td>Oral Presentation Abstract</td>
<td>1</td>
</tr>
<tr>
<td>Poster Presentation Abstract</td>
<td>87</td>
</tr>
<tr>
<td>Proceeding Assemble Staff</td>
<td>111</td>
</tr>
</tbody>
</table>
Rajabhat Maha Sarakham University, Maha Sarakham (Thailand)

In Cooperation with

- Roi Et Rajabhat University (Thailand)
- Vidyasirimedhi Institute of Science and Technology (Thailand)
- Institute for Research and Development of New Technologies (Vietnam)
- Vobra Special Pet foods, BV, Veghel (Netherlands)
- University of Technology Sydney (Australia)
- National University of Laos (Laos)
- Waseda University (Japan)
- Shinshu University (Japan)
- Jena University (Germany)
- Vinh University (Vietnam)
Advisory Committees

- President of Rajabhat Maha Sarakham University
- President of Roi Et Rajabhat University
- President of Vidyasirimedhi Institute of Science and Technology
- President of Institute for Research and Development of New Technologies
- President of Vobra Special Pet foods, BV, Veghel
- President of University of Technology Sydney
- President of National University of Laos
- President of Waseda University
- President of Shinshu University
- President of Jena University
- President of Vinh University

Organizing Committees

- Vice President for Research, Planning and Development
- Vice President for International Relations, Art and Culture
- Vice President for Academic Affairs
- Vice President for Student Affairs and Human Resource Development
- Vice President for Administration
- President’s Assistant for Academic Extension and Public Relations
- President’s Assistant for Information and Technology
- President’s Assistant for Architecture and Landscape Development
- Dean, Faculty of Education
- Dean, Faculty of Humanities and Social Sciences
- Dean, Faculty of Sciences and Technology
- Dean, Faculty of Management
- Dean, Faculty of Agricultural Technology
- Dean, Faculty of Information Technology
- Dean, The College of Laws and Governance
- Dean, Graduate College
- Director, Research and Development Institute
- Director, Office of International Relations and International Education
- Director, Office of President
- Director, Office of Academic Promotion and Records
- Director, Office of Academic Resources Center
- Director, Office of Arts and Cultures
- Director, Office of Information Technology
- Director, Office of Academic Services
- Director, Office of University’s Standard and Quality Assurance
- Deputy Directors, Research and Development Institute
- Deputy Directors, Office of International Relations and International Education
Reviewers

- Prof. Dr. Pruet Siribanpitak
- Prof. Dr. Sumpan Rittidech
- Prof. Dr. Arunrat Chaveerach
- Assoc. Prof. Dr. Kanokorn Sumprach
- Assoc. Prof. Dr. Somsak Srisanatisuk
- Assoc. Prof. Dr. Alongklod Tanomtong
- Assoc. Prof. Dr. Wimol Sumranwannich
- Assoc. Prof. Dr. Jongkol Kanperm
- Assoc. Prof. Dr. Wareerat Kaewurai
- Assoc. Prof. Dr. Rachanee Sunsern
- Assoc. Prof. Dr. Virapong Saeng-xuto
- Assoc. Prof. Dr. Chaiyot Ruangsuwan
- Assoc. Prof. Dr. Thoop Tong Kwangswad
- Assoc. Prof. Dr. Prasart Nuangchalarern
- Assoc. Prof. Dr. Pisamai Sriampae
- Assoc. Prof. Dr. Suban Ieamvijarn
- Assoc. Prof. Dr. Aurawan Rittidech
- Assoc. Prof. Dr. Wimonrat Soonthornrojana
- Assoc. Prof. Dr. Sukanya Vongtanaboone
- Assoc. Prof. Dr. Sirisiri Thee-arsana
- Asst. Prof. Dr. Wantanee Buggakupta
- Asst. Prof. Dr. Chalida Niamnuy
- Asst. Prof. Dr. Chatree Faikhamta
- Asst. Prof. Dr. Jeerawan Ketsing
- Asst. Prof. Dr. Viroj Jadesadalug
- Asst. Prof. Dr. Nantarat Kruea-In
- Asst. Prof. Dr. Sakultala Wannapakhe
- Asst. Prof. Dr. Nipon Bhuwakietkumjohn
- Asst. Prof. Dr. Thanya Parametthanuwat
- Asst. Prof. Dr. Kowit Nambummeen
- Asst. Prof. Dr. Sa-nguansak Thanapornpoonpong
- Asst. Prof. Dr. Doungporn Amornlerdpisan
- Asst. Prof. Dr. Wichan Khongtham
- Asst. Prof. Dr. Nanta Palitawanont
- Asst. Prof. Dr. Tipparat Sittiwong
- Asst. Prof. Dr. Pufa Savagpun

Chulalongkorn University
Mahasarakham University
Khon Kaen University
Khon Kaen University
Khon Kaen University
Khon Kaen University
Kasetsart University
Naresuan University
Mae Fah Luang University
Chiang Mai University
Mahasarakham University
Mahasarakham University
Mahasarakham University
Mahasarakham University
Mahasarakham University
Phuket Rajabhat University
Rajabhat Maha Sarakham University
Chulalongkorn University
Kasetsart University
Kasetsart University
Silpakorn University
Kasetsart University Kamphaeng Sean Campus
King Mongkut's University of Technology North Bangkok Prachinburi Campus
King Mongkut's University of Technology North Bangkok Prachinburi Campus
King Mongkut's University of Technology North Bangkok Prachinburi Campus
Mae Fah Luang University
Chiang Mai University
Maejo University
Maejo University
Burapha University
Naresuan University
Naresuan University
Reviewers

- Asst. Prof. Dr. Thitiya Bongkotphet
- Asst. Prof. Dr. Pongsaton Amornpitoksuk
- Asst. Prof. Dr. Sutitda Rakkapao
- Asst. Prof. Dr. Kanit Mukdasai
- Asst. Prof. Dr. Niwut Srisawat
- Asst. Prof. Dr. Surachai Chancharat
- Asst. Prof. Dr. Sayan Phokate
- Asst. Prof. Dr. Songchai Wiriyampaipwong
- Asst. Prof. Dr. Panarat Phadee
- Asst. Prof. Dr. Sangkom Pumipun
- Asst. Prof. Dr. Somchat Maneechoti
- Asst. Prof. Dr. Benchob Wanno
- Asst. Prof. Dr. Adisak Singseewo
- Asst. Prof. Dr. Prayoon Wongchantra
- Asst. Prof. Dr. Bhumibong Jomhongbhibhat
- Asst. Prof. Dr. Sunee Sathitanant
- Asst. Prof. Dr. Ladawan Wattanaboot
- Asst. Prof. Dr. Mayureesiriin Siriwan
- Asst. Prof. Dr. Sasithorn Chaowarat
- Asst. Prof. Dr. Chanukorn Tabtimsai
- Asst. Prof. Dr. Toansakul Santiboon
- Asst. Prof. Dr. Wuthikorn Saikaew
- Asst. Prof. Dr. Somsangun Passago
- Dr. Kunlayanee Tantranont
- Dr. Yanasinee Suma
- Dr. Nittaya Pasukphun
- Dr. Pitchaya Boonsrirat
- Dr. Kittima Panprueksa
- Dr. Chaiyapong Ruangsuan
- Dr. Aripong Putkham
- Dr. Boonsom Yodmalee
- Dr. Monludee Chaowarat
- Dr. Sudapon Panyprouks
- Dr. Petcharat Jaiboon
- Dr. Nattinee Thongdee
- Dr. Panayuth Choeybai
- Dr. Nitya Klangchane
- Dr. Nisarat Chotechoei

Naresuan University
Prince of Songkla University
Prince of Songkla University
Khon Kaen University
Khon Kaen University
Khon Kaen University
Rajamangala University of Technology ISAN
Khonkaen Campus
Mahasarakham University
Mahasarakham University
Mahasarakham University
Mahasarakham University
Mahasarakham University
Mahasarakham University
Udon Thani Rajabhat University
Rajabhat Maha Sarakham University
Rajabhat Maha Sarakham University
Rajabhat Maha Sarakham University
Rajabhat Maha Sarakham University
Rajabhat Maha Sarakham University
Chiang Mai University
Mae Fah Luang University
Mae Fah Luang University
Prince of Songkla University
Burapha University
Khon Kaen University
Mahasarakham University
Mahasarakham University
Chiang Rai Rajabhat University
Sakon Nakhon Rajabhat University
Nakhon Ratchasima Rajabhat University
Udon Thani Rajabhat University
Rajabhat Maha Sarakham University
Rajabhat Maha Sarakham University
Welcome Speech
And Opening Address

Report on The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University
by Asst. Prof. Dr. Chumnian Pollaharn
Chairman of the Organizing Committee

Associate Professor Somchai Wongkasem, President of Rajabhat Maha Sarakham University, Chairman of the Opening Ceremony:

On behalf of the organizing committee, I would like to express deep appreciation for your presiding over the opening ceremony of the 5th International Conference on Sciences and Social Sciences ICSSS 2015. This year’s conference adopts the timely theme of Research and Innovation for Community and Regional Development, in “Celebrating the 90th Anniversary of Rajabhat Maha Sarakham University and the 150th Anniversary of Maha Sarakham Province”. The aims of the ICSSS 2015 are promoting research dissemination and enhancing academic networks as well as generating knowledge exchanges in Science and Social Sciences among Thai and international scholars.

This conference is organized by Rajabhat Maha Sarakham University in cooperation with the following educational institutions: Roi Et Rajabhat University (Thailand), Vidyasirimedhi Institute of Science and Technology (Thailand), Institute for Research and Development of New Technologies (Vietnam), Vobra Special Pet foods, BV, Veghel (Netherlands), University of Technology Sydney (Australia), National University of Laos (Laos), Waseda University (Japan), Shinshu University (Japan), Jena University (Germany), Vinh University, and Institute for Research and Development of New Technology (Vietnam). Without kind cooperation and shared resources from our partner universities, this event would not have been possible.

The ICSSS 2015, which is organized during September 17-18, is to present and share academic works or research studies through oral and poster presentations. For this conference, there are 107 research presentations (84 oral and 23 poster presentation), 8 keynote and invited speakers’ presentations. It is expected that there are approximately 500 participants taking part in the activities organized during this event.

May I now invite Associate Professor Somchai Wongkasem, President of Rajabhat Maha Sarakham University to declare open and address this International Conference on Sciences and Social Sciences 2015: Research and Innovation for Community and Regional Development.

Thank you.
Welcome and Opening Address

The 5th International Conference on Sciences and Social Sciences (ICSSS 2015)

by

Assoc. Prof. Somchai Wongkasem

President, Rajabhat Maha Sarakham University

Chairman of the conference organizing committee, Associate Professor Dr. Somchet Thinaphong, keynote and Invited Speakers, Participants, Distinguished Guests, Ladies and Gentlemen:

It is a great pleasure and honor for me to welcome you to Rajabhat Maha Sarakham University and address the 5th International Conference on Sciences and Social Sciences (ICSSS 2015): Research and Innovation for Community and Regional Development “Celebrating the 90th Anniversary of Rajabhat Maha Sarakham University and the 150th Anniversary of Maha Sarakham Province”. As stated in the announcement of this year’s conference, Rajabhat Maha Sarakham holds this international conference as one of the major events to celebrate the 90th anniversary of this institution that coincides with the 150th anniversary of Maha Sarakham Province.

On behalf of Rajabhat Maha Sarakham University, I would like to congratulate the organizing committee from RMU and our partner universities on the mutual commitment in organizing this international event as an academic platform for scholars and researchers to share and update their work in pursuing academic excellence. This is a great opportunity for participants to become informed of new ideas and progress in various fields under the disciplines of sciences and social sciences, especially in attempting to provide and seek solutions in different areas for upgrading our practices towards community and regional development.

May I express sincere appreciation to the organizing committee for their hard work, to the supporting organizations for their encouragement and moral support; and especially to all the partner universities taking part in this event, for their cooperation and generosity in sharing their resources and co-hosting this international conference.

I would like to extend my deep appreciation to all the participants, scholars and researchers, faculty and students of various universities, who submitted their papers for presentation at this conference in order to share their work and keep us informed of useful knowledge and research findings.

Last but not least, special appreciation goes to the opening keynote speaker, Associate Professor Dr. Somchet Thinaphong for his kind presentation, and other keynote and invited speakers of the various workshops for their kind cooperation to share their expertise and experience with the audiences of the different sessions. To all the participants and everyone involved, I wish you all a fruitful and successful conference and a very pleasant stay in Maha Sarakham Province.

May I now take this auspicious moment to declare open the International Conference on Sciences and Social Sciences (ICSSS 2015): Research and Innovation for Community and Regional Development.

Thank you.
Keynote Speaker
Assoc. Prof. Dr. Somchet Thinaphong
Director National Innovation Agency
Thailand

OFFICE
Director National Innovation Agency, Ministry of Science and Technology, Thailand

PRESENT POSITION
Associate Professor Doctor

EDUCATION
- 1980 Doctor of Engineering (D.Eng.) Asian Institute of Technology (AIT) (King’s Scholarship (Thailand))
- 1973 Master of Engineering (M.Eng.) Asian Institute of Technology (AIT) (British Government Scholarship)
- 1971 Bachelor of Engineering (B.Eng.) University of Tasmania (Australia) (Colombo Plan Scholarship)

EXPERIENCE
The experiences in engineering field are of extensive roles.
- 1988-2013 Executive Board Directors in Government Enterprises; directly involving in Mega Projects development such as Airports, Seaports, Underground Rapid Transit; and Expressway; and also board director in the field of oil and gas industries at PTTEP
- 1990-2000 Governor of Industrial Estate Authority of Thailand (IEAT)
- 1999-2001 President of Suvarnabhumi Airport
- 2009-2011 Chairman of the Board of the Market Organization, Ministry of Interior
Invited Speakers
Prof. Dr. Makoto OGAWA
Chemical Engineering and Biomolecular Engineering, Vidyasirimedhi Institute of Science and Technology
Thailand

OFFICE
Department of Chemical Engineering and Biomolecular Engineering, Vidyasirimedhi Institute of Science and Technology, Rayong 21210
Thailand

PRESENT POSITION
Professor Doctor

EDUCATION
- 1987 Graduate in Applied Chemistry (Inorganic chemistry), Waseda University, Tokyo
- 1992 Doctor (Engineering), Waseda University, Tokyo

SPECIALIZATION
Intercalation chemistry:
- Preparation and applications of mesoporous oxides
- Photochemistry and photophysics of organic dyes adsorbed on solids
Assoc. Prof. Dr. Tomohiko OKADA

Department of Chemistry and Material Engineering, Faculty of Engineering, Shinshu University
Japan

OFFICE
Department of Chemistry and Material Engineering, Faculty of Engineering, Shinshu University, Nagano 380-8553 Japan

PRESENT POSITION
Associate Professor

EDUCATION
- 1999 Bachelor, Department of Earth Sciences, Waseda University
- 2001 Master; 2004 Doctor (Sci.), Department of Resources and Environmental Engineering, Waseda University (Director: Prof. Makoto OGAWA)

SPECIALIZATION
Silica-based hybrid materials for possible applications as adsorbents, catalysts, separation and sensors
- Morphology: spherical (including hollow) particles and fibers;
- Components: layered silicates, Brønsted acid, magnetic particles, etc.
- Technique: emulsion, sol-gel, hydrothermal
Prof. Dr. Tony Moon
Institute of Physics
University of Technology Sydney
Australia

OFFICE
Organisation: University of Technology Sydney
Department/Division: Senior Deputy Vice-Chancellor

PRESENT POSITION
Professor

EDUCATION
- Graduated with First Class Honours from the University of Melbourne
- 1970 Ph.D. in Physics

SPECIALIZATION
- Science research policy
- Modern materials including nanotechnology
- International student issues
Prof. Dr. Craig Wheway
Faculty of Humanities and Social Science
Rajabhat Maha Sarakham University
Thailand

OFFICE
Faculty of Humanities and Social Sciences
Rajabhat Maha Sarakham University
80 Nakorn Sawan Road, Tambon Talad, Amphoe Maung
Maha Sarakham, 44000 Thailand

PRESENT POSITION
Professor Doctor

EDUCATION
- 2012 Ph.D. in Human Geography, University of Leicester.
- 2005 Upper Second Class Honours, Geography B.A., University of Leicester.

SPECIALIZATION
Urban and rural geography, gentrification, the geography of higher education and regional development. The class structures of advanced and emerging world economies including South East Asia as tourism in the developed and the developing world.
Prof. Dr. Anton C. Beynen
Vobra Special Pet foods, BV, Veghel
Netherlands

OFFICE
Vobra Special Pet foods, BV, Veghel, Netherlands

PRESENT POSITION
Professor Doctor

EDUCATION
-1977 Master of Science in Human Nutrition
-1981 Ph.D. Biochemistry
-1987-1992 Professor at the University of Wageningen

EMPLOYMENT
-1991-1993 University of Indonesia
-1993-2007 University of Utrecht
-2006-Now Rajamangala University of Technology-Isan, Sakon Nakhon
2009-2014 King Saud University, Riyadh, Saudi Arabia

SPECIALIZATION
-Applied animal nutrition
-Diet in health and disease in dogs and cats
Assoc. Prof. Atsushi Shimojima
Department of Applied Chemistry
Waseda University
Japan

OFFICE
Department of Applied Chemistry, Waseda University,
Tokyo 169-8555, Japan

PRESENT POSITION
Associate Professor

EDUCATION
-1995 B.Sc. Waseda University, Tokyo
-1997 M.Sc. Waseda University, Tokyo
-2002 Ph.D. Waseda University (Prof. Kazuyuki Kuroda), Tokyo

SPECIALIZATION
- Functional Hybrid Materials
- Mesoporous Materials
- Self-Assembly Processes
Dr. Nadezda Kosyakova
Institute of Human Genetics,
Jena University, Hospital,
Friedrich Schiller University, Jena,
Germany

OFFICE Ph.D., research fellow, Institute of Human Genetics, Jena University Hospital, Friedrich Schiller University, Jena, Germany

PRESENT POSITION Doctor

EDUCATION -1994-2000, I.M. Sechenov Moscow Medical Academy, Moscow, Russian Federation, Honors MD diploma
-2000-2003, PhD in Genetics, Research Center for Medical Genetics, Russian Academy of Medical Sciences (Moscow, Russian Federation)
-2004, European Advanced Postgraduate Course in Molecular Cytogenetics, University of Montpellier, France.

SPECIALIZATION Cytogenetics, molecular cytogenetics, chromosome microdissection, evolutionary cytogenetics
Invited Speakers Abstract
Clay Minerals as Natural Nano-Materials with a Wide Range of Industrial and Scientific Applications

Makoto OGAWA

Department of Chemical Engineering and Biomolecular Engineering, Vidyasirimedhi Institute of Science and Technology, Rayong 21210, Thailand

Abstract

Nanomaterials and hybrid materials have been studied recent years, due to the potential for improved performance in the ongoing materials as well as for the innovative applications. Size and shape of the materials, in nanometer scale, are keys to observe unique physicochemical characteristics, which are not available for conventional bulk solids. A huge variation of nanometer sized materials have been synthesized by soft chemical processes as well as physical processes in vacuum. In addition to the synthetic nanomaterials, there are natural (both biological and geological origins) nanomateriais useful as advanced materials. Among them, nanofibers and nanosheets of natural materials have attracted increasing interests.

In the present lecture, the nanosheet materials of geological origins will be introduced. The applications of the natural nanosheet materials will be discussed based on the origin, structure and chemical nature of the materials.

Keywords: Clay Minerals, Nano-Materials, Chemical
Silica-Based Functional Core-Shell Microspheres

Tomohiko OKADA

Department of Chemistry and Material Engineering, Faculty of Engineering, Shinshu University, Nagano 380-8553, Japan
(E-mail: tomohiko@shinshu-u.ac.jp)

Abstract

Precisely controlled nanostructure and morphology are important in the fabrication of materials with such abilities as adsorption of a particular molecule, sensing, and the controlled release. Our group has investigated the surface modification of colloidal spherical silica particles, including monodisperse spheres, magnetic core-shell particles for such practical uses. We have been interested in adsorptive properties of the layered silicates including clay minerals for uptake of an organic molecule. Homogeneous deposition of layered silicates on monodisperse spherical silica has been achieved, producing core-shell particles of a layered silicate (shell) on silica microspheres (core); colloidal monodisperse spherical silica particles acted as a sacrificial template in the presence of sources of the silicates (Li and Mg salts) and urea at 373 K. As a result the layered silicate was firmly glued onto the silica particles. Intercalation of cations into the layered silicate on the silica was demonstrated without flaking off the silicate layers from the product.

We have occluded functional nanoparticles into hollow organosilica microspheres using the sol-gel reactions of alkylsilyl trichlorides around water droplets in a water-in-oil emulsion. Metallic cobalt and magnetite nanoparticles was encapsulated into the hollow particles to give a magnetically collectable, reusable adsorbent and catalyst for concentrating heavy metal ions in acidic aqueous solutions and solid acid catalysis in aqueous media. Sulfonic groups, that acted as adsorption sites for Zn and Pb ions under an acidic condition, were immobilized on the external surface through silylation with 3-mercaptopropyl(trimethoxysilane) and subsequent oxidization of the thiol groups by 7 M HNO₃. The adsorbent was regenerated using 1 M HCl without eroding the magnetic nanoparticles.

Keywords: Silica, Nanoparticles, Organosilica, Core-Shell, Particles
Science Education for the Next Century

Tony Moon
Institute of Physics University of Technology Sydney
Australian

Abstract

Most societies realise the importance of Science, Technology, Engineering and Mathematics (STEM) to sustainable economic growth and the well-being of their citizens. The provision of an adequate STEM education at school or university varies across the world. This presentation discusses why STEM is important. It looks at the statistics of STEM education and examines the decline in STEM education in some economies and some of the reasons for this decline. Looking to the future, the presentation speculates on what should be taught in STEM, how it should be taught, who should teach it and who will teach the teachers.

Keyword: Science, Education, Technology, Engineering, Mathematics
Tourism and Regional Development within Asean

Craig Wheway

Faculty of Humanities and Social Sciences
Rajabhat Maha Sarakham University
80 Nakorn Sawan Road, Tambon Talad, Amphoe Maung
Maha Sarakham, 44000
Thailand
(E-mail: craigwheway@hotmail.com; Mob: +66 (0) 854610593)

Abstract

Thailand is known to be one of the most popular tourism economies within the ASEAN bloc of countries. As a consequence of the creation of ASEAN, there are a number of opportunities and threats entry poses including access to a large regional tourism market from the ten member states but also the proliferation of regional competition. The Bangkok Post (25.06.15) recently reported that whilst Thailand had been successful in attracting tourists from China (4.6 million during 2014) there was a risk over ‘over-dependency’ on such a lucrative market. This paper attempts to argue that a more balanced tourism promotion policy through the provision of wider ‘up-country’ development of tourism products is required. With declining returns from agricultural outputs and the growing unpredictability of rice crop yields in part due to climate change, development of alternative engines of economic growth for the Thai economy are proposed. In addition, entry in to ASEAN means that large multinational companies (MNCs) have increasing options to relocate their business operations in difficult economic times. Thailand must be prepared to train its workforce to be ASEAN ready, particularly in key industrial strength areas (Seagate in Korat is an example used) where English proficiency can be seen to hinder Thailand’s progression up the economic value chain. Key to this argument is the development of the Northeast region in terms of infrastructure (to support tourism development) as well as the strengthening of the higher education base from the Rajabhat universities up to and including the research intensive institutions (Khon Kaen University being an example). This requires a significant shift in emphasis from the Thai state who have been criticised for an over centralised investment within the Bangkok Metropolitan Region (BMR) rather than distributing the fruits of Thai economic growth to the regions of Thailand. The same strategies from the past will not work in the future-tourism development in the Northeast requires detailed planning because ‘mass’ tourists will not simply travel to remote rural locations without an incentive. Targeting the trend towards, alternative, ‘niche’ tourism forms such as volunteer tourism are proposed as possible solutions to aid the development of small local communities and help as part of a wider economic development plan for lagging regional economies within Thailand.

Keywords: Regional Development, Northeast Thailand, Tourism Development, Volunteer Tourism
Natural trends in dog and cat nutrition

Anton C. Beynen
Vobra Special Petfoods, Veghel
Netherlands

Abstract

There is a wide variety of dog and cat foods on the market. Industrially prepared pet food comes in different brands and forms and with different prices and claims. How a product will be advertised and sold relates to the marketing concept. Contrasting, basic marketing concepts for pet food can be identified. Among these concepts there can be modifications, combinations and crossovers. Fully grown markets with a high percentage of pets consuming commercial foods have close to flat volume sales. In order to increase sales money value, pet food manufacturers launch more expensive products founded on new designs and nutrition trends. The selling points of products may concern price, exclusive ingredients, animal category, animal health or the owner’s view of life. Mature pet food markets are dominated by natural foods and their grain-free subclass. Natural foods are not allowed to contain chemically synthesized substances, except for vitamins and minerals. Grains are pushed into unnatural, unhealthy and unsuitable, but the arguments are false. At the same time, well-formulated grain-free foods are nutritionally adequate. Organic and holistic pet foods usually are grain-free or wheat- and corn-free. Organic plant and animal ingredients must meet defined criteria as to production and processing. For commercial pet foods the predicate holistic has no clear meaning. Ancestral, evolutionary, instinctive or wild foods claim to simulate what dogs and cats would eat in nature. The extruded dry foods normally are grain-free and high in animal protein. Ancestral frozen and freeze-dried foods feature raw as additional claim.

Keywords: Nutrition, Pet Food, Animals, Marketing
Building-Block Assembly Toward Functional Siloxane-Based Nanomaterials

Atsushi Shimojima

Department of Applied Chemistry, Waseda University

3-4-1 Ohkubo, Shinjuku-ku, Tokyo 169-8555
Japan

(E-mail: shimojima@waseda.jp; Fax: +81-3-5286-3281)

Abstract

Inorganic–organic hybrid materials have extensively studied because of their structural and compositional varieties leading to many applications. Organosiloxane-based materials, having various organic groups attached to siloxane (Si-O-Si) networks by Si-C bonds, are important class of hybrid materials with high stability and high transparency along with diverse functionalities endowed by organic moieties. Bottom-up assembly of molecular building blocks is a promising approach to well-defined hybrid architectures. In this paper, recent progress in the design of nanohybrid materials based on the controlled assembly of organosilane and organosiloxane molecules will be presented. Over the past decade, we have established the formation of various hybrid mesostructures, including lamellar, 2D hexagonal, and cubic structures, by self-assembly of amphiphilic alkylsilane and alkyl-oligosiloxane molecules. Recently, a unique photo-responsive material has been successfully obtained by incorporation of azobenzene groups instead of simple alkyl chains. Lamellar azobenzene-siloxane hybrids assembled from the mixture of two types of organoalkoxysilanes containing bridging- and pendant-azobenzene groups were found to show reversible bending and unbending behaviors upon UV/Vis irradiations. On the other hand, core-shell organosiloxane nanoparticles as small as ~3 nm in diameter have been obtained by dispersion of reverse-type mesostructures assembled form linear oligosiloxane molecules bearing a bulky trialkylsilyl group. In situ encapsulation of fluorescent dyes into the nanoparticles demonstrated their ability to function as nanocarriers. Another topic will be the construction of novel nanoporous materials by interconnection of cage-type oligosiloxanes. Our recent efforts on the regular assembly of cubic siloxane cages will be presented.

Keywords: Self-assembly, Inorganic-organic Hybrid, Nanomaterials, Siloxane
Principle of Fluorescence in situ Hybridization (FISH) Technique and Applications towards Biodiversity, Including Fishery Researches

Nadezda Kosyakova, Thomas Liehr

Jena University Hospital, Friedrich Schiller University, Institute of Human Genetics, Kollegiengasse 10, D-07743 Jena, Germany

Abstract

Fluorescence in situ hybridization (FISH) assays became indispensable for a precise description of chromosomes in any species. Routine application of such techniques on human chromosomes started in 1981. In animals and plants FISH was introduced much later, even though human cytogenetics was done in the early years mainly by people being trained in plant cytogenetics. This review presents an overview on the available FISH methods and applications in human and compares those with nowadays usage of FISH in animals. The main difference is the availability of DNA-based probes, which is hampering sophisticated FISH-studies in many species still. A way out here is the use of repetitive sequence probes and glass-needle based chromosome microdissection.

Keywords: Biodiversity, DNA, Fluorescence, FISH technique, Cytogenetic
Conference Program

September 17, 2015

<table>
<thead>
<tr>
<th>Time</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.00-09.00</td>
<td>Registration</td>
</tr>
<tr>
<td>09.00-09.30</td>
<td><strong>Welcome performance:</strong> Roi Et Rajabhat University</td>
</tr>
<tr>
<td>09.30-09.45</td>
<td><strong>Report by:</strong> Asst. Prof. Chumnian Pollaharn, Vice President of Rajabhat Maha Sarakham University</td>
</tr>
<tr>
<td>09.45-10.15</td>
<td><strong>Welcome and Opening Address:</strong> Assoc. Prof. Somchai Wongkasem, President of Rajabhat Maha Sarakham University</td>
</tr>
<tr>
<td>10.15-10.30</td>
<td>Coffee and tea break</td>
</tr>
<tr>
<td>10.30-11.00</td>
<td><strong>Keynote Speaker:</strong> Assoc. Prof. Somchet Thinaphong, “Research and Innovation for Community and Regional Development”</td>
</tr>
<tr>
<td>11.00-12.00</td>
<td><strong>Invited Speaker:</strong> Prof. Makoto OGAWA, “Clay Minerals as Natural Nano-Materials with a Wide Range of Industrial and Scientific Applications”</td>
</tr>
<tr>
<td>12.00-13.00</td>
<td>Lunch</td>
</tr>
<tr>
<td>13.00-16.50</td>
<td>Oral Presentation Place: Theater Hall (1st Fl. Bld.34), 5th Fl. Bld.34 (Room 340501-6)</td>
</tr>
<tr>
<td></td>
<td>- Poster Presentation Place: 1st Fl. Bld.15</td>
</tr>
<tr>
<td>17.30-20.00</td>
<td>Dinner</td>
</tr>
</tbody>
</table>

September 18, 2015

<table>
<thead>
<tr>
<th>Time</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.00-12.00</td>
<td>- Oral Presentation Place: Theater Hall (1st Fl. Bld.34), 5th Fl. Bld.34 (Room 340501-3)</td>
</tr>
<tr>
<td></td>
<td>- Poster Presentation Place: 1st Fl. Bld.15</td>
</tr>
<tr>
<td>12.00-13.00</td>
<td>Lunch</td>
</tr>
<tr>
<td>13.00-14.40</td>
<td>Oral Presentation Place: Theater Hall (1st Fl. Bld.34)</td>
</tr>
<tr>
<td>15.00-16.00</td>
<td>Oral and Poster Presentation Awards</td>
</tr>
</tbody>
</table>
Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.30</td>
<td>Science Education for the Next Century</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Invited: Prof. Dr. Anthony Moon</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>13.30-13.50</td>
<td>Dendrochronology and Sunspot Cycles: Effects and Determinants of Global</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warming on Climate Change Toward Affecting Drought and Flood Natural</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disaster in Thailand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toansakul Santiboon</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13.50-14.10</td>
<td>Ascertaining Improved Pedagogical Administration Through Innovative</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Classroom Management Software</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lakshmi Kala Prakash</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>14.10-14.30</td>
<td>To Develop an Ubiquitous Learning Environment Model to Increase the</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem Solving Thinking Skills in Vocational Education Students</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Klednatee Chaichana</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>14.30-14.50</td>
<td>The Problems of Research Conducting of Graduate Students: Educational</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administration, Thepsatri Rajabhat University</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phuwadon Chulasukhont</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>14.50-15.10</td>
<td>Local History Learning for Children and Youths</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prasopsuk Rittidet</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15.10-15.30</td>
<td>Integrated Children Literature Classroom to School Library for</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enhancing Reading Promotion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wilawan Phornphatcharaphong</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15.30-15.50</td>
<td>Analysis of Information Science Education for 21st Century</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wilawan Phornphatcharaphong</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>15.50-16.10</td>
<td>A Study on Problems and Strategies for Creating Awareness of Sexual</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Behaviors of Lower Secondary School Students</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sasithorn Kotkanta</td>
<td></td>
</tr>
</tbody>
</table>
### Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.30</td>
<td>Tourism and Regional Development with in ASEAN <strong>Invited:</strong> Prof. Dr. Craig Wheway</td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>13.30-13.50</td>
<td>Knowledge Management Development on Organic Agriculture Marketing of Farmer Group, Makha Sub-District, Kantharawichai District, Maha Sarakham Province <strong>Wongpattanakorn Sriprasert</strong></td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>13.50-14.10</td>
<td>Constructing a Model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in Renunakhon District, Nakhon Panom province, Thailand and Khammuan Province, Lao People’s Democratic Republic <strong>Warit Rasri</strong></td>
<td>101</td>
</tr>
<tr>
<td>4</td>
<td>14.10-14.30</td>
<td>Beyond On-Air Language: Unraveling the Influence of Papa Jack’s Programs to the Values and Views of Regular Listeners <strong>Ernesto Cordero Collo, Jr.</strong></td>
<td>107</td>
</tr>
<tr>
<td>5</td>
<td>14.30-14.50</td>
<td>Reality of Tourism Development in Lao Cai, Vietnam <strong>Le Quoc Thang</strong></td>
<td>116</td>
</tr>
<tr>
<td>6</td>
<td>14.50-15.10</td>
<td>Limited Contexts and Leadership of University Leaders in Northeastern Thailand in Twenty-First Century <strong>Hatai Noisombut</strong></td>
<td>122</td>
</tr>
<tr>
<td>7</td>
<td>15.10-15.30</td>
<td>Factors that Attract Foreign Direct Investment in the Thai Automotive Industry in 2009 to 2013 <strong>Prodige Feizoure</strong></td>
<td>129</td>
</tr>
<tr>
<td>8</td>
<td>15.30-15.50</td>
<td>The Application of Three Major Investor’s Approaches on the Tehran Stock Exchange <strong>Marjan Bahramabadian</strong></td>
<td>134</td>
</tr>
<tr>
<td>9</td>
<td>15.50-16.10</td>
<td>The Religious Sculpture and Politics of Cultural Business Space in Maha Sarakham <strong>Kittikorn Bumroongboon</strong></td>
<td>145</td>
</tr>
<tr>
<td>10</td>
<td>16.10-16.30</td>
<td>The Accused Student Identity Development <strong>Piyaluk Potiwan</strong></td>
<td>149</td>
</tr>
</tbody>
</table>
Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.30</td>
<td>Natural Trends in Dog and Cat Nutrition</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Invited Speaker:</strong> Prof. Dr. Ir. Anton Beynen</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>13.30-14.00</td>
<td>Principle of Fluorescence <em>in situ</em> Hybridization (FISH) Technique and</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Applications towards Biodiversity, Including Fishery Researches</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Invited Speaker:</strong> Dr. Kosyakova Nazda</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>14.00-14.20</td>
<td>The sensitivity of Ramshorn Snail, <em>Marisa cornuarietis</em>, Embryos to</td>
<td>154</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the Pesticide Chlorpyrifos and Methiocarb</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Banthita Sawasdee</em></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>14.20-14.40</td>
<td>The Study of Traditional Fishing Gears and Fish Species of Fisherman</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in Nong Bo Reservoir, Borabu, Maha Sarakham Province</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Leklai Chanthabut</em></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>14.40-15.00</td>
<td>Effects of Fat Sources on Feed Intake and Feed Cost of Total Mixed</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ration in Crossbred Thai Native X Brahman Bulls</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Wantanee Polviset</em></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>15.00-15.20</td>
<td>Gene Cloning and Expression of F3H Gene in Phenylpropanoid Pathway</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td></td>
<td>from Bitter Molon (<em>Momordica Charantia</em> L.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Nguyen Thi Thanh Mai</em></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15.20-15.40</td>
<td>Development of Effective Procedure for Mediated Transformation of Bitter Melon (<em>Momordica Charantia</em> L.) by Agrobacterium Rhizogenes</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Nguyen Thi Thanh Mai</em></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15.40-16.00</td>
<td>Pathogenicity and Antimicrobial Activity of <em>Streptoccus</em> sp. Isolated from Siamese Fighting Fish (<em>Betta Splendens</em> Regans)</td>
<td>181</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Chutharat Kanchan</em></td>
<td></td>
</tr>
</tbody>
</table>
### Oral Presentation

**Session:** Science and Application Science  
**Date:** September 17, 2015  
**Time:** 13.00-16.30  
**Room:** 5th Fl. Bld. 34 Room 340503  
**Chairperson:** Assoc. Prof. Dr. Sittichai Bussaman  
**Committee:** Asst. Prof. Dr. Wuthikorn Saikaew  
**Committee:** Asst. Prof. Dr. Kanokporn Tongsodsang

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.20</td>
<td>Sustainable Development of Agriculture, Rural Areas and Farmers in Vietnam: Achievements and Challenges</td>
<td>185</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tran Tu Khanh</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>13.20-13.40</td>
<td>To Promote Some Measuring the Combinational and Training Researches on Applied Scientific Technology of Social Science in Universities and Institutes in Vietnam</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nguyen Thi Dung</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13.40-14.00</td>
<td>Applying Experiences of Thai People Through Behaviors with Water into Protecting the Ecological Environment in Vietnam</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dang Thi Oanh</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>14.00-14.20</td>
<td>Biodiversity of Medicinal Plants in Pu Mat National Park</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dao Thi Minh Chau</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nguyen Thi Thu Huong</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>15.00-15.20</td>
<td>Expression of Soybean Antioxidant System After Cowpea Aphid Infestation</td>
<td>212</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mai Van Chung</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dau Thi Khoa</td>
<td></td>
</tr>
</tbody>
</table>
Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.30</td>
<td>Building-Block Assembly Toward Functional Siloxane-Based Nanomaterials</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Invited Speaker: Assoc.Prof. Atsushi Shimojima</em></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>13.30-13.50</td>
<td>Stakeholders’ Assessment on the Relevance of the Dmmmsu-Sluc School-On-Air Program</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jesus Rafael B. Jarata</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13.50-14.10</td>
<td>Electric Lawn Mower Saving Energy and Reducing Pollution</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Siriwan Arjbanrung</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chanakorn Tabtimsai</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>14.30-14.50</td>
<td>Effect of Inorganic Fertilizer and Organic Fertilizer on Growth and Yield of Sweet Corn Var. Hi-Brix 3</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theerarat Chinnasaen</td>
<td></td>
</tr>
</tbody>
</table>
Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.20</td>
<td>A Constructivist Learning Environments in Biology Classes for Upper Secondary Students at Grade-Tenth Level in Burapha Pittayakarn Municipal School Phakamart Sangsai</td>
<td>252</td>
</tr>
<tr>
<td>2</td>
<td>13.20-13.40</td>
<td>Predicting the Achievement of the Grade 12th Upper Secondary School Students Towards Biology from their Perceptions of the Classroom Learning Environment in Chiang Yuen Pittayakom School Pornnapha Wichachai</td>
<td>262</td>
</tr>
<tr>
<td>3</td>
<td>13.40-14.00</td>
<td>Measuring Students’ Perceptions of their Chemistry Learning Classes in Rajabhat Maha Sarakham University Demonstration School Monwipha Mueangprafang</td>
<td>272</td>
</tr>
<tr>
<td>4</td>
<td>14.00-14.20</td>
<td>Assessing Chemistry Laboratory Classroom Learning Inventory in Upper Secondary Wapeepatum School at Eleventh Grade Level Waraporn Kratud-ngern</td>
<td>283</td>
</tr>
<tr>
<td>5</td>
<td>14.20-14.40</td>
<td>Research into the Environment of Physics Laboratory Classes in Upper Secondary Students at the Tenth-Grade Level Wiphaphron Phanphrom</td>
<td>293</td>
</tr>
<tr>
<td>6</td>
<td>15.00-15.20</td>
<td>An Application of the Questionnaire on Teacher Interaction in Physics Laboratory Classroom Learning Environments for Upper Secondary Students at Grade 10th Level in Thakhonyang Pittayakom School Siriwan Yaitoi</td>
<td>304</td>
</tr>
<tr>
<td>7</td>
<td>15.20-15.40</td>
<td>Predicting Students’ Outcomes from their Perceptions of Biology Classroom Learning Environments at Tenth-Grade Level in Wat Sathong Municipal School Siwanat Ninsu</td>
<td>317</td>
</tr>
<tr>
<td>8</td>
<td>15.40-16.00</td>
<td>Motivating Learning Activities of Students of Science and Technology while Teaching Advanced Mathematics Nguyen Chien Thang</td>
<td>327</td>
</tr>
</tbody>
</table>
### Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.20</td>
<td>The Impact of Systemic Reform Efforts in Promoting Constructivist Approaches in Physics Classroom Learning Environments in Thakhonyang Pittayakom School <em>Salinee Sanwang</em></td>
<td>333</td>
</tr>
<tr>
<td>2</td>
<td>13.20-13.40</td>
<td>Are My Students Collaborating Effectively in My Science Classroom Learning Environment Inventory at Grade 8&lt;sup&gt;th&lt;/sup&gt; Level in Mittrapab School <em>Supawan Polruang</em></td>
<td>343</td>
</tr>
<tr>
<td>3</td>
<td>13.40-14.00</td>
<td>Using the Individual Classroom Environments Questionnaire (ICEQ) to Associations between Students’ Perceptions of their Chemistry Classes and their Attitudes toward Chemistry in Mahawichanukoon School at the Eleventh Grade Level <em>Supranee Aengsatha</em></td>
<td>352</td>
</tr>
<tr>
<td>4</td>
<td>14.00-14.20</td>
<td>Improving Students’ Learning Achievements in Chemistry Classroom Learning Environments of the Grade 12&lt;sup&gt;th&lt;/sup&gt; Level Upper Secondary <em>Sopida Senanorit</em></td>
<td>361</td>
</tr>
<tr>
<td>5</td>
<td>14.20-14.40</td>
<td>Students’ Outcomes in Physics Classroom Learning Environments Inventory in Chiangyuen Pittayakom School at Grade Level10 <em>Orawan Sasrisao</em></td>
<td>371</td>
</tr>
<tr>
<td>6</td>
<td>15.00-15.20</td>
<td>An Instrument for Monitoring the Development of Constructivist of Constructivist Science Learning Classroom Environments for Enhancing Students’ Achievements at Eight-Grade Level in Burapha Pittayakhan Municipal School <em>Utumporn Anamart</em></td>
<td>381</td>
</tr>
<tr>
<td>7</td>
<td>15.20-15.40</td>
<td>Using the ICEQ to Assessment Students’ Perceptions of their Attitude Toward Chemistry in Roi-Et Wittayalai School at the Tenth-Grade Level <em>Chatchai Netakham</em></td>
<td>391</td>
</tr>
<tr>
<td>8</td>
<td>15.40-16.00</td>
<td>Research for Development, the Participation of the Community and Elevate to Management Cultural Tourism Model in Chiang Khan Municipality, Chiang Khan District, Loei Province <em>Thongsai Yowa</em></td>
<td>401</td>
</tr>
</tbody>
</table>
Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>09.00-09.30</td>
<td>Silica-Based Functional Core-Shell Microspheres</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Invited Speaker:</em> Assoc. Prof. Dr. Tomohiko OKADA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>09.30-09.50</td>
<td>A Model for Teacher Development in Local Administrative Organizations in Maha Sarakham Provincial Municipality by Applying Local Wisdom of the Sufficiency Economy Philosophy for Educational Management in Schools <em>Prapatsorn Preiam</em></td>
<td>407</td>
</tr>
<tr>
<td>3</td>
<td>10.10-10.30</td>
<td>The Development Process of Research Through the Integration With Critical Thinking Skills and Metacognition Amongpre-Service Teacher Students, Faculty of Education, Rajabhat Maha Sarakham University <em>Samarn Ekkapim</em></td>
<td>413</td>
</tr>
<tr>
<td>4</td>
<td>10.30-10.50</td>
<td>Learning Process for Improving Waste Management in Communities by using Participation-Based Technology Model <em>Wilert Wanatip</em></td>
<td>423</td>
</tr>
<tr>
<td>5</td>
<td>10.50-11.10</td>
<td>A Study of Organic Rice Development Model for Youths <em>Pikit Srichana</em></td>
<td>428</td>
</tr>
<tr>
<td>7</td>
<td>11.30-11.50</td>
<td>Training Teachers at the Hand of Competence Approach at Lao Cai Teacher Training College in Lao Cai Province, Vietnam <em>Hoang Van Duong</em></td>
<td>440</td>
</tr>
<tr>
<td>8</td>
<td>11.50-12.10</td>
<td>A Model of Teaching-Self-Learning for the 21st Century in High School Physics Subject of Vietnam <em>Pham Thi Phu</em></td>
<td>446</td>
</tr>
</tbody>
</table>
### Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00-13.20</td>
<td>Constructivist and Survey of Physics Laboratory Classroom Learning Environments in Srinakarindra the Princess Mother Sondej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School Jatuporn Veansri</td>
<td>454</td>
</tr>
<tr>
<td>2</td>
<td>13.20-13.40</td>
<td>Psychological Environment Inventory in Science Laboratory Learning Classes for Lower Secondary Educational Students in Burabu Wittayakhan School Jeeraphon Sarabun</td>
<td>464</td>
</tr>
<tr>
<td>3</td>
<td>13.40-14.00</td>
<td>Investigations of Physics Classroom Learning Environments for Upper Secondary Educational Students at Grade Level 10 in Burapha Pittayakharn Municipal School Chanidapha Kopolrat</td>
<td>475</td>
</tr>
<tr>
<td>4</td>
<td>14.00-14.20</td>
<td>What is Happening in Biology Classroom Learning Environments at Grade Level 10 in Thakhonyang Pittayakom School Titima Panyong</td>
<td>485</td>
</tr>
<tr>
<td>5</td>
<td>14.20-14.40</td>
<td>Students’ Perceptions of their Science Classroom Environments and their Attitudes Toward Science at Grade Level 7 in Wapipathum School Natnaree Jaramrum</td>
<td>496</td>
</tr>
<tr>
<td>6</td>
<td>14.40-15.00</td>
<td>Development Herbal Production for Serving Community Attractions Case Study of Nathong Village Vangvieng District Vientiane Province Laos Bounxom Sriharath</td>
<td></td>
</tr>
</tbody>
</table>
Oral Presentation

<table>
<thead>
<tr>
<th>Session</th>
<th>Date</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>September 18, 2015</td>
<td>09.00-12.00</td>
<td>The Important Role of the World Miraculous Characters in Vietnamese Fairy Tales for Teaching Folklore Literature at Schools</td>
<td>507</td>
</tr>
<tr>
<td></td>
<td></td>
<td>09.00-09.20</td>
<td>Research on Using Micro Teaching Technique in Training Physics Teachers in Vietnam</td>
<td>512</td>
</tr>
<tr>
<td></td>
<td></td>
<td>09.40-10.00</td>
<td>Self-Study and Research Based Physics Teaching at the High School Level</td>
<td>517</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.00-10.20</td>
<td>Conducting Institute Research for Developing International Quality Assurance of Secondary Schools in the Central of Northeast of Thailand using Basic Educational Standard</td>
<td>524</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.20-10.40</td>
<td>Factors Influencing Teacher Interpersonal Behaviours on Students Perceptions in Biology Classroom Learning Environments in Sarakham Pittayakom School</td>
<td>530</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.40-11.00</td>
<td>Assessments of Individual Chemistry Classroom Learning Environments for Students’ Individual Outcomes at the Tenth-Grade Level in Thakhonyang Pittayakom School</td>
<td>541</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.00-11.20</td>
<td>Adaptation of the Questionnaire on Teacher Interaction (QTI) for Biology Classroom Learning Environments in Rajabhat Maha Sarakham University Demonstration School</td>
<td>552</td>
</tr>
</tbody>
</table>
## Oral Presentation

<table>
<thead>
<tr>
<th>Session</th>
<th>Education</th>
<th>Assoc. Prof. Dr. Praphatsorn Priiam</th>
<th>Chairperson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>September 18, 2015</td>
<td>Asst. Prof. Dr. Paisarn Worakham</td>
<td>Committee</td>
</tr>
<tr>
<td>Time</td>
<td>09.00-12.00</td>
<td>Asst. Prof. Dr. Arunee Chansila</td>
<td>Committee</td>
</tr>
<tr>
<td>Room</td>
<td>5th Fl. Bld. 34 Room 340502</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>09.00-09.20</td>
<td>Measuring Students’ Perception of Actual Individualized Classroom Environment in Physics Laboratory Classes in Borabu Wittayakhan School at Twelfth-Grade Level Piyanooot Chaiyaphon</td>
<td>565</td>
</tr>
<tr>
<td>2</td>
<td>09.20-09.40</td>
<td>Students’ Perceptions of their Science Classroom Environments and their Attitudes toward Science Classes Piyarat Tumtard</td>
<td>574</td>
</tr>
<tr>
<td>3</td>
<td>09.40-10.00</td>
<td>The Study of Development Method of Morality and Ethic Learning and Teaching Models for Education of Extended Schools Somthawin Pheanglap</td>
<td>584</td>
</tr>
<tr>
<td>4</td>
<td>10.00-10.20</td>
<td>Improving Self-Reliance by Using the Livelihood form of the Local Wisdom at Yad-Fah Village, MahaChanachai, Yasothorn Umaporn Aonkam</td>
<td>589</td>
</tr>
<tr>
<td>5</td>
<td>10.20-10.40</td>
<td>The Development Model of School Management and Local History Thee Sittihakoat</td>
<td>593</td>
</tr>
<tr>
<td>6</td>
<td>10.40-11.00</td>
<td>The Development Model of the Model Farmers of the Water Meal to Strong Community Manit Luemkoommarn</td>
<td>597</td>
</tr>
<tr>
<td>7</td>
<td>11.00-11.20</td>
<td>The Study Development of Elementary Students’ Reading of the Thai Content Pattra Saonhom</td>
<td>601</td>
</tr>
<tr>
<td>8</td>
<td>11.20-11.40</td>
<td>Science Laboratory Classroom Inventory for Lower Secondary Educational Students at Grade Level 8 in Wapipatum School Nootchanard Waidee</td>
<td>605</td>
</tr>
</tbody>
</table>
## Oral Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>09.00-09.20</td>
<td>Associations Between Student’s Perceptions and their Science Attitudes Toward Science in Borabu Wittayakhan School at Grade 9th Level Nopphadon Manolai</td>
<td>615</td>
</tr>
<tr>
<td>2</td>
<td>09.20-09.40</td>
<td>Associations Between Teacher-Student Interpersonal Behavior and Student Attitudes to Physics Classroom Learning in Borabu Wittayakhan School Weerayut Taodee</td>
<td>625</td>
</tr>
<tr>
<td>3</td>
<td>09.40-10.00</td>
<td>Application of the CUCEI Instrument for Developing Classroom Learning Environments in Biology Classes at the Twelfth-Grade Level in Thakhonyang Pittayakom School Sarawut Wongwipath</td>
<td>635</td>
</tr>
<tr>
<td>4</td>
<td>10.00-10.20</td>
<td>The Critical Theory Perspectives for Monitoring Constructivist on Science Classroom Learning Environments at Ninth-Grade Level Students in Wat Sathong Municipal School Atipong Sangrat</td>
<td>647</td>
</tr>
<tr>
<td>5</td>
<td>10.20-10.40</td>
<td>Measuring and Improving Chemistry Classroom Learning Environments for Upper Secondary Students at Twelfth-Grade Level Atipong Phukaokaew</td>
<td>657</td>
</tr>
<tr>
<td>6</td>
<td>10.40-11.00</td>
<td>A Variety of the ICEQ Instrument for Assessing Distinct Aspects of the Chemistry Classroom Climates in Tenth-Grade in Khattiyawongsa School Isara Boonyatipitak</td>
<td>667</td>
</tr>
<tr>
<td>7</td>
<td>11.00-11.20</td>
<td>The Use of Folk Wisdom to Manage Conflicts in Community Wiyada Mungpon</td>
<td>677</td>
</tr>
</tbody>
</table>
# Poster Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | Sc1  | 13.00-13.20 | Sex Determination from Greater Sciatic Notch and Acetabulum in Thai Population  
*Saphawan Latthitham* | 681  |
| 2  | Sc2  | 13.20-13.40 | Utilization Potential of Rice Husk in Fired Clay Bricks for Construction Material  
*Nonthaphongphonphuak* | 686  |
| 3  | Sc3  | 13.40-14.00 | Effect of Malaria Infection on Blood Cell Parameters  
*Manas Koteepui* | 692  |
| 4  | Sc4  | 14.00-14.20 | The Incidence of Liver Diseases at Phopphra Hospital  
*Kwuntida Uthaisar* | 695  |
| 5  | Sc5  | 14.20-14.40 | Swamp Buffalo Production in Natural Wetland of Thale Noi Non-Hunting Area: Traditional Practice, Problems and Constraints  
*Aporn Songsang* | 697  |
| 6  | Sc6  | 14.40-15.00 | Food Product Development for Pre-Biotic Healthy from by Product of Product of Germinated Brown Fermentation Process for the Enterprise Community Production  
*Mali Nachaisin* | 704  |
## Poster Presentation

<table>
<thead>
<tr>
<th>Session</th>
<th>Science and Application Science</th>
<th>Asst. Prof. Dr. Sunan Butsat</th>
<th>Chairperson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>September 17, 2015</td>
<td>Assoc. Prof. Sarin Thongthummachat</td>
<td>Committee</td>
</tr>
<tr>
<td>Time</td>
<td>13.00-15.00</td>
<td>Aj. Metta Kengchuwong</td>
<td>Committee</td>
</tr>
<tr>
<td>Room</td>
<td>1st Fl. (Bld. 15)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sc7</td>
<td>13.00-13.20</td>
<td>Efficiency Enhancement of Green Briquettes Fuel Corncob Residue Materials using Macadamia Charcoal Suminya Teeta</td>
<td>708</td>
</tr>
<tr>
<td>2</td>
<td>Sc8</td>
<td>13.20-13.40</td>
<td>Screening and Potential of Antagonistic Fungi for Growth Inhibition of Chilli Anthracnose Kanchalika Ratanacherdchai</td>
<td>714</td>
</tr>
<tr>
<td>3</td>
<td>Sc9</td>
<td>13.40-14.00</td>
<td>Effect of Growing Media and Release on Growth and Yield of Broccoli Taweesab Chaiyarak</td>
<td>721</td>
</tr>
<tr>
<td>4</td>
<td>Sc10</td>
<td>14.00-14.20</td>
<td>Multimedia Website Designing and Developing to Promote Group of “Roi-Kaen-Sarn-Sin” Travelling Potsirin Limpinan</td>
<td>726</td>
</tr>
<tr>
<td>6</td>
<td>Sc12</td>
<td>14.40-15.00</td>
<td>Preparation of Reactor Generation Clean Energy from Waste Aluminum Pornchai Chinnasa</td>
<td>736</td>
</tr>
</tbody>
</table>
### Poster Presentation

<table>
<thead>
<tr>
<th>Session</th>
<th>Human and Social Science</th>
<th>Asst. Prof. Dr. Kanlaya Kunsuwan</th>
<th>Chairperson</th>
<th>Date</th>
<th>Time</th>
<th>Room</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dr. Thatawat Roasuwan</td>
<td>Committee</td>
<td>September 17, 2015</td>
<td>13.00-15.00</td>
<td>1st Fl. (Bld. 15)</td>
<td>The Motivation to Work of the Personnel of Sub-District Administration Organizations in Maha Sarakham Province, Thailand Nittaya Kaewhanam</td>
<td>744</td>
</tr>
<tr>
<td>1</td>
<td>Hs1</td>
<td>13.00-13.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A Model for Service Quality Management of Sub-District Municipalities in Kalasin Province, Thailand Praiya Kongsomjit</td>
<td>748</td>
</tr>
<tr>
<td>2</td>
<td>Hs2</td>
<td>13.20-13.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Guidelines for Community Development to Sustainability: a Case Study of Ban Tharsee, Kokaeo Sub-District, Selaphum District, Roi Et Province Prasarn Sripongplerd</td>
<td>752</td>
</tr>
<tr>
<td>3</td>
<td>Hs3</td>
<td>13.40-14.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Poster Presentation

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Time</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ed1</td>
<td>09.00-09.20</td>
<td>The Development of Teachers’ Instructional Techniques by Using Thinking Tools</td>
<td>757</td>
</tr>
<tr>
<td>2</td>
<td>Ed2</td>
<td>09.20-09.40</td>
<td>The Teaching Plans Development for English Instructional Design Through Story Telling Approach on the Bachelor of English Education Students, Roi-Et Rajabhat University</td>
<td>760</td>
</tr>
<tr>
<td>3</td>
<td>Ed3</td>
<td>09.40-10.00</td>
<td>The Development of E-Learning on Microteaching for Practical Teaching Skill in Industrial Education</td>
<td>768</td>
</tr>
<tr>
<td>4</td>
<td>Ed4</td>
<td>10.00-10.20</td>
<td>Development of the Science Process Skills Development (SPSD) Kit for Science Teachers in the Primary Schools in Roi-Et Province</td>
<td>772</td>
</tr>
<tr>
<td>5</td>
<td>Ed5</td>
<td>10.20-10.40</td>
<td>The Practicum Outcome of Pre-Service Teacher Students Majoring Biology in Education Program of Rajabhat Maha Sarakham University</td>
<td>775</td>
</tr>
<tr>
<td>6</td>
<td>Ed6</td>
<td>10.40-11.00</td>
<td>Development of the Science Activity Packages on Concept Mapping: The Structures and Functions of Flower Plants for Grade 11th Students</td>
<td>779</td>
</tr>
<tr>
<td>7</td>
<td>Ed7</td>
<td>11.00-11.20</td>
<td>Enhancing Learning Achievement and Analytical Thinking in Biology Course by Science Instructional Package</td>
<td>787</td>
</tr>
<tr>
<td>8</td>
<td>Ed8</td>
<td>11.20-11.40</td>
<td>The Development of Parents’ Growth Evaluation for Disability Children, Special Education Center, Kalasin Province</td>
<td>794</td>
</tr>
</tbody>
</table>
Oral Presentation

Full Paper
Dendrochronology and Sunspot Cycles: Effects and Determinants of Global Warming on Climate Change toward Affecting Drought and Flood Natural Disaster in Thailand

Assistant Professor Dr. Toansakul Santiboon
Department of Master of Science Education Program, Faculty of Education
Rajabhat Maha Sarakham University, Thailand
Corresponding E-mail: toansakul35@yahoo.com.au

Abstract

The practical applications of the study of tree rings are numerous; Dendrochronology is the techniques can be applied to associate. Sunspot cycle is temporary phenomena on the surface of the Sun that appear visibly as dark spots compared to surrounding regions. Investigating Dendrochronology Technique and Sunspot Cycle to analyze of sample size of the 60 tree rings and 80 average years from 20 districts at rice fields, limb of water basins, and down hills thought out of Udon Thani province. To investigate, determine, and analyze of the climate characteristically change in the provincial Udon Thani in the period of 60 surrounding years from 1951 to 2010 A.D. that it’s transferred to effects of climatologically substance data for determining of global warming; the mean of temperature, rainfall, relative humidity, air pressure, evaporation, wind speed, cyclone storm, forest assessment and water river at Maekhong river. Statistically significant were not found for the 60 years of Udon Thani climatologically substance data. However, changing data that it’s followed as the Sun Spot cycle for accounting of increasing and decreasing every 4.8 years (1955 – 1962, …, 1999 – 2003 A.D.) and 6.2 years (1951 – 1954, …, 2004 – 2010 A.D.), total is 11.1 years (1951 – 1954, …, 1999 – 2010 A.D.) surrounding. Statistically significant were found for investigating and analyzing data with multivariate analysis; polynomial function and linear function, the analysis of relative on climate characteristically change with Linear regression, Pearson correlation, and Compare mean (ANOVA-paired sample t-test) were used. Statistically significant were found at the level 0.001 (R²= 1.00). The percentage of mean average of Udon Thani’s in term of climatologically increasing changes is 3.51% such as means of temperature, minimum temperature, extreme minimum temperature, extreme rainfall, wind speed, and evaporation, and in term of climatologically decreasing changes is 4.11% such as mean maximum temperature, extreme maximum temperature, rainfall, number of days with rainfall, relative humidity, air pressure, number cyclone storm, forest assessment, and water level of Maekhong river. The determinants of 60 surrounding years of Udon Thani’s climatologically changes are affected of increasing temperature and evaporation of water, decreasing rainfall and number days of rainfall but change to heavy storm, heavy wind speed but decreasing number of cyclone storm and dry humidity, forest assessment were found. The effects of thermal energy from the sun radiation energy and human activities that they’re followed as the sunspot cycle and Climate Change in Udon Thani are able to be predicted from the last to the future of the uniformitarian’s the climate change and global warming effect of the world.

Keywords: Climate Change, Global Warming, Udon Thani Province Weather

Introduction

Not only after the tidal waves of the Tsunami from the Indian Ocean earthquake was an undersea megathrust earthquake has not forgotten with an epicentre off the west coast of Sumatra, Indonesia that struck into southern of Thailand and many countries in Southeast Asia in 2004 was as a direct result of an "tsunamigenic earthquake" but also there were the great floods have covered in China, Taiwan, and Northern of Thailand, and powerful quake rocks Japan, Tsunami hit Japan in 2011 together. The 2011 China floods are a series of floods currently occurring in central and southern parts of China. They were caused by heavy rain that inundated portions of 12 provinces, leaving other provinces still suffering a prolonged drought, a total of over 36 million people have been affected, killing at least 239 and with direct economic losses of nearly US$6.5 billion. The major natural disaster from the effects of Hurricane Ivan in the Lesser Antilles and South America included 44 deaths and over $1 billion in damage primarily in Grenada where it was considered the worst hurricane in nearly 50 years. People have a question with themselves “what have happened of the weather of the world?” The hypothesis of scientists described on this situation, that it’s the results from the climate change to build the increasing temperature to effect of air cycling pressure of the world with the climate system and increases in global mean temperature to develop to the heavy thunderstorm for each area. As South Africa prepares to host
the United Nations climate change summit in Durban this year, Lake Chad is living proof of the continent’s environment in crisis. It was almost double the area of Gauteng just four decades ago but has shrunk by 95%. It is now smaller than Johannesburg. A cyclone in the Indian Ocean hit the Indian state of West Bengal and neighboring Bangladesh, Bhutan has been hit with heavy rainfall and flash floods throughout most of the country, although it is hundreds of kilometers inland [1].

The most common cause of wildfires varies throughout the world. In the United States, Canada, and Northwest China, for example, lightning is the major source of ignition. In other parts of the world, human involvement is a major contributor. In Mexico, a wildfire is any uncontrolled fire in combustible vegetation that occurs in the countryside or a wilderness area. In Florida, during the drought in 1998, catastrophic wildfires burned numerous homes. Russia’s record heat wave may already have taken 15,000 lives and cost the economy $15 billion as fires and drought ravage the country. At least 7,000 people have probably died in Moscow as a result of the heat, and the nationwide death toll is likely to be at least twice that figure, a 15-year-old Internet weather service that gathers information from around the world.

A natural disaster is the effect of a natural hazard (e.g., flood, tornado, hurricane, volcanic eruption, earthquake, or landslide). It leads to financial, environmental or human losses. The resulting loss depends on the vulnerability of the affected population to resist the hazard, also called their resilience. Natural Disasters are low-probability, high-impact events that can overwhelm physical infrastructure and human communities [2]. Major storm and flood disasters have occurred in the last two decades. The impacts of weather disasters are considerable and unequally distributed. For example, natural disasters have been shown to result in increased domestic violence against. In terms of deaths and populations affected, floods and tropical cyclones have the greatest impact example at as above regions. Vulnerability to weather disasters depends on the attributes of the person at risk, including where they live and their age, as well as other social and environmental factors. The effects of drought on health include deaths, malnutrition, infectious diseases and respiratory diseases [2]. In some regions, changes in temperature and precipitation are projected to increase the frequency and severity of fire events. Forest and bush fires cause burns, damage from smoke inhalation and other injuries. The ratio of natural disaster as 30.7% from over flood disaster, 26.6 % from heavy storm disaster, 11.2% from epidemic disease disaster, and 8.6% from earthquake disaster that it’s affected the entire world [3]. Focusing on the continental disaster, to be found that the natural disasters as heavy exploring epidemic disaster in Africa, heavy hurricane storm and over flood in North America, heavy tropical cyclone, over flood, earthquake and tsunami in Asia, flood and heat wave in Europe, and earthquake in Oceania. These situations are reflected of the varia.

Dendrochronology or tree-ring dating, is the scientific method of dating based on the analysis of patterns of tree rings, also known as growth rings. Dendrochronology can date the time at which tree rings were formed, in many types of wood, to the exact calendar year. This has three main areas of application: paleoecology, where it is used to determine certain aspects of past ecologies (most prominently climate); archaeology, where it is used to date old buildings, etc.; and radiocarbon dating, where it is used to calibrate radiocarbon ages ble of the world weather clearly [1]. In some areas of the world, it is possible to date wood back a few thousand years, or even many thousands. Currently, the maximum for fully anchored chronologies is a little over 11,000 years from present. Dendrochronology was developed during the first half of the 20th century originally by the astronomer A. E. Douglass, the founder of the Laboratory of Tree-Ring Research at the University of Arizona. Douglass sought to better understand cycles of sunspot activity and reasoned that changes in solar activity would affect climate patterns on earth which would subsequently be recorded by tree-ring growth patterns [3].
This article is about the effects of global warming and climate change. The effects, or impacts, of climate change may be physical, ecological, social or economic. Evidence of observed climate change includes the instrumental temperature record, rising sea levels, and decreased snow cover in the Northern Hemisphere. According to the Intergovernmental Panel on Climate Change [4], most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in [human greenhouse gas] concentrations”. It is predicted that future climate changes will include further global warming (i.e., an upward trend in global mean temperature), sea level rise, and a probable increase in the frequency of some extreme weather events. Signatories of the United Nations Framework Convention on Climate Change have agreed to implement policies designed to reduce their emissions of greenhouse gases.

The most general definition of climate change is a change in the statistical properties of the climate system when considered over long periods of time, regardless of cause [5]. Accordingly, fluctuations over periods shorter than a few decades, such as El Niño, do not represent climate change. The term sometimes is used to refer specifically to climate change caused by human activity, as opposed to changes in climate that may have resulted as part of Earth's natural processes and the differentiation of these two causes, human impact vs. natural processes is a key component of the climate change debate (UNFCCC, 2010). Climate change reflects a change in the energy balance of the climate system, i.e. changes the relative balance between incoming solar radiation and outgoing infrared radiation from Earth. When this balance changes it is called “radiative forcing”, and the calculation and measurement of radiative forcing is one aspect of the science of climatology. The processes that cause such changes are called "forcing mechanisms" climate change will impact agriculture and food production around the world due to: the effects of elevated CO2 in the atmosphere, higher temperatures, altered precipitation and transpiration regimes, increased frequency of extreme events, and modified weed, pest, and pathogen pressure [7]. In general, low-latitude areas are at most risk of having decreased crop yields [8]. So far, the effects of regional climate change on agriculture have been relatively limited. Changes in crop phonyology provide important evidence of the response to recent regional climate change.

Focusing on this research that it was interested at the sunspot cycle, Duvall (1995) found that travel times were reduced for waves traveling through a sunspot with the effect being almost independent of distance. In this case the waves were not measured in the spot at all but by looking at the second time-distance curve [8]. The solar magnetic fields show a remarkable degree of organization on the global scale, displaying the "butterfly" diagram and polarity reversals quite regularly with the 11-year cycle is believed to be the place of magnetic field generation and the source of the 11-year sunspot cycle [10]. The discovery two decades ago that sunspots act as both absorbers and refractors of incident solar acoustic waves (p-modes) offered the promise of probing the subsurface structure of sunspots [11]. Solar physicist David Hathaway [12] of the National Space Science & Technology Center (NSSTC) explains: "First, remember what sunspots are--tangled knots of magnetism generated by the sun's inner dynamo. A typical sunspot exists for just a few weeks. Then it decays, leaving behind a 'corpse' of weak magnetic fields." Current prediction for the next sunspot cycle maximum gives a smoothed sunspot number maximum of about 58 in July of 2013. They are currently two years into Cycle 24 and the predicted size continues to fall. The sunspot number is falling progressively, below the sunspot number corresponding to the microwave flux, and the sunspot number will be rather useless as a measure of solar activity, so Hathaway will have to continually adjust the predicted SSN down, the next sunspot cycle would be 30% to 50% stronger than the previous one. If correct, the years ahead could produce a burst of solar activity second only to the historic Solar Max of 1958. The sun's conveyor belt is a current, not of water, but of electrically-conducting gas. It flows in a loop from the sun's equator to the poles and back again. Just as the Great Ocean Conveyor Belt controls weather on Earth, this solar conveyor belt controls weather on the sun. Specifically, it controls the sunspot cycle [13].

![Sunspot Number](image1.png) ![Sunspot Cycle Predictions](image2.png)

Fig.2. Sunspot number and Sunspot cycle predictions
Thailand is a country with a rich history and distinct cultural identity centered on the Buddhist religion and a respect for tradition. These things, combined with a warm climate and spectacular landscapes, make it one of the most popular tourist destinations in Asia today. Geographically Thailand can be divided into four regions. In the north, centered on Chiang Mai, and along almost the entire length of the border with Myanmar, are mountains. Thailand has begun implementing interesting strategies to adapt to climate change, to mitigate some of the effects that are already felt across sectors, and to protect farmland, coasts, and cities. The lessons learned will prove useful to Thailand as it faces future climate challenges, and can be referenced by other Southeast Asian countries with similar situations.

Thailand is the home to 65 million people, the majority of whom live in rural, agricultural areas. The country is the world’s largest exporter of rice, and is often called “the rice bowl of Asia.” Agriculture employs 49% of the population and contributes 10% of GDP. Tourism and fisheries abound on Thailand’s 3,200 kilometers of coastline and play important roles in the economy, providing 6% of GDP and a livelihood to 10% of the population. The capital city, Bangkok, is home to 15% of the country’s population and serves as the economic, political and social center not only for Thailand but for the greater Mekong region, giving it the status of a global city. Climate change threatens all three important sectors of Thailand’s economy: agriculture, tourism, and trade.

Today, Thailand produces only 0.8% of the world’s carbon dioxide emissions, and has a lower per capita emission rate than the global average (3.25 metric tons in 2002, compared with 3.97 per capita worldwide). However, Thailand’s total CO₂ emissions doubled between 1991 and 2002 and the government recognized its contribution to global warming. In April 2007, Bangkok hosted an International Panel on Climate Change summit and in the following year hosted UN climate change talks. The following month, the Bangkok Metropolitan Administration published the 2007 Action Plan on Global Warming Mitigation, calling for reductions in Bangkok’s greenhouse gas emissions by 15% below currently projected 2012 levels. [14]

During the past decade, weather patterns in Thailand have fluctuated from severe droughts to severe floods, leaving residential and agricultural areas reeling. Between 1990 and 1993, rainfall was below normal levels, causing water shortages in 1993. Intense rainfalls in 1994 and 1995 resulted in the worst floods in Thailand’s recent history. In 2005, 11 million people in 71 provinces were affected by water shortages, in 2008; the population suffers from severe drought again, with over ten million people in the rural agricultural region affected. According to Thailand’s Disaster Prevention and Mitigation department, 55 of the country’s 76 provinces have suffered, damaging over 150,000 rai (60,000 acres) of farmland, primarily rice paddies. The drought has contributed to concerns of a global food crisis and soaring grain prices.

The effects of climate change, including higher surface temperatures, floods, droughts, severe storms and sea level rise, put Thailand’s rice crops at risk and threaten to submerge Bangkok within 20 years [14]. The damage to agriculture, coastal tourism, and the capital city as consequences of climate change will have enormous economic, cultural and environmental impacts: one degree of warming will destroy the rice crops that are central to the economy, and a few centimeters of sea level rise will submerge the capital city and devastate coastal tourism. Thailand’s mitigation and adaptation efforts include a slow shift to organic agriculture, a tsunami warning system along the Andaman Sea. On December 26, 2004, a magnitude 9.3 earthquake triggered the Indian Ocean tsunami, one of the most devastating natural disasters ever recorded. Anthropogenic climate change causes coastal erosion, mangrove loss and coral reef destruction; in the absence of these natural protective barriers, the giant wave carried its energy all the way to shore, killing over 250,000 people and causing billions of dollars of damage.

In term of the weather of the Northeast region in Thailand, can best be described as tropical and humid for the majority of the country during most of the year [15]. The area of Thailand northeast has a climate determined by three seasons. In northeast Thailand the seasons are clearly defined. Northeast region experiences Savanna (Aw) climate which marks humid hot and dry weather alternatively with medium rain volume. There are 3 seasons including winter, rainy season and summer. Summer is between February and May. It is influenced by southeast monsoon from South China Sea and the Gulf of Thailand. Due to the long distance from the sea, the weather is hot and dry. The province that has highest temperature is Udon Thani. Rainy season is between May and October with an influence of depression. However, the amount of the rainfall is quite uneven although 80% of the total rainfall occurs in August and September, average annual precipitation varies from 2,000 mm. Winter season is between October to February, the region is influenced by northeast monsoon. Then the cold wind and high pressure comes from China and covers the area in the north and northeast regions of Thailand. It can be relatively cool during the night. The average highest temperature is at 32.1 C and average lowest temperature is 21.2 C. The highest temperature recorded was 43.8 C in Udon Thani province, the lowest 0.1 C in Loei province. The lowest temperature is in January and highest in April [15].
Udon Thani (Thai: อุดรธานี) is one of twenty provinces of the north-eastern provinces (changwat) of Thailand. Neighboring provinces are (from north clockwise) Nong Khai, Sakon Nakhon, Kalasin, Khon Kaen, Nong Bua Lamphu and Loei. Udon Thani, province covering an area of 11,730 square kilometers, is a prime business center of I-San, is located in the north of the Khorat Plateau, use latitude 17°23'N and longitude 102°48'E in the form and elevation 177 m, in Roman script it is also often spelled Udorn. The province is subdivided into 20 districts (amphoe). The districts are further subdivided into 155 subdistricts (tambon) and 1,682 villages (muban). The province is most famous for the archeological site Ban Chiang dig uncovering pottery dating back over 5,000 years with its remains of the Bronze age. Udon is one of the more bustling markets for agricultural goods in the relatively dry northeast of Thailand, and received its biggest economic boost in the 1960s when the US built the Udon Royal Thai Air Force Base as a joint-force military base during the Vietnam War. Udon Thani is also known among Thais for producing fragrant Udon Sunshine perfume, made from an orchid of the same name -- orchids which bizarrely react to music.

Focused on the weather in Udon Thani is dominated by the two Asian monsoons. From May to October the south-west monsoon brings moisture from the Indian Ocean that falls as rain, peaking in August and September. From October to February the wind direction is reversed and a cooler drier north-east monsoon wind blows off the Asian landmass, bringing a dry season. Temperatures fall slightly in the dry season but this is only really noticeable at night. There is a short transitional period between the monsoons during March and April. This is the hottest time of the year over the whole country. With the onset of the monsoon in May temperatures drop slightly and cloudier conditions persist through to October. Udon Thani is largely protected from the full force of typhoons that affect the South China Sea by the landmass of Laos, Vietnam and Cambodia lying between it and the ocean.

This research was thinking of shooting in weather the Udon Thani area, was the 60 surrounding years during from 1951 to 2010 A.D. of weather forecast for showing means of daily, monthly and yearly of the predominant weather conditions including means of temperature, maximum and minimum temperatures, extreme of maximum and minimum temperatures, means of rainfall, maximum and minimum rainfalls, accounting days of rainfall, extreme of maximum rainfall, humidity, air pressure, wind speed, yearly accounting cyclone storms, evaporation of water, forest assessment, and water quantitative of Maekhong river that they are indicators plus directing information analysis.

**Research Objective**

1. To investigate of the weather in Udon Thani province, Thailand in the period of 60 surrounding years from 1951 to 2010 that its’ determinate from Dendrochronology and sunspot circle’s recording data.
2. To provide information on the climate changes that the Udon Thani province, Thailand will face, how these changes should be affected on the Global Warming impact, and what needs to be done now to adapt to the predicted impacts in 60 surrounding years from 1951 to 2010.

To compare and determine of the climate changes that the Udon Thani province, Thailand will change in 60 surrounding years from 1951 to 2010.
Research Framework

1. The inner portion of a growth ring is formed early in the growing season, when growth is comparatively rapid (hence the wood is less dense) and is known as "early wood" or "spring wood" or "late-spring wood". The outer portion is the "late wood" (and has sometimes been termed "summer wood", often being produced in the summer, though sometimes in the autumn) and is denser. Focused on the Yang tree (Dipterocarpus alatus Roxb). This frame work is to make available as much information about dendrochronology allowing archaeologists to name the specific year a tree was cut to make a wooden object. The atmosphere plays a major role in controlling the planets' temperature.

2. The climate is changing. The earth is warming up, and there is now overwhelming scientific consensus that it is happening, and human-induced.

3. An important thing to realize when thinking about climate is that, atmospheric and oceanic circulation carries different climatic features all over the planet.

4. The world mostly agrees that something needs to be done about global warming and climate change.

5. The Intergovernmental Panel on Climate Change (IPCC) was created by the United Nations Environment Programme (UNEP) and the World Meterological Organization (WMO) to assess the scientific knowledge on global warming.

6. The IPCC concluded in 1990 that there was broad international consensus that climate change was human-induced.

7. Researches have shown that air pollutants from fossil fuel use make clouds reflect more of the sun’s rays back into space.

8. Carbon emissions don't respect borders and the sad fact is that the world's most vulnerable people are the ones that are suffering most from its impacts.

9. The Kyoto Protocol is a crucial first step but far, far more needs to be done.

10. Thailand plus a few other countries, and many large corporations, have been against climate change treaties due to the fear of the threat to their economy and profits if they have to make substantial changes.

11. Udon Thani Province is located in the north of the Khorat Plateau, between the provinces of Khon Kaen to its south, and Nong Khai to its north.

12. As temperatures in Udon Thani increase further, there will almost inevitably be more flooding, more droughts, more disease and more famine, creating hundreds of refugees and causing the destruction of entire ecosystems and species.

13. Sunspot cycle is an effected of increased temperature is a possible change in the community structure of the weather in Udon Thani.

14. There was the first time for recording data system of the meteorological substances at the Udon Thani Metrological Station in 1951.

15. Model of Climate Change of Udon Thani Weather.
Procedure and Methodology

This study is the first of its kind. It is unique because it: covers an entire Thailand government region, makes projections of climate change at a new and improved scale of resolution compared to this research, combines cutting-edge research and analyze nationally-recognized professional meteorological substances and the period of time that its’ effect from sunspot cycle with the practical experience of staff working at the Udon Thani meteorological station’s data, weather, averaged over time—usually a maximum of 60 years. Regional climate means the average weather trends in an area. Considers impacts across a wide range of different sectors, and provides practical advice on adaptation measures within a range of organizations and bodies of data.

1. Planning framework of content and title.
2. Writing research proposal for administration by step system.
3. Previous research and literature reviews.
4. Policies and variable Targets; measuring, recording, organizing data and communication, and interpreting data conclusion.
5. Limiting conceptual research definitions.
6. Research example and population for recording data analyze of Udon Thani meteorological substances in 60 surrounding years.
7. Measuring of the year ring of the Yang trees by the Dendrochronology Technique to analyze of sample size of the 60 tree rings and 80 average years from 20 districts at rice fields, limb of water basins, and down hills thought out of Udon Thani province.

**Figure 4. The dendrochronology tools.**

8. Investigations of the Sunspot Cycle’s researches.
9. Provides practical advice on adaptation measuring data.
10. Using statistically analysis of data Microsoft Excel Program and SPSS.
11. Research conclusion, explanation and suggestion.

In statistics, a result is called statistically significant if it is unlikely to have occurred by chance. A regression line approximates real data points; an r-squared of 1.0 (100%) indicates a perfect fit. The formula for r is:

\[
r(X,Y) = \frac{\text{Cov}(X,Y)}{\text{StdDev}(X) \times \text{StdDev}(Y)}
\]

The Pearson product-moment correlation coefficient (sometimes referred to as the PPMCC, and typically denoted by r) is a measure of the correlation (linear dependence) between two variables X and Y, giving a value between +1 and −1 inclusive. It is widely used in the sciences as a measure of the strength of linear dependence between two variables.

\[
r = \frac{1}{n-1} \sum \left( \frac{X_i - \bar{X}}{s_X} \right) \left( \frac{Y_i - \bar{Y}}{s_Y} \right)
\]

The assessment of correlation via the familiar Pearson product-moment procedure applies only to those situations where one particular member of a bivariate pair of measures unequivocally belongs to the X (Yearly Mean Average Temperature variable) and the other unequivocally belongs to the Y (Others Yearly Mean Average) variables. Both of these measures of correlation have the same level of statistical significance as the F-ratio of the ANOVA from which they derive. The interpretation of eta squared is straightforward: of the total variability contained within the 15 measures in this data set, that reflects on-average differences among the 15 pairs of twins, any particular pair to have approximately the same measures.
A $t$-test is any statistical hypothesis test in which the test statistic follows a yearly mean average temperature's $t$ distribution if the null hypothesis is supported. Most $t$-test statistics have the form $T = Z/s$, where $Z$ and $s$ are functions of the data. Typically, this gives information about correlation and re association between variables. The table 2 shows the results of an analysis of variance performed upon this data set, along with two measures of correlation for unordered pairs that can be derived from these results. Statistically significant were found for investigating and analyzing data with multivariate analysis; polynomial function and linear function, the analysis of relative on climate characteristically change with Linear regression, Pearson correlation, and Compare mean (ANOVA-paired sample t-test) were used.

**Results**

This study is interested in the model of climate change of the provincial Udon Thani’s weather in 60 surrounding years from A.D. 1951 – to 2010. The climate characteristically change were investigated, determined, and analyzed, that they’re transferred to effects of climatologically substance data for determining of global warming; the mean of temperature, rainfall, relative humidity, air pressure, evaporation, wind speed, cyclone storm, forest assessment and water river at Maekhong river. Statistically significant were not found for investigating and analyzing data with multivariate analysis; polynomial function and linear function, the analysis of relative on climate characteristically change with Linear regression, Pearson correlation, and Compare mean (ANOVA-paired sample t-test) were used ($R^2 < 0.81$). However, changing and adapted data that it’s followed as the Sun Spot cycle for accounting of increasing and decreasing every 4.8 years (1955 – 1962, …. 1999 – 2003 A.D.) and 6.2 years (1951 – 1954, …. 2004 – 2010 A.D.), total is 11 years (1951 – 1954, …. 1999 – 2010 A.D.) surrounding years. In 2008 - 2010 is coming to a close with yet other spotless days according to the latest solar image (The 23rd Sunspot Cycle) and current prediction for the next sunspot cycle maximum gives a smoothed sunspot number maximum in 2013. The findings of this study are following as:

A. Relationships between the period yearly and Udon Thani region weather in the 60 surrounding years (A.D. 1951–2010)

Most climate change simulations are created with models that simulate the global scale and produce global averages as these results, to understand how global warming will affect in regional simulations and impact studies are needed. The 60 surrounding yearly of Udon Thani’s weather models show regional models depict the climate of a small area in more detail in Figure 3

**References**


Ascertaining Improved Pedagogical Administration Through Innovative Classroom Management Software

Lakshmi Kala Prakash
PhD Candidate in English for Professional Development
@ Mae Fah Luang University, Chiang Rai
Thailand
E-mail: 5771006258@lamduan.mfu.ac.th

Abstract

Organizing classrooms materials, activities, providing feedback, while saving time and money is a challenge faced by many EFL teachers. This predicament is doubled when the class that is being taught concerns correcting essays or other written work in a second language. Implementing innovative classroom management software can help overcome some issues such as providing teachers and administrators with the tools for connecting with students within and out of classrooms; sharing activities and announcements; maintaining folders on student activities, and increasing collaboration between students and teachers. The present classroom action research was carried out with the implementation of three freely available software applications: Google Classroom, Versoapp and TodaysMeet to ascertain if organizational affordances: access; storage and retrieval; sharing and recycling of materials, and cost efficiency (Reinders, & White, 2010) could be met in order to improve pedagogical management in an EFL Writing Classroom. The responses garnered through online questionnaires created with Google forms from 94 student participants attending an Upper Intensive English program at a University in Northern Thailand indicate that, applying one or more of the three applications may have positive pedagogical, and organizational benefits for all stakeholders. The findings from the action research study therefore recommends the implementation of such classroom management software as Google Classroom, or Versoapp in combination with TodaysMeet for improved pedagogical management following a systematic professional development workshop for all concerned stakeholders.

Keywords: Management software, Affordances, Access, Storage & retrieval, Sustainable education, Educational innovation

Introduction

In an ever-changing world, ideologies or deep-rooted conventions hinder progressive change. Yet educational systems around the world are focused on new directions for several reasons either pedagogical, or organizational. However, in South-East Asia such changes are still in their infancy or met with skepticism revealing a profound paradox: ‘education is held to be a key agent of change, and yet is largely part of the unsustainable problem it needs to address’ (Sterling, 2001). In spite of attempts by Universities to upgrade themselves with latest technological provisions for use on and off campus, capitalizing on these innovative educational applications is yet to be realized, or made sustainable. On this topic as retrieved from Giles, & Hargreaves, (2006), Hargreaves, (2003) states that despite the evolution of the “knowledge society” secondary schooling with its age-graded, subject-based curriculum, and lesson-by-lesson schedule, have proved remarkably resistant to the influence of successive reform movements. It has been surmised from research that perceptions of fellow professionals about innovative applications or schools being unlike ‘real schools’ which also leads to animosity or resistance to change and threatens long-term persistence in-turn leading to a spread of “scaling up” of new ideas (Metz, 1999; Fink, 2000; Hargreaves & Fink, 2000, and Smith et al., 1987) embody the first factor that contribute to the weakness and sustainability of a successful application of innovative tools, and ultimately innovative schools.

Stronge, Tucker, and Hindman, (2004) reveal that teachers learn the tricks of the trade, such as effective classroom management, from several sources including watching other teachers, reading about it, and reflecting on what is occurring in their classrooms. Classroom management involves “the actions and strategies teachers use to solve the problem of order in classrooms” (Doyle, 1986, p. 397). This order can also be dependent on the teacher’s approach to her own workload. Murray-Harvey, Silins, & Saebel, (1999) state that ‘teacher stress is an enduring, complex problem that has been well documented in the literature, a literature that also proposes ways of managing, or coping with stressors inherent in teaching’. Effective classroom management could be one suggested way for coping with stress. In order to achieve this, educational
practitioners in and from Western countries usually apply innovative applications. However, capitalizing on similarly available tools by teachers in the East is rarely achieved. Despite several Universities, with their own administrative goals for recognition, or improved World rankings, have provided their staff with the latest innovative applications, using them for their optimum potential is minimum at best. Many teachers in this part of the world still follow archaic practices when it comes to managing or organizing their classrooms. They are comfortable carrying loads of papers to and from classrooms; correcting student essays, or written activities with a red-inked marker, and rarely raising their voices for fear of losing face in a tightly bound community. Classroom management software is a chosen alternative, which allows a teacher to view their student’s computer screen from their own electronic devices while simultaneously guiding the way the page is used for effective interaction. Convincing the laggards to favor innovative change is a challenge. However, procuring evidence can help shift the mindset of majority of educational practitioners, who could be considered as resilient, and not resistant to change. Chapelle, (2001) based on Rasool's 1999 suggestion on 'communicative competence' states that "anyone concerned with second language teaching and learning in the 21st century needs to grasp the nature of the unique technology-mediated tasks learners can engage in for language acquisition and how such tasks can be used for assessment", which is partly in the realm of classroom management.

Several online tools are freely available for example in a 2013 EdTech Review on the impact of technology in Elementary classrooms in India, one such tool called ‘Schoolfy’ was shown to provide benefits not only for the students, but also for teachers by enabling them to add the names of all concerned stakeholders. These tools also provided a platform for collaboration with other teachers, and saved them time by offering options for setting up homework, sending documents, creating calendars, and making student assessments. Although several studies have explored the pedagogical effects of using these online tools in classrooms, studies with respect to the organizational effects of the same and their benefits or limitations are scarce. In addition the actual assessment before implementation in Universities in Thailand from the point of view of the main stakeholder relationship ‘the student-the teacher’ is limited. This action research is therefore conducted in order to fill this gap, which will lead to providing the administrative committee of an established University in the North of Thailand evidence on the benefits of using either Google Classroom, or Versoapp as the chief application for strengthening classroom management along with TodaysMeet for improving real time interaction. In order to achieve the stated objectives the following research questions were drawn-up.

RQ1: What organizational affordances does the use of Google Classroom or Versoapp in combination with TodaysMeet provide for an EFL Writing Class in a Thai University?

RQ2: What is the overall consensus of the student participants from the EFL Writing Class toward the use of either Google Classroom or VersoApp in combination with TodaysMeet in a Thai University?

Materials and Methods

Waters-Adams (2006) definite states that action research, ‘Action research is a practical approach to professional inquiry in any social situation’. Indeed this form of research did not take its roots in education, but the potential benefits to teacher development soon led to its application noted by Lewin as far back as1948 (Water-Adams, 2006). The present action research study was conducted at an established University in the North of Thailand. The 94 participants included fresher students attending the compulsory Upper Intensive English (UIE) program in the summer of 2015. The UIE program comprised five rotational modules namely Listening & Speaking; Reading; Writing; Grammar and Vocabulary; and Digital Media and Literacy. The researcher-teacher was assigned to the Writing module where the present action research took place.

Materials:

Research instruments:

1. Google Classroom with its banner ‘Beyond Classroom Walls’ developed as an online application by Google available to teachers, and educational institutions. It provides key features that allow teachers better classroom management. The features looked at by this researcher were that of uploading student names; uploading or hiding assignments, or announcements; ease of application and access with students; collaboration with teachers; storage and retrieval of submitted work; visual appeal, and saving time, energy and cost.

2. Versoapp with its banner ‘Giving students a Voice’ is another recently established free educational application and used in this study to discern an alternative choice to recommend to the University’s administrative committee for implementation in improving classroom management. Versoapp like Google Classroom provides, and was explored for similar features as in Google Classroom.
3. TodaysMeet with its banner ‘Realtime Interaction’ is the third application used and is also available free online. As the name suggests it was explored for its ability as an effective backchannel platform for the weekly rotation with the student participants. The available transcript tool of real time interaction from one Section of the participants in this study was used by the researcher to collect any critical incident episodes (CIEs) that occurred during the interaction for use in giving feedback on form or forms as a possible step for a future study.

4. Google Forms were used to develop the questionnaire feedbacks and then distributed via Classroom webpage or Versoapp webpage respectively to the participating groups use of these tools. They were chosen as they provided an easy link to the researcher-teacher’s Google Drive for return of responses as well as for its effective, in-built analytical tools. In line with the need for reducing teacher workload these forms were also chosen for their ability to be designed to suit specific needs of individual teacher’s classroom management. In line with Philips’ (2006) description based on Levy and Stockwell’s in press evaluation modes, this ‘checklist’ form was designed to retrieve both quantitative and qualitative data from the student participants with a mix of open-ended, Lickert scale type, and multiple choice questions. The forms were easy to fill in as they had very few questions with clear instructions, which were written and verbally directed face-to-face in class. All participants were informed of the reason for gathering their responses before they filled them voluntarily.

5. Researcher-Teacher’s Reflective Journal: Writing reflective journals while carrying out research is an effective part of data gathering (Wright, 2003). Maintaining such a document at the end of the day provided for key points that might not be within the ability of the student participants such as related ‘cost efficiency’ ease of entering student names, or retrieving files and maintaining folders, and other critical points.

Analytical Framework

Six criteria as espoused by Chapelle (2001) were adopted as the criteria for evaluating the CALL tasks set through either one of the three innovative applications. However, as the predominant focus of this research was on the evaluation of organizational affordances for efficient classroom management, the following four key advantages: access; storage & retrieval of learning behavior and records; sharing and recycling of materials, and cost efficiency, (Reinders & White, 2010) comprised the key analytical framework. These four categories provided the division of responses from the student participant checklists.

Method

The three online tools were applied over a period of 5 weeks. The UIE classes were scheduled for 3 hours a day 5 days a week therefore the total number of hours they had application within the classroom was 75 hours in total. However, as Google Classroom or Versoapp were primarily used as out of class management tools the period of application was more than 75 hours in total. The five sections of student participants were exposed to the applications with simple and concise instructions. They were grouped initially so that peer assistance in operation could be maximized. Assigned out of class activities also followed a similar design with the initial activities being group and collaborative writing activities. Subsequent to ascertaining ease of use among all student participants in the group, individual assignments were distributed online. In addition, the teacher or peers were in contact if any student participant required facilitation. At the end of each five-day rotation with each of the five groups the online Google Form was uploaded to procure feedback confidentially.

Results

In accordance with the analytical framework proposed by Reinders and White (2010) refer to in Table 1, on a summary of the evaluation of the three applications: Google Classroom or Versoapp, and TodaysMeet. With respect to the first research question the following comments indicate the organizational affordances pointed out by the student participants for an EFL Writing Module in a Thai University.

The first affordance namely ‘Access’ was the dominant choice when the discourse from the student responses were examined, here are some noteworthy responses (the responses have been shared without any editing) to the following questions for answering research question 1

Q. What was the best feature of Google Classroom/Versoapp for you?
- It easy to sent homework.
- It's easy to connect in classroom with friends and teacher.
- This system is really good and easy to access the information from the teacher.
- From the Reflective Journal:
- Some students needed extra instruction after class and this was made possible through Google Classroom.
- I needed to remind students to make a copy of the Writing Rubric for the following final session and this was easily done with just one announcement by posting on Google Classroom or Versoapp.

Q. Give at least one suggestion to your teacher to use Google Classroom/Verso to improve your English Language skills?
- Here are some answers that reveal the aspect of sharing and recycling of materials as the second overwhelming reason for wanting to use these applications:
- If everybody in the class use this app like a Facebook or use it twice a day, Google classroom will be the fastest way to announce the news, give students an assignment, change classroom for tomorrow class.

**TABLE 1:** Organizational Affordances of the three applications under evaluation

<table>
<thead>
<tr>
<th>Affordance</th>
<th>Google Classroom</th>
<th>Versoapp</th>
<th>TodaysMeet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Storage &amp; Retrieval</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Sharing and recycling of materials</td>
<td>√</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>Cost efficiency</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

- Verso is a good app to help teacher order homework to students.
- (TodaysMeet) Make we are close and share the moment.

From the Reflective Journal
- Some of the past assignments could be hidden so as not to confuse the students, yet revealed for
- Reassignment at the appropriate time.
- On the aspect of Storage and retrieval of materials the following points were discerned from the student responses and reflective journal of the researcher-teacher.
- The folder options provide for easy storage and assessment of student assignments.
- It was easy with the mute option on Google Classroom to control students of different batches once they had completed their Writing rotation with me. A good feature to keep student logs without deleting them entirely.
- The editing and suggesting options done in green font is better on the eyes of the students and would not intimidate them.
- The tasks can be recycled when the time is appropriate with the delete and show delete option on Classroom page.
- TodaysMeet provides transcript tools for printing and checking teacher-student interaction in class, which can inform the teacher on their own teaching practices.
- Versoapp has a good dashboard option that is attractive to the students and helps maintain privacy by hiding student names when displayed in class to check student comments or assignments.
- It's convenient to you that you can assign any works to student and easy to check their works. By the way if you want to upload of any substance you can do it! It's good!

As to Cost-efficiency it is noted that students might not be the best evaluators of this criteria, nevertheless a few clear responses such as the
- In my opinion I love the assignment online very much it save times and save papers.

However, from the reflective journal notes it is clear that cost efficiency is clearly visible to the teacher, or viewing the tasks completed online by the five batches of students, cost in terms of paper usage or printing is an undoubted affordance. On another issue for future study is the abundance of authentic data available instantaneously to the alert teacher via TodaysMeet, for the correction of form or forms. The advantage of privacy provided by this application can help the teacher provide negative feedback to the entire class without actually embarrassing the student(s).

Answering research question 2 the following percentage was indicated from the questions on the checklist designed to retrieve quantitative data:
● 92% of the participants favor the use of Google Classroom or Versoapp.
● Over 55% agree that it is useful for them
● 100% agree that TodaysMeet should be used in the classroom.

Conclusions and Discussions

Changing the underlying philosophy of deep-rooted conventions can be achieved through informed research, but for educators it begins with the educator’s own practice in the form of action research. Applying innovative applications in the 21st Century educational practice cannot be ignored by Universities or educators. Despite the benefits, some key learning points regarding the need for improved instruction on the use of these applications for both students and teachers were recorded. One point noted was the actual clichés regarding content recording while typing a comment in Google Classroom. Unless educational providers use these applications such hidden problems can never be identified for correction by a Google support team. In addition involving support staff as well as tech support crew of any University is imperative for a successful operation of any innovative application. Teachers cannot be expected to learn how to use educational technology in their teaching after a one-time workshop. Teachers need in-depth, sustained assistance not only in the use of the technology, but also in their efforts to integrate technology into the curriculum (Kanaya & Light, 2005). Teachers also need embedded opportunities for professional learning and collaborating with colleagues in order to overcome the barrier of time and teachers' daily schedules (The National Council of Staff Development, 2001; Kanaya & Light, 2005). In order to achieve this goal in the Thai context, professional development workshops to suit the needs of Thai EFL educators should take place before actual implementation. The present research provided insights from one of the main stakeholder namely the Thai EFL student on the organizational affordances three applications namely Google Classroom, Versoapp or TodaysMeet offer. It is also discerned from their feedback that they would like their University to adopt these applications for improved pedagogical management. Furthermore from the researcher-teacher’s reflective journal it is evident that these applications have the potential to reduce the burden placed on EFL instructors who are specifically assigned instruction of EFL Writing classes. In light of these findings implementing Google Classroom or Versoapp in combination with TodaysMeet for improved pedagogical management is recommended.

Acknowledgements

It would be reminiscent of me to not include my deep appreciation and gratitude to first Mr. Allan Grubb for his love, support, and encouragement as I take this academic journey. I am also indebted to Professor Hayo Reinders for his guidance and constructive comments during this study and submission of this conference paper. In addition to Dr. Sasima Charubusp and Mae Fah Luang University for their advice and support my sincere gratitude.

References


To Develop an Ubiquitous Learning Environment Model to Increase the Problem Solving Thinking Skills in Vocational Education Students

Klednatee Chaichana1,∗ Kanok Samawattana1 and Sanit Teemueangsai1

1Rajabhat Maha Sarakham University
80 Nakhonsawan Rd., Muang district, Maha Sarakham 44000 Thailand
(∗author for correspondence, E-mail: klednatee@hotmail.com)

Abstract

This research aims to: 1) Synthesize and develop an Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education Students and; 2) Evaluate the model developed. The sample group used in the study were consisted of 9 experts divided into 3 areas; U-Learning, Problem Solving Thinking Skills and Information Technology. All were selected purposively to improve the conceptual model and 5 experts for approved the conceptual model. Data were analyzed by arithmetic mean and standard deviation. The research findings were as follows: 1. The Development of the Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education students consists of three components as follows: a) Principles. The principles are the basic concepts to develop a model curriculum. b) Objectives. The objective of this Ubiquitous Learning Environment model is to increase the Problem Solving Thinking Skills. c) Instructional process. The instructional process consists of two stages. The first stage is the preparation stage and the second stage is the learning stage. The evaluation of learning is to measure the problem solving thinking skills development by authentic assessment. 2. The development of the Ubiquitous Learning Environment model increases the Problem Solving Thinking Skills in Vocational Education students to very high proficiency level.

Keywords: Ubiquitous learning environment, Problem solving, Thinking skills

Introduction

Researchers conducted a study and review of documentaries concerning Vocational Education’s situation and found out why enterprises in the locality don’t cooperate seriously with internship/apprenticeship agreement with students. Students need to go outside their respective provinces to undergo training at their own expense. The reason is because the establishments think that students lack discipline, diligence, patience and skills to solve problems.

The researchers verified the problem by asking the personal opinion of various staff in establishments and the outcome of the research is consisted with the findings from the documentaries. The problem about lack of problem solving thinking skills continues to be a problem.

The researcher studied and analyzed the causes of the problem by reviewing technical documents. Research, both at home and abroad found that the main cause is that teachers often use the regular classroom teaching methods then assess learners using a test that does not correspond to the real situation that students will face in their working life. This make the students not motivated to learn and lack Problem Solving, Thinking Skills.

Students of vocational mostly are those with relatively low academic achievement. Students rarely bothered to learn as much as they should. In addition, students have some difficulty to follow the rapid change of technology.

Materials and Methods

Research Instruments.

1. A questionnaire for the Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education students. Present the model to the 9 experts for consideration by in-depth interview.

2. A questionnaire of needs assessment for the Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education students. Present the model to the 5 experts for evaluate the model’s suitability.
The conceptual framework of this research is to integrate the design of learning of Ubiquitous Learning Environment and the Problem Solving Thinking Skills, as shown in Figure 1.

**Figure 1. Conceptual Framework**

The Ubiquitous Learning Environment increases the Problem Solving Thinking Skills in Vocational Education students.

The instructional process consists of two stages.

**The First Phase**

Synthesize and develop the Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education Students. The researchers conducted the study and documents review divided 5 Steps.

1. Analyze and synthesize former researches relevant to the elements of
   1.1 Analyze and synthesize former researches relevant to the elements of
       1.1.1 ubiquitous learning environment
       1.1.2 problem-solving skills
       1.1.3 Create the materials for research
       1.1.4 Study former researches
   1.2 Define Conceptual Frame Work
   1.3 Collect data by in-depth interview.
2. Select experts
   The sample group used in the study were consisted of 9 experts divided into 3 areas; U-Learning, Problem Solving Thinking Skills and Information Technology. All were selected purposively improvement the conceptual model and 5 experts for approved the conceptual model. Data were analyzed by arithmetic mean and standard deviation.
3. Create Instruments by in-depth interview.
4. Collect data
   4.1 Study about learning process by interviewing the instructors in order to synthesize the data of
learning activity; and by interviewing the students about their ability to use ICT tools for learning, their learning and cognitive style.

4.2 Design the Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education Students.

4.3 Present the model to the advisors for consideration and revision.

4.4 Present the model to the 9 experts for consideration by in-depth interview.

4.5 Present the model to the 5 experts for confirmation.

5. Final data to create model.

The Second Phase

This phase was to evaluating the Ubiquitous Learning Environment model to increase the Problem Solving Thinking Skills in Vocational Education students

5.1 Present the designed model to the 5 experts.

5.2 The model is modified according to the experts’ suggestions.

5.3 After modification, presenting the model in the form of diagram with report.

5.4 Analyze the results of evaluation of the model by mean ($\bar{x}$) and standard deviation (S.D.) consisting of 5 criteria for evaluation according to the idea of Likert scale.

$\bar{x}$ = Very High
$\bar{x}$ = High
$\bar{x}$ = Moderate
$\bar{x}$ = Low

The acceptable average to 3.51.

Results

Research findings show that:

A. Ubiquitous Learning Environment model increases the Problem Solving Thinking Skills in Vocational Education students. The learning environment in the Ubiquitous Learning Environment model increases the Problem Solving Thinking Skills in Vocational Education students. It consists of seven modules, namely

1) Teacher Module.
2) Students Module.
3) Ubiquitous Learning Environment Module.
4) Resources Module.
5) Communication Module
6) Learning Module.
7) Evaluation Module.
B. Evaluation of model feasibility

Evaluation of model feasibility was conducted by five experts and the results thereof were presented in Table 1-4.

Table 1: Evaluation of Principles and basic concepts to develop the model.

<table>
<thead>
<tr>
<th>Evaluation Lists</th>
<th>Results</th>
<th>Appropriateness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Provide students with the opportunity to bring new knowledge.</td>
<td>5.00</td>
<td>Very High</td>
</tr>
<tr>
<td>2. Use authentic assessment.</td>
<td>5.00</td>
<td>Very High</td>
</tr>
<tr>
<td>3. Students to create new knowledge.</td>
<td>4.80</td>
<td>Very High</td>
</tr>
<tr>
<td>4. Student analysis.</td>
<td>4.80</td>
<td>Very High</td>
</tr>
<tr>
<td>5. The students learn in different conditions</td>
<td>4.80</td>
<td>Very High</td>
</tr>
<tr>
<td>6. The students are doing work using differing assumptions.</td>
<td>4.60</td>
<td>Very High</td>
</tr>
<tr>
<td>7. Students’ cognitive equilibrium.</td>
<td>4.20</td>
<td>High</td>
</tr>
</tbody>
</table>

**Summary**: The experts found that the overall elements of this instructional model were suitable at Very high level ($\bar{x} = 4.74$, S.D. = 0.39). This means the elements and the process of this instructional model were suitable to be appropriate to bring to the design model of learning.
Table 2: Evaluation of The Elements of model

<table>
<thead>
<tr>
<th>Evaluation Lists</th>
<th>Results</th>
<th>S.D.</th>
<th>Appropriateness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Communications</td>
<td>4.90</td>
<td>0.22</td>
<td>Very High</td>
</tr>
<tr>
<td>2. Evaluation</td>
<td>4.77</td>
<td>0.39</td>
<td>Very High</td>
</tr>
<tr>
<td>3. The instructors</td>
<td>4.71</td>
<td>0.51</td>
<td>Very High</td>
</tr>
<tr>
<td>4. Ubiquitous Learning Environment</td>
<td>4.55</td>
<td>0.70</td>
<td>Very High</td>
</tr>
<tr>
<td>5. The learners</td>
<td>4.46</td>
<td>0.64</td>
<td>High</td>
</tr>
<tr>
<td>6. Learning resources</td>
<td>4.40</td>
<td>0.91</td>
<td>High</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>4.63</strong></td>
<td><strong>0.56</strong></td>
<td>Very High</td>
</tr>
</tbody>
</table>

Table 2: The experts found that the elements of model was suitable at very high level ($\bar{x} = 4.63$, S.D. = 0.56). It means elements of model of learning are conducive for learning.

Table 3: Evaluation of Learning Stage.

<table>
<thead>
<tr>
<th>Evaluation Lists</th>
<th>Results</th>
<th>S.D.</th>
<th>Appropriateness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Analysis Step</td>
<td>4.78</td>
<td>0.39</td>
<td>Very High</td>
</tr>
<tr>
<td>2. Learning Step</td>
<td>4.76</td>
<td>0.43</td>
<td>Very High</td>
</tr>
<tr>
<td>3. Problem Step</td>
<td>4.64</td>
<td>0.55</td>
<td>Very High</td>
</tr>
<tr>
<td>4. Hypothesis Step</td>
<td>4.64</td>
<td>0.55</td>
<td>Very High</td>
</tr>
<tr>
<td>5. Conclusion Step</td>
<td>4.58</td>
<td>0.61</td>
<td>Very High</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>4.68</strong></td>
<td><strong>0.51</strong></td>
<td>Very High</td>
</tr>
</tbody>
</table>

Table 3: The experts found that the learning stage was suitable at very high level ($\bar{x} = 4.68$, S.D. = 0.51). This means the teaching processes suitable to be defined as activities that promote the teaching of thinking skills to solve problems.

Table 4: The evaluation results of Thereviews model the curriculum as a whole.

<table>
<thead>
<tr>
<th>Evaluation Lists</th>
<th>Results</th>
<th>S.D.</th>
<th>Appropriateness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consistency and relevance during the process of learning each step.</td>
<td>4.80</td>
<td>0.45</td>
<td>Very High</td>
</tr>
<tr>
<td>2. Learning the 5 steps process can lead to the purpose of research.</td>
<td>4.80</td>
<td>0.45</td>
<td>Very High</td>
</tr>
<tr>
<td>3. The appropriateness of the management model to learn about the context of vocational education.</td>
<td>4.80</td>
<td>0.45</td>
<td>Very High</td>
</tr>
<tr>
<td>4. The appropriateness of the management model of learning with the students' courses.</td>
<td>4.80</td>
<td>0.45</td>
<td>Very High</td>
</tr>
<tr>
<td>5. The possibility of bringing this model of learning in vocational education.</td>
<td>4.80</td>
<td>0.45</td>
<td>Very High</td>
</tr>
<tr>
<td>6. Innovative learning to develop the ability to think of a solution.</td>
<td>4.80</td>
<td>0.45</td>
<td>Very High</td>
</tr>
<tr>
<td>7. The clarity of the diagram presented in the form of learning.</td>
<td>4.60</td>
<td>0.55</td>
<td>Very High</td>
</tr>
<tr>
<td>8. Learning the five steps to comply with the framework for research.</td>
<td>4.60</td>
<td>0.55</td>
<td>Very High</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>4.75</strong></td>
<td><strong>0.47</strong></td>
<td>Very High</td>
</tr>
</tbody>
</table>

Table 4: The experts found that thereviews model the curriculum as a whole was suitable at very high level ($\bar{x} = 4.75$, S.D. = 0.47). This means the model is suitable for increase the problem solving thinking skills and it is really practical.

Conclusions and Discussion

According to the results of this research, the discussion is as below:

1. According to the evaluation, the overall elements of this instructional model were suitable at high level. This is because the development of this model applied the concepts of Ubiquitous Learning
Environment. This corresponds to the research of Bruner, J.S. [4] who found that to create interesting learning, flexible context that limited knowledge exists only in the classroom.

2. According to the evaluation, it is found that the elements of model were suitable at very high level. It is important to make the learners well learning is appropriate to set to the environment for learning.

3. According to the evaluation, the learning stage was suitable at very high level. This will help improve the problem solving thinking skills. This is consistent with research of Hains-Wesson. [13] Found that the adoption process of solutions. Instruction can be used to promote solutions and achievement high learning as well.

4. According to the evaluation, the views of the model curriculum as a whole was suitable at high level. This model can increase the problem solving thinking skills and use u-learning model. Because of today’s technology with the availability of devices such as tablets, smartphones, etc. can make the learning environment based on the model developed for real.

Acknowledgements

I would like to thank all the people who contributed in some way to the work described in this thesis. First and foremost, I thank my academic advisors, Dr. Kanok Samawattana and Dr. Sanit Teemueangsai for their support and advice. I’m thankful also to Ms. Marilou Ranay and Ms. Roselyn Cagampang for helping me in my report.

References


The Problems of Research Conducting of Graduate Students: Educational Administration, Thepsatri Rajabhat University
Phuwadon Chulasukhont
Thepsatri Rajabhat University
164/100 M.3 Nikomsangton-ang Muang Lop Buri 15000
Thailand

Abstract
This research aims at studying 1) the problems in research conducting of graduate students: Educational Administration, Thepsatri Rajabhat University, and 2) the comparison of problems in research conducting of graduate students when they were different genders. 213 graduated students from 4 different campuses were samples of the study. The Yamane technique was chosen to stratify random sampling. A questionnaire was used as a tool for data collecting and found a reliability at 0.966. The data were statistically analyzed by percentage, mean, standard deviation, t-test, one-way ANOVA, and Scheffe’s test.

The findings show that: 1) from graduate students’ opinion, the problems in research conducting were rated overall at a medium level. Considered all the cause aspects individually, they were ranked in descending order of their mean values as follows: university services aspect, workplace of student aspect, student characteristic aspect, curriculum and teaching aspect and advisor aspect. 2) The comparison of genders of the graduate students’ opinions indicates significantly difference at .05. Nonetheless, their opinions were not different when they were different in age, marital status, position, research type, workplace and campus.

Keywords: Research conducting, Graduate students, Educational administration

Introduction
The graduate study is very important that the students must study, research and construct new knowledge and apply it to their work and organization. Therefore, the university should support graduate school to conduct the research effectively under the academic principles and theories. (Somjit, 2008)

Educational Administration program of Thepsatri Rajabhat University customized the 2 years plan for the graduate coursework and 3 year plan for their research conducting. But only 40 percent graduated within time limited. Most graduate students averagely spent 4 years and 8 months to finish their degree. (Graduate school, Thepsatri Rajabhat University, 2014)

The cause that the graduate students could not finish their degree on time, because they did not completed the research. Therefore, there were several effects such as, the program couldn’t enroll the new students, and there were not enough advisors for the students, because many students were not graduated. They also affected the research quality. The researcher realized the problems and the importance of the issues mentioned above. Therefore, researcher studied the problems of research conducting of graduate students: educational administration, Thepsatri Rajabhat University to be the guideline of problem solving and help the graduate students understand it correctly and clearly. In addition, the study was aimed to promote the students’ attitude toward research conducting.

Materials and Methods
The sample of the research was 213 graduate students from 4 campuses of Thepsatri Rajabhat University, included Thepsatri campus, Chaibadan campus, Dermbang-nangbuach campus and Takhi campus in 2012-2014 academic year.

The researcher studied the problems in research conducting of graduate students majoring in educational administration of Thepsatri Rajabhat University by synthesizing the five variables from Poj (2007) Kanyawee (2008) Somjit (2008) Nuchanart (2008) and Nannapas (2010) included, student characteristic aspect, workplace of student aspect, advisor aspect, curriculum and teaching aspect and university service aspect. (See Table 1)
Table 1: Synthesized of conceptual framework.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student characteristic aspect</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Workplace of student aspect</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Advisor aspect</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Curriculum and teaching aspect</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>University service aspect</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

The research instrument was a questionnaire of problems of research conducting of graduate students: educational administration, Thepsatri Rajabhat University. The researcher created the questionnaire by studying related textbooks and research studies, and it was divided into two sections as follow:

Section 1 were the check-list questions about the profile of the graduate students, the data were analyzed by frequency and percentage.

Section 2 were the questions about the problems of research conducting of graduate students: educational administration, Thepsatri Rajabhat University. Focusing on the 5 aspects. The questions used five-level rating scale analyzed by mean and standard deviation. Then the research hypotheses were statistically tested using T-Test and one-way ANOVA to compare the means of research problems. Scheffe's method was applied when the differences were statistically significant.

**Results**

Most graduate students were 30-40 years old, female, working in the office of basic education commission and studying in Dermbang-nangbuach campus.

The data analysis of problems of research conducting of graduate students: educational administration, Thepsatri Rajabhat University, found that overall there was a problem at the medium level. When considering individual aspect in descending order, there were university services aspect, workplace of student aspect, student characteristic aspect, curriculum and teaching aspect, and advisor aspect respectively. (See Table 2)

Table 2: Overall of problems in research conducting of graduate students majoring in educational administration of Thepsatri Rajabhat University.

<table>
<thead>
<tr>
<th>The problems in research conducting of graduate students</th>
<th>The problems level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
</tr>
<tr>
<td>1 Student characteristic aspect</td>
<td>2.86</td>
</tr>
<tr>
<td>2 Workplace of student aspect</td>
<td>2.95</td>
</tr>
<tr>
<td>3 Advisor aspect</td>
<td>2.10</td>
</tr>
<tr>
<td>4 Curriculum and teaching aspect</td>
<td>2.29</td>
</tr>
<tr>
<td>5 University service aspect</td>
<td>3.11</td>
</tr>
<tr>
<td>Overall</td>
<td>2.66</td>
</tr>
</tbody>
</table>

The comparison of the students’ perspectives on the problems in research conducting was shown that they had different perspectives when they were different gender at a significance level of .05. However, their opinion was not different when they were different in age, marital status, position, research type, workplace and campus.

**Conclusions and Discussion**

4.1 The problems in research conducting of graduate students majoring in educational administration were rated overall at a medium level. If considering in each aspect, it was found that:
4.1.1 The student characteristic aspect was rated overall at a medium level, whereas the highest level of problems were, computer data processing program ability, and family obligations and responsibilities. This may be because of some students did not know how to use the computer data processing program, and most of them already have family. Therefore, they spent their time for family and obligations of daily life. This may include, less skills of searching data from various sources to support their research. According to Thidaporn (2010, p.64), the study of success factors in thesis performance of graduate students at Rajabhat Rajanagarindra University, found that the knowledge and understanding of the research process, students’ self-management were success factors in thesis performance. However, the problem such as, lack of graduate students’ research knowledge were still found. Because the majority of graduate students must perform their routine work alongside with study, they could not spend their time for thesis. If they did not plan properly and spent time for research, this may become critical problems and obstructions of thesis performance.

4.1.2 The workplace of student aspect was rated overall at a medium level whereas the highest level of problems was the responsibilities in workplace. This was because they had workload in their workplace. Some of them might have many assignments from their supervisor, thereby decreasing time for research conducting. According to Arunsree (2009, p.121) studied of success in thesis writing of graduated master degree students of Hatyai University, and found the problems and obstructions of thesis conducting success. This included lack of allocated time in thesis conducting and work, and the success in thesis writing was affected from routine works. Therefore, the students discouraged and they chose to work and ignored thesis, finally they incompeleted thesis writing.

4.1.3 The advisor aspect was rated overall at a low level. The lowest levels of problems were qualification of advisors, knowledge and expertise in the research process, including the interaction between advisors and students. This was because all advisors of educational administration major had qualification that had been guaranteed from office of the higher education commission. In addition, all advisors also had experience, competence and specialized in the research methodology. Therefore, students could easily talk, meet, and consult with them both officially and unofficially. According to Nannapas (2010, p.108) studied of problems related to writing master’s degree thesis for the master of laws program, Ramkhamhaeng University, and founded that advisory committee aspect was rated overall at a low level of problems. This is because the advisory committee were always attentive and followed thesis of students, but there might be some problems about a small of advisors per students.

4.1.4 The curriculum and teaching aspect were rated overall at a low level whereas the lowest level of problems was the knowledge gained from the course in the curriculum. This might be because of the educational administration program focused on educating students in the theory and how to apply in their organizations. In addition, the time frame of study plan was appropriate and relevant, in terms of teaching and learning activities and thesis process. Disagreeable with Kanyawee (2008, p.62) studied the problems in writing thesis in graduate college, King Mongkut’s University of Technology North Bangkok, and founded that the problems in writing thesis of curriculum aspect were rated at a high level. Because the knowledge were gained from curriculum were still not enough, the students could not applied to thesis methodology.

4.1.5 The university services aspect was rated overall at a medium level whereas the highest level of problems was the services and information from university staff. This may be because the students might expect to receive the good services from the university staff, but the quantity of staff was not enough and they might have too much workload. Moreover, the process of the thesis took a long time and caused the thesis delay. According to Thidaporn (2010, pp.65-66) studied the success factors in thesis performance of graduate students at Rajabhat Rajanagarindra University and founded that the university service was support factors of success for students who were writing thesis as well as library service which the student would have often accessed during the thesis writing and the contact with graduated college. Therefore, the services from university staff affected the success factors in thesis performance.

4.2 The comparison of their perspectives on the problems in research conducting of graduate students majoring in educational administration shown that,

4.2.1 When they were different gender, they had different perspectives at a significance level of .05. This might be because female students spent their time for family and obligations of daily life more than male students. And their emotional behavior profound tenderness, delicate and discreet more than male students. Students’ family responsibilities were more than male students. A study by Chanika (2010, p.112) founded the differences between male and female, commitment to their thinking, speaking, beliefs, attitudes and family.
Moreover female were sensitive for all details while male students concentrated only the importance. These might be the cause of female students had more problems of thesis writing than male students.

4.2.2 When they were different ages, in overall perspectives were not different. Whereas if considering each aspects revealed that, student characteristic aspect and curriculum and teaching aspect were difference. This might be because the younger than 30 years old students had obligation to be responsible less than the older students, these might include family responsibilities. It was a reason why they had less problems than older students. According to Thidaporn (2010, p.66) studied the success factors in thesis performance of graduate students at Rajabhat Rajanagrarindra University and founded that students were different ages, they had different perspectives of success factors in thesis performance, because most students were older than 45 years old and some of them were school administrators. They could spent thier time for thesis performance regularly, and might had more responsibilities than younger students.

4.2.3 When they were different marriage status, in overall perspectives were not different. Whereas if considering each aspects revealed that, student characteristic aspect was difference. This might be because marriage students had family responsibilities together with research process. Included divorced or widowed students, someone might had obligation to aliment their child by themself. Therefore, they had more problems than single students. According to Nuchanart (2008, p.78) studied the problems and problem solving alternatives on thesis conducting of non-formal education students, faculty of education, Chiang Mai University. Revealed that students with marriage status, they lacked of consultant with thier advisors. Because marriage students had more family responsibilities, they could not spent thier time for research methodology, might affected to problems on thesis conducting.

4.2.4 When they were different campus, in overall perspectives were not different. Whereas if considering each aspects revealed that, university services aspect was difference. This might be because each campuses had different services, such as the quantities of university staffs, how to give the informations to students, included the manner personality of the staffs from each campuses were difference. That affected to different problems in each campus, disagreeable with Bussakorn (1991, p.92) studied the problems related to writing master’s degree thesis, Srinakharinwirot University. Revealed that Prasarnmit campus and Songkhla campus, in overall of thesis writing problems were not different. These might be because all staffs from each campus service all students equality.

Suggestions

This studying examined only 5 aspects, therefore, the future research should study as many aspects as possible. Furthermore, this research studied only the major of educational administration which may not represent the general population. In the future, other majors should be studied.

Acknowledgements

The author expresses his appreciation to graduate students who were samplers and all experts in educational administration and research methodology for their expertise and cooperation in checking research instruments, Thepsatri Rajabhat University, a coordinator, and everyone who participated in this research.

References


Local History Learning for Children and Youths

Prasopsuk Rittidet¹*, Sombat Rittidet² and Tanthip Khuana³

¹Lecturer in Curriculum and Instruction, Faculty of Education, Rajabhat Maha Sarakham University
²Lecturer in Physics, Faculty of Education, Rajabhat Maha Sarakham University
³Project Researcher Local History Learning

(*author for correspondence, E-mail: prasopsuk2552@hotmail.com)

Abstract

The research had the objectives to: 1) study the body of knowledge of the local history of Ban Gudkaen community; and 2) study the needs for learning history of children and youths in Ban Gudkaen community. The research employed participatory action research and oral history study. The research instruments were: (1) a survey form for the body of knowledge of the local history; (2) a structured and unstructured interview form; (3) guidelines of questions for focus group; and (4) a record of the focus group. The scope of the research covered: (1) the target group comprising 30 children and youths, 3 community learned persons, 2 trainers, and 30 parents of the children and youths, obtained through simple random sampling, drawing lots; (2) the setting was Ban Gudkaen, Tambon Nongno, Muang District, Maha Sarakham Province. The duration was from September 2014 to September 2015. The statistics employed in the analysis of data were percentage, mean and standard deviation. The presentation of the results employed a descriptive analysis.

The results are as follows:

1) Regarding the knowledge of the local history of Ban Gudkaen community, during the period prior to the present time, from 1947 to 1973, and the present period from 1974 to 2014, there were 8 types of local history but the content of each type changed with the dimension of time as a result of the country’s modernization. Some types of the local history adapted themselves and have existed in the community. However, some types have disappeared. For instance, on the aspect of community economy, on taking up the occupation, there have been no more growing of jute and cotton, and on the aspect of culture there have been no more of Esan-styled folk singing shows, folk dances, witty sayings and lullabies.

2) Regarding the needs for the local history learning of children and youths, 100 percent of them wanted to learn the following in the highest level: concerning the community’s economy, they wanted to learn how to raise buffaloes; concerning culture, they wanted to learn about Boon Boeg Ban festival; and concerning learning resources, they wanted to learn about the HuayKamPu brook. Regarding how to learn, they wanted the following techniques: cooperative learning, project learning, independent learning, and learning from media, individuals, learned villagers, trainers, videos, documentaries and learning sources available in the community. The results of the study mentioned above were congruent with the focus group which revealed that the local history of Ban Gudkaen community comprised 8 types, and some types have disappeared because village learned persons who possessed knowledge did not transmit the local history to the people in the community. Meanwhile, children and youths liked technological media such as mobile telephones, and the Internet. Regarding how to learn, the children and youths wanted to learn with the following techniques: cooperative learning, independent learning and learning with other media that are suitable for the content of the local history that still exists in Ban Gudkaen community.

Keywords: Learning, Local history, Children, Youths

Introduction

Thai educational reform began in B.E. 2542. There have been attempts to reform learning at the school level, writing curriculums and organizing learning of history with more participation of local communities in organizing education in their own areas, hoping that the learners would learn things close to them, would see changes that take place in their own locality, would love and be attached to their mother land, would help tighten relationship among community members, from generation to generation with more admiration for each other. Also, it is hoped that children and youths would respect adults’ body of knowledge, and adults would be happy having had their knowledge transmitted to their children in the community (SilapornBuasai. 2009 : 6). Moreover, the study of the local history during the last half of the past century has been continuous and has gained more progress. The study has a tendency to shift from the matters of cities and biographies of personages
to a variety of content in the village communities where the people are regarded as center in order to understand the various ways of life in the “localities” that have combined together to be “Thai nation” at present.

Therefore, studying local history means studying national history because the important local history is the villagers’ memory in bargaining and fighting the economic system of capitalism. After all, the villagers’ shared memory not only is used as power that generates community’s potentiality for facing problems and for adaptation in the situation but also turns “villagers’ history” into the entire wisdom bank of the community as a common treasure that everyone can use when they solve problems that they are facing at present (AttachakSattayanurak. 2005 : 30-31)

Learning local history that concerns the majority of the people and that is a result of collaboration can “communicate” with the people in the locality forcefully because the villagers can see their own selves. So they can answer the questions of who they are, how they have come to be as they are, and on what basis they will go further. Local history of such nature will induce new type of historical conscience – the conscience that national history is not only history that has the center at the capital or biographies of personages but also a history that includes history of people’s fights in various localities, people who have melted together since the past and have become “Thai nation” at the present time. People in the localities are important and they have had their roles in the national history. Villagers are therefore not lowly. They are not underdogs who only are victims, but they are humans with abilities and wisdom that have long been accumulated. Their ancestors have been a part of the history and were ones who set or who were doers in the national history. The historical conscience helps people to perceive their own past, present, future, weaknesses, strengths, and limitations. Such perception helps people not to look down upon themselves but have pride of the fights their ancestors performed. Revival of historical conscience that is the shared memory of the community creates a relationship that links people in the community together to get ready to protect their community which includes resources and wisdom that are “community’s property” that the people have the right on and have been inherited. (SrisakWallipodom. 2001 : 170).

The community’s property as mentioned in the study of SrisakWallipodom is concordant with the community of Ban Gudkaen, TambonNongno, Muang District, MahaSarakham Province which has a long history of matters inherited from their ancestors. These comprise the history of village founding, the history of economy, taking up subsistence occupation for self-support and making merit. Later they took up occupation for consumption and sale, and the agricultural tools changed according to the capitalism – from using the labor of oxen and buffaloes to the age of machinery, chemicals and pesticides that are harmful for health. However, the community did not collapse because it adapted itself to the change by taking up alternative agriculture according to the Royal Initiatives. That is, they rely on the natural agriculture which is chemical-free. They use herbal pesticides and they use compost to improve the quality of the soil. All of these things took place according to the dimension of time and change as related to the way of life of the villagers on the aspect of adaptation. This has been the economic history of Gudkaen villagers (PrasopsukRittidet et al. 2012 : 60). In addition, Ban Gudkaen community has a shared memory of using natural resource in the case of HuayKamPu brook. This brook has been used by the people in several communities since their villages were founded. Everyone in TambonNongno knows the natural brook and forest from which they use the water for cultivation and find their food. The people in Ban Gudkaen are Buddhists like people in general in Esan. They make merit according to the 12-month merit making traditions which govern the communities as if they were laws, and these traditions bring peace to the communities because the villagers believe that if they do good they will receive good as Buddhism teaches them.

The study of the local history of Ban Gudkaen dealt with the following aspects: memory of the local history; the shared conscience in taking up the occupation; following the traditions and using resources from the forest and the river together. However, Ban Gudkaen community encountered the problem of cultural obliteration. The community has been developed through the National Economic and Social Development Plan 1 to Plan 7. As a result, the people forgot their own history because the value of the knowledge and memory that have been handed down did not mean anything to the economic development because the development gave a higher priority to the industrial sector. The lives of most people in Ban Gudkaen became underdogs of the capitalist economic system. Particularly, the usurpation of resources such as cutting down trees to build infrastructures like roads, water supply, electricity, and the community lost its self-reliance; people forgot their roots of culture; the natural resources they used to resort to in making a living in the past have been lost. Particularly, children and youths in the community had more serious problems in sex, consumption habit, and the behavior of not eager to learn. The problems were results of receiving various media inappropriately. There was imitation of foreign culture and children and youths forget their roots and their community history. Then there was the lack of continuation of good local traditions because they lacked pride of their local community,
eagerness to learn, and analytical thinking. They did not have the courage to express their opinions (Report of NongnoTambo Administration Organization, Muang District, MahaSarakham Province, 2012 : 60).

From the aforementioned problems, there should be learning organization on matters close to the learners, with participation of families, the community, private organizations and government organizations. These institutions worked together to organize local history study. Thus, the research team decided to study “Local History Learning for Children and Youths” in order to provide opportunities for the children and youths to learn the local history, and use the lessons from the past as guidelines in community development in the future in order to sustain the community’s adaptation in the modern society.

Objectives

1. To study the body of knowledge of the local history of Ban Gudkaen community during the period prior to the present time and the present period.
2. To study the needs for local history learning of children and youths in Ban Gudkaen community.

Instruments and Methodology

1. The research instruments consisted of (1) a survey form for the body of knowledge of the local history; (2) a structured and unstructured interview form; (3) guidelines of questions for the focus group; and (4) a record of the focus group.
2. Research Methodology
   The research followed the methodology of participatory action research and oral history research.
3. Scope of the Research
   1) Population and Sample
      1.1) The population comprised 50 children and youths, males and females 8 to 18 years of age, 50 parents, 2 trainers, 5 learned villagers; all of them lived in Ban Gudkaen, Village No. 2 and Village No. 6, Tambon Nongno, Muang District, MahaSarakham Province.
      1.2) The sample comprised 30 children and youths, 30 parents, 2 trainers, 3 learned villagers, obtained through simple random sampling, by drawing lots. The number of people is the sampling unit.
   2) Content of the Research
      (1) The body of knowledge of the local history during the period prior to the present time and the present period.
      (2) The needs for local history learning of children and youths in Ban Gudkaen community.
   3) Setting
      The community of Ban Gudkaen Village No. 2 and Village No. 6, Tambon Nongno, Muang District, MahaSarakham Province.
   4) Duration
      From September 2014 to September 2015

Data Collection

(1) Collect data from related documents and research works; (2) Collect data from the survey form on knowledge of the local history of the community of Ban Gudkaen community; (3) Collect data from the interview and the focus group.

Analysis of Data

The analysis of data comprised analysis of related research documents and the analysis of data from the field on the topic of The Knowledge of the Local History and Needs of Children and Youths in Learning the Local History of the community of Ban Gudkaen.

Statistics Employed in the Analysis of Data

Basic statistics comprising percentage, mean, and standard deviation were employed.
Results

The results revealed that:

1. Regarding the knowledge of the local history of Ban Gudkaen community, during the period prior to the present time, from 1947 to 1973, and the present period of 1974 to 2014, there were 8 types of local history: (1) community economy: growing rice, cassava, chili, tobacco, jute, and cotton, working for wages, working as a government official, raising cattle, water buffaloes, and pigs; (2) the local history and social matters: throughout both periods the people of Ban Gudkaen have had social relationships with family, relatives, neighbors, government organizations and non-government organizations, and they have had relationships with production groups both inside and outside the community; (3) the culture of Ban Gudkaen community: the culture of both periods exist in the community. There is culture at the person level. It includes beliefs, marriage, dressing, birth, death, making merit for the dead, and there is shared culture. It includes making merit according to the 12-month merit making traditions: Songkran, Boon Boeg Ban, Boon Pawed, Chinese rocket launching, ordainment, making merit for the dead, Magha Puja Day, Visakha Puja Day, Buddhist holy day, and the third lunar month merit making; (4) politics and government: the villagers of Ban Gudkaen follow the democratic system of government. The village is divided into governmental sections. The village headman is the community leader. There are various organized groups such as the Saving group, the Million Baht fund, the Agriculture and Cooperative Bank group, and the Funeral group; (5) education: Gudkaen villagers get their education from the school, the temple and the family; (6) health: Gudkaen villagers receive health service from applied Thai traditional doctors and modern medical doctors; (7) the community resources that the villagers use together are the temple, the school, the shrine, HuayKamPu brook and the community forest; and (8) local technological history: this refers to the use of communication tools and public utility tools such as radio receivers, television sets, mobile telephones, electricity, water supply, roads, machinery, automobiles, motorcycles and tractors, etc.

Regarding the knowledge of the local history of Ban Gudkaen community, some matters of the content have been changed to facilitate adaptation of the people in the community. Some other matters have disappeared. On the cultural aspect, there are no more folk games and entertainment, no more Esan-styled singing show, no more folk dance and witty sayings while watching the Esan-styled singing show. On the aspect of taking up an occupation, Gudkaen villagers do not grow jute and cotton, but they plant eucalyptus and grow grass for animal feeding. The disappearance of the local history was caused by the modernization of the community.

2. The results of the study of the needs for learning history of children and youths: they wanted to learn all of the 8 types of the local history. However, when the content of each type was considered, it was found that 80 percent of what the children and youths wanted to learn are in this order: how to raise water buffaloes, HuayKamPu brook, and Boon Boeg Ban. The children and youths gave their opinion that water buffaloes give people their labor. They are beneficial for Gudkaen villagers. However, at the present time the number of water buffaloes is small. Therefore, they want to conserve and revive water buffalo raising. They also want Gudkaen villagers to avoid littering, not letting chemical liquid get into HuayKamPu brook because the fish will die and local vegetables will not grow because there is epidemic. Besides, in Ban Gudkaen community before rice growing season, the people performed Boon Boeg Ban festival for 3 days. It is a tradition that should be disseminated to the neighboring communities. And the study of the methods of learning the local history revealed that the method the children and youths need in the highest level, 100 percent, was the project cooperative learning group in which they themselves, parents and the elderly in the community transmit the knowledge to the learners; and they want to learn from the trainers, video media, and learning sources available inside and outside the community. Which method to be used depends on the content. Raising water buffaloes, Boon Boeg Ban, HuayKamPu brook, and learning the local history are congruent with the focus group. Being asked in the in-depth interview, the children and youths, parents of the children and youths of Ban Gudkaen revealed many types of occupations in the local history such as rice growing, trading, working for wages, working as a government official. All of these occupations have existed since the time of their grandparents. In each month, Gudkaen villagers together conducted the 12-month tradition. So, they make merit throughout the year. There were Boon Boeg Ban, Boon KhaoJee, the third lunar month festival, and Songkran festival. On the government aspect, the village headman, the head of the Saving group and the head of the Housewives group were elected (Jirawadee Sukpuangkaew. 2014 : Interview). Also, when they are sick, they are cured by the magic spell doctor, by the traditional medical man, and the doctor at the hospital, or sometimes they go to the community health center in the village. On the aspect of education, the villagers of Ban Gudkaen are taught by monks, local wisdom teachers, and the family. It is education organized in the temple, school and family. At the present time, the matters of the local history that have not been continued are as follows: on the aspect of...
occupation, there has been no more jute and cotton growing; on the aspect of culture, there has been no more of lullaby singing, no Esan-styled folk singing show, and no folk dance. This is because the community learned persons who possessed the knowledge of acting did not transmit it to the people in the community. Moreover, children and youths did not like folk shows. They rather watched soap operas, movies, singing contests on television, on the Internet, or Facebook. Folk arts, therefore were not conserved and revived in the community of Ban Gudkaen. The way to solve the problem of forgetting the cultural roots is having the elderly tell the local history to the children and youths (ThongjanSukpuangkaew. 2014 : Interview).

Discussion

In the study of the local history of Ban Gudkaen, 8 types of local history were found: community economy, education, health, resources, politics and government, culture, society and technology. It is a history of the period prior to the present time and the period of the present time. This is congruent with the study by SrisakWallipodom (2011 : 170) which explains the importance of local history. Local history refers to the history of villagers which is not a nationalistic history that comes from the state, but it is a history that derives from the conscience that people in the community share. Making use of the knowledge from the 8 types of local history together, the people in the community become peacefully happy, have jobs, have traditional activities to do together both in the individual and the community levels. And to sustain the study of the local community, there must be organization of learning with participation of organizations, institutions, families, educational institutions and charity organizations that collaboratively organize local history learning. Local history must link the elderly in the community to children and youths more closely. This is congruent with a study of SilapornBuasai (2009 : 6) which indicates the methods of transmitting the local history learning with participation of community organizations, particularly when the elderly have transmitted the knowledge they possess to children and youths, a closer relationship takes place and they would be happy to have learned the memory of the local history together.

Suggestions

Suggestions from the study:
1. Suggestions for application in instruction in the school system: the local history can be made a local-based curriculum or the instruction can be done through inserting the content into club activities or inserting the content into the 8 learning strands in school according to appropriateness of the content.
2. Suggestion for further research: Further research should be on local history learning with participation of community organizations for enhancement of self-value perception of children and youths.

References

Integrated Children Literature Classroom to School Library for Enhancing Reading Promotion

Wilawan Phornphatcharaphong

Department of Information Science, Faculty of Informatics,
Maha Sarakham University 44150,
Thailand
E-mail: jaom97@gmail.com

Abstract

The aim of the research was reviewing the integrated activities from children literature’s classroom to school library for enhancing of children’s reading ability. The mix methodologies were used. There are the observing, creating, and interviewing techniques for collecting data. Purposive sampling is 30 undergraduate students in the children literature’s classroom in semester 1 year 2014 at Department of Information Science, Faculty of informatics, Mahasarakham University, Thailand. One thousand primary students in Mahasakham holy infant Jesus school joined in the reading activities. The result presented the children literature’s classroom can integrated with school library to enhance reading promotion of students in primary school. The popup activities will be the strategies to encourage for reading. Primary students enjoy the reading activities.

Keywords: Children literature, School library, Reading promotion

Introduction

All over the world libraries are dedicated to providing free and equitable access to information in term of print, electronic, or audiovisual form. They play a key role in creating literate environments and promoting literacy by offering relevant and attractive reading material for all ages and all literacy levels and by offering adult and family literacy classes. They embrace the social responsibility to offer services that bridge social, political and economic barriers, and traditionally make a special effort to extend their services to marginalized people. Libraries assist in finding, using and interpreting appropriate information that opens up opportunities for lifelong learning, literacy enhancement, informed citizenship, recreation, creative imagination, individual research, critical thinking, and ultimately, empowerment in an increasingly complex world. [1]

Since 1972, Thailand began a reading national agenda to promote reading and books when UNESCO declared the international year book because the book has contributed significantly to the prosperity of society and the individual. It contributes to a better understanding between people in different nationalities. Thailand, as a member of UNESCO, operated the Board. “The National Committee for organizing International Book” in 1972. Later, the National Education Plan by the government had given priority about reading and learning by focusing on knowledge and skills in Thailand as the state “Should provide education to all the people of Thailand.” In year 1997, Cabinet of the Prime Minister Mr. Chuan Leekpai focused on expanding opportunities for basic education to expand educational opportunities for at least 12 years. Moreover, The National Economic and Social Development Plan No. 8 (1997 - 2001) still focusing on promoting reading and learning although during this time Thailand faces globalization and deeps in economic crisis. The plan focused on people who are as the centered development and prepare Thai population to face new situation.

There are many approaches to promote reading as following supporting books and resources in community, supporting tax incentives to reduce price of book, supporting devices to enhance learning quality and cheap, promoting formal and non formal education. The Education Act of 1999 required the variety of activities for the students to learn from real experience practice and love reading. Besides, school creates learning process which aiming to provide students with creative learning, self-learning continues, and focus knowledge and language skills. In 2001, Police Lieutenant Colonel Thaksin Shinawatra, as Prime Minister had policy that the education policy should be reform. There are various strategies, promote reading, lifelong learning, self-learning, adequate provision of materials and resources. Ministry of Education announced that year 2003 was a year of learning to promote reading. There was a compaign as “read to all” to encourage everyone to read a book for 10 - 15 minutes per day. Until in year 2005, Thailand still encourages reading and the government promoted the habit of reading books seriously since childhood throughout life to be ready for knowledge-based society. In year 2008, Cabinet of Prime Minister Abhisit Vejjajiva stated on reforming education system and the publishing books for children was concentrated. There was a foundation of booksellers Association in Thailand. Following National Economic and Social Development Plan No. 10-11(year 2007-
2016), Thailand still focuses on society of wisdom and learning by requiring the learner's reading habits and family support learning potential. Since the social development strategy still direct for lifelong learning and sustainability, the approach to develop Thailand related with preparing people in all ages to access the learning resources and knowledge as well as wisdom and cultural knowledge. [2]

From the statistics of reading, by National Statistical Office, in year 2008 the rate of reading was 66.30 percent. The target group of reading in Thailand was the people age 6 years and above. According to reading criteria by aged, children aged 6 - 14 years (81.5 %), young people aged 15-24 (78.6 %), People aged 25 - 59 years (64.3 %), seniors age 60 and over (39.3 %). Most Children read textbook whereas other read newspapers (71.0 %). There are variety of media for example, novels / comics / books and fiction (38.8 %) magazine (35.4 %). Time of reading is average 39 minutes per day and young people had the highest rate (46 minutes per day). From the region, population who lived in the municipality had the rate of reading more than those who lived outside the municipality. From educational levels, the higher education read mostly (95.6 %), high school (85.8 %), other level (83.4 %), uneducated people (15 %). People usually read books in free tie and read outside the classroom. There were 3.2 million persons read electronic media (8.1 percent). The five outstanding suggestions from Thai reader were that the book should be cheaper, the book should be interesting, libraries should be expanded to the villages and community, Parents should be encouraged for reading habit, and the language used in the book should be simple to make everyone understand.

In year 2009, The literacy rate of Thai population from the survey of Department of Community Development, Ministry of Interior found that the rate was 99.7 percent. Although the high literacy rate of reading among Thai (99%), reading promotion still be concentrated. School library will have new role as the supporting place for students to be ready in the 21st century and being ASEAN citizens. [3]. 21st Century Skills mentioned that learners must be learned throughout life for 3R x 7C skills. 3R is Reading (reading out), (W) Riting (written), and (A) Rithmetics (calculators are), and 7C are Critical Thinking and Problem Solving, Creativity and Innovation, Cross-cultural Understanding, Collaboration, Teamwork and Leadership, Communications, Information, and Media Literacy, Computing and ICT Literacy, Career and Learning Skills. [4]. Finally the researcher tries to mix the idea of classroom and library together in order to review that the children literature classroom can impact the reading literacy in Thailand. Moreover, this reading activities project will be useful for building the networking between information science education, librarian or information professional, and primary schools.

Materials and Methods

The mix methodologies were used. There are the observing, creating, and interviewing techniques for collecting data. Purposive sampling is 30 undergraduate students in the children literature’s classroom in semester 1 year 2014 at Department of Information Science, Faculty of informatics, Mahasarakham University, Thailand. One thousand primary students in Mahasarakham Holy Infant Jesus School joined in the reading activities.

There are two phases. Phases 1 is reviewing children literature’s classroom at Faculty of informatics, Mahasarakham University, Thailand. Phase 2 is implementing reading activities in school library, Mahasarakham Holy Infant Jesus School. The reading activities begin for one day at 8.00 a.m.-4.00 p.m.

Results

The research presented in two parts. Part 1 is reviewing children literature’s classroom at Faculty of informatics, Mahasarakham University, Thailand. Part 2 is implementing reading activities in school library, Mahasarakham Holy Infant Jesus School.

Part 1 : Reviewing children literature’s classroom

Children literature is the selective course in Mahasarakham University, Thailand. There are 2 credits and undergraduate will study for 15 weeks including theory and practice for 15 weeks. The objectives for this course are gaining knowledge of children literature and able produce children book. In the semester 1 year 2014, there are 30 undergraduate students who enrolled.

In the learning activities, teacher will teach the theory of children literature and how to produce the children literature. From the theory, teacher will present the background of children’s literature and example of children’s literature as table 1 [5,6, 7]
Table 1: Theory and Example of Children’s Literature

<table>
<thead>
<tr>
<th>What is children’s literature?</th>
<th>Example of children’s literature works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s literature includes stories, books, magazines, and poems that are enjoyed by children. Modern children's literature is classified in two different ways: genre and age of the reader. Genre are picture books, traditional literature, Fiction, Non-fiction, Biography, Poetry and verse. Age of the reader are ages 0–5 (Picture books), ages 5–7 (Early reader books), ages 7–12 (Chapter book), ages 12–18 (Young-adult fiction). Children’s literature can be traced to stories and songs, part of a wider oral tradition that adults shared with children before publishing existed. When printing became widespread, many classic “children's” tales were originally created for adults and later adapted for a younger audience. Since the 1400s, a large quantity of literature, often with a moral or religious message, has been aimed specifically at children. The late nineteenth and early twentieth centuries became known as the “Golden Age of Children’s Literature” as this period included the publication of many books acknowledged today as classics. Award of children’s literature: In the United Kingdom and Commonwealth, the Carnegie Medal for writing and the Kate Greenaway Medal for illustration. In the United States, the American Library Association give Newbery Medal for writing, Caldecott Medal for illustration.</td>
<td></td>
</tr>
<tr>
<td>Aesop's Fables</td>
<td>Aladdin</td>
</tr>
<tr>
<td>Alice's Adventures In Wonderland</td>
<td>Beauty And The Beast</td>
</tr>
<tr>
<td>Charlie And The Chocolate Factory</td>
<td>Charlotte's Web</td>
</tr>
<tr>
<td>Cinderella</td>
<td>Grimm's Fairy Tales</td>
</tr>
<tr>
<td>Gulliver's Travels</td>
<td>Harry Potter Series</td>
</tr>
<tr>
<td>Jack The Giant Killer</td>
<td>King Arthur And His Knights</td>
</tr>
<tr>
<td>Robinson Crusoe</td>
<td>Snow White</td>
</tr>
<tr>
<td>The Adventures Of Pinocchio</td>
<td>The Chronicles Of Narnia</td>
</tr>
<tr>
<td>The Frog Prince</td>
<td>The Hobbit</td>
</tr>
<tr>
<td>The Hundred And One Dalmatians</td>
<td>The Little Mermaid</td>
</tr>
<tr>
<td>The Little Prince</td>
<td>The Lost World</td>
</tr>
<tr>
<td>The Merry Adventures Of Robin Hood</td>
<td>The Tale Of Peter Rabbit</td>
</tr>
<tr>
<td>The Three Little Pigs</td>
<td>The Wonderful Wizard Of Oz</td>
</tr>
<tr>
<td>Thumbelina</td>
<td>Winnie-The-Pooh</td>
</tr>
</tbody>
</table>

Then, the undergraduate students who learn in the class will produce the children media that aiming to apply and be useful for kids in primary school. Undergraduate students create the children literature as “popup book.” Teacher will train undergraduate about how to make the popup book and support for equipments, picture, children book, magazine, paper, scissors. The activities of popup book spend about 3 hours. The learning environment looks relaxing and students enjoy working.

In Figure 1, there are the examples of students’ tasks or pop up books. There are many styles of picture that found in popup book. Some are hero whereas are different. Some tasks presents flowers, animals, train, family, etc. So, there are many creative works in the children literature’s classroom.

All undergraduate students’ tasks were tried out with some primary students before implementing in school libraries and reading promotion’s activities. In this research, these tasks were tries out by two primary students (boy aged 9 years, and girl aged 10 years). Both of them feel satisfied with all the pop up tasks.
Part 2 : Implementing reading activities in school library

From the research, Mahasarakham Holy Infant Jesus was purposive sampling. This school is the private primary school in Mahasarakham province, Thailand. There is a female teacher as the librarian who has responsibility for both teaching and managing library. She is nice and active. The library is full of knowledge corners; scientific, literature, magazine, computer, etc. The director of the school will allocate the budget for library.

When School library, Mahasarakham Holy Infant Jesus, sets the activities for reading promotion in ASEAN theme, primary students can join various activities. There are eight zones for entertainment that related with literature and reading as follows:

1)  Zone 1: ASEAN dressing Contest.  Reading the name of ASEAN Countries
2)  Zone 2 : Local Folk Dancing. Watching the cultural drum dancing.
3)  Zone 3 : B-Boy Dancing. Watching the modern dancing
4)  Zone 4 : Local Food Contest. Tasting the cultural food such as papaya salad.
5)  Zone 5 : Popup Book Production. Producing the easy popup book.
6)  Zone 6 : ASEAN Q & A Answering about ASEAN.
7)  Zone 7 : ASEAN Talking Talking about the ASEAN greeting
8)  Zone 8 : Thai Literature Drama. Watching Thai literature drama “Kaew na ma”

(Miss Horse Face). The literature is about a good woman whose face is like a horse. One day, she feel in love with the prince. However, the prince never loves her. She still does good things and stops for sin. Finally, because of her goodness, the prince loves her.

In Figure 2, When the popup activities zone is ready for primary students, most of them can join the reading literature both theory and practice. In the concept of the literature theory, primary students will realize the five components of literature, plot, story, language, character, stage. Then, the children will know the strategies of reading literature. There are four points, main character, characteristic, stage or place, and situation.

From the popup zone, children can join and practice to do the popup works. They can begin find the cartoon character from the book and cut it. Then, they will put and stick the selected cartoon character in front of some book cover. Most primary students enjoy the popup zone. Some of them can write easy story with the character. Some students like to read the pop up book that produced by undergraduate in the university. Some children enjoy doing popup work by finding their favorite characters and cut it from the book.

Finally, this popup zone can be the floor to demonstrate the undergraduates’ tasks from the children literature classroom. The primary students can read and use the popup that share from the literature classroom. Also, primary students can produce the easy popup book by themselves.
Conclusions and Discussion

From the research, children literature’s classroom can integrate with school library to enhance the reading ability and encouraging the reading habit of primary students. The popup activities will be the strategies to encourage the reading promotion. The information science classroom, especially, children literature’s classroom is useful for applying in authentic place as school library. Information science’s undergraduate students have a chance to learn both theory and practice of children’s literature in classroom. They can practice to create the media of children for supporting children’s reading. Besides, primary students can enjoy reading and understanding literature. Moreover, this classroom can improve the literate of young people in country.

Finally, this important research can create the networking of school libraries, primary school, and university. In the future, this valuable network can join and work for the new project to support younger people in community, especially the reading literacy of younger person. Beside, information science education and library still have the same mission “creating literate environments and promoting literacy by offering relevant and attractive reading material”. Moreover, in the future, the cooperative project between children literature’s classroom and school library will be strong because the content of literature can reflect the experience to all children. [5] Literature is an engagement with society. Especially, children’s literature means literature that is a fascinating which reflects the living conditions, Social conditions, and problems. It plays an important role in the innovation involved in the promotion of reading and learning and develop the youth under the age of 15 years to build the competitiveness and their intellences. [6]

Acknowledgements

This research was funded by the Faculty of Informatics. Mahasarakham University.

References


Analysis of Information Science Education for 21st Century

Wilawan Phornphatcharaphong
Faculty of Informatics, Mahasarakham University
Thailand
E-mail: jaom97@gmail.com

Abstract

This research aims to analysis the information science undergraduate education for the 21st century. The methodology is a qualitative research based on document analysis (Content Analysis). The results showed two parts. Part 1 presented the locations and content of information science education. There are twenty two of Information Science institutions which located in Thailand and international. The knowledge of information science education found in ten core courses as following (1) Theoretical Informatics (2) Resources (3) Information classification and organization (4) Knowledge Management (5) Information storage and retrieval (6) information services (7) Technology and applications (8) Information center management (9) Information and Society (10) User Studies. Part 2 presented the job market of Information Science undergraduate and guideline of skill development. Librarian is the popular position of information science education (38.10 %). The guidelines for developing of Information Science students in the 21st century follow the four skills and model 3R x 4C as following (1) Core Subjects skills, or 3 R (Reading, wRiting, aRithmetic) (2) Learning and Innovation Skills or 4 C (Critical thinking, Communication, Collaboration, Creativity) (3) Information, Media, and Technology Skills for development of website and information systems (4) Life and Career Skills to provide undergraduate students having endurance while working.

Keywords: Information science, 21st Century, Education, Knowledge management

Introduction

In the phenomenon of creative economy, the higher education institutions have a key role to produce graduates as creative labors in accordance with the requirements of the creative economy industry - including Publishing, Television, Film, Computer, and Software industry. “Creative Economy” can generate revenue for the domestic economy in modern society and it focuses on innovative products and services which link to cultural roots. The collective wisdom of society, Thailand Combined with technology To create economic value and may extend to the creation of social value. [1]

Nowadays, developed countries drives the country’s economy with creative industry for example, the United Kingdom begins the project of UK DCMS Model to classify of creative industries in 13 groups - advertising, architecture, art and antiques, crafts, design, fashion, film and video, music, performing arts, publishing, software, television and radio, video and computer games. The UK has the vision over the next 10 years to be as the Creative Hub that served by five strategies. The first is the employment for workers in the sector of creative industries for two million people. The second is the promotion of creative skills through various activities such as exhibitions, performances, musical works, the museum tours, creating films or digital contents in libraries and Archives. The third is establishment of creative industries sector to reach of 5,000 researches and innovations. The forth is protecting intellectual property. The last is promoting education to build children's creativity. [2]

In Thailand, the main curriculum that production labor in creative sector is Information Science education. In addition, information science education is also consistent with the National Economic and Social Development Plan No. 11 (2012-2016) focused on principles. “People are the center of development”, as well as immunity for facing global change in all dimensions. The information science is still promotes awareness of the community in various fields, including the appropriate use of information technology, creating opportunities to access and use information and information technology, and promotion of quality education to lifelong learning.

The bachelor’s degree of information science education are found in 22 universities in 2015 which aims to provide students with the knowledge, information and services related to enterprise information dissemination through media formats such as print media, visual media and electronic media. [3,4] Then, Information Science undergraduate students should have skills that relevant to the information industry in economic development, reading in the creative production and dissemination. [5]
Although information science curriculum produce undergraduates in information industry mainly, Thai Qualifications Framework for Higher Education (TQF: HEd) found that the quality of learning are not achievement the total of five aspects- ethics and moral, knowledge, cognitive skills, interpersonal skills and responsibility, and numerical analysis, communication and information technology.[6] The Ministry of Education. (2012 : 8) found that the higher education in Thailand does not reach top 200 with the international ranking of The Time Higher Education World University Rankings 2010- 2011.[7] In addition, the institutions are still experiencing problems that do not produce information science undergraduate as market need. Piloksiri and Pimrampai (2013 : 23-35) found that executives need information sciences undergraduate who have various skills in technology and cognitive as users and information needs, software, business, web technology [8] while the Office of the Civil Service Commission needs labors who are skillful in learning, reading and comprehension. Entrepreneurs need labors in technology, media and publishing [5]. Especially, Australian Library and Information Association (2014: 2, 10) found the trend of information science education will associate with the print media and digital media to support creative economy in the future. [9]

Since information science education is impact with two main factors, such as the mission of production the labors to support the creative economy among 21st century, the quality of information science students who do not meet the needs of entrepreneurs, the teachers should concentrate to research the curriculum further. Then, the research aim to analysis of information science undergraduate education in Thailand and International in term of course descriptions, job markets, and skills in the 21st century in order to develop information science courses are ready to meet the needs of society and the creative economy as well as to support information science learner to be the professional workforce in the information industry in the 21st century.

Materials and Methods

This research is qualitative research by Content Analysis from research, website, articles, and newspaper. There are two phases of research. Phase I includes analysis of information science curriculum in Thailand and International in term of locations and content. Phase II includes guidelines for the development of information science learners to meet the needs of the job market in the 21st century

Results

There are two phases of the results as following, phase I : Information science curriculum in Thailand and International and phase II Guidelines for Information science learners' Skills in the 21st century

Phase I : Information science curriculum in Thailand and International

In the year 2015, there are 22 universities which students enroll in information science field. There are 15 state institutions in Thailand and 7 are in the international. If comparison with the whole education institutions in Thailand with a total of 169 higher educational institutions [10], the information science places are a small group (4.14%). By the way, Patoompong and Choloapat (2015: 172-186) found that the information science education found for teaching and learning in interdisciplinary and originated with Library field. Then, information science education found offering in 34 institutions (20.11 %) with different name among eight disciplines 1) Library and Information Science 2) Information and Library Science 3) Information Science 4) Information Science for Communication 5) Information Studies 6) Information Management 7) Digital Information Management 8) Information Management and Technology. Finally, information science education generally provide in Thailand in term of state university totally and integrate in discipline as communication, information, technology, management. [11]

Table 1 : location of information science education

<table>
<thead>
<tr>
<th>Locations</th>
<th>Number</th>
<th>Percentage</th>
<th>Name of Universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>15</td>
<td>68.12</td>
<td>Sukhothai Thammathirat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mahasarakham university</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Khonkaen university</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Roiet Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mahasarakham Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kalasin Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chakasem Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chiangmai Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Thonburi Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Petchaboon Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phuket Rajabhat University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valaialongkorn Rajabhat University</td>
</tr>
</tbody>
</table>
The content of knowledge in information science education which follow the criteria of Chaim Zins (2007) in ten groups as foundation, resources, knowledge workers, contents, applications, operations and processes, technologies, environments, organizations, Users. [12] Then, totally information science institution sets the core courses following the criteria in 10 subjects such as Information science research, Information resources development, Knowledge management, Organization and classification of information, Information services, Information storage and retrieval, Technology and applications, Information and society, Information center management, and User studies. As the core course contents, the curriculum can enhance learners in skills of information management and information services in the enterprise and information sector. [13,14,15]

Table 2 : Knowledge of information science education.

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Core course</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foundations</td>
<td>Information Science Research</td>
<td>Introduction to the research study. Research Methodology Research techniques and research process. Statistics for research. Research Evaluation Using a computer to research The status and direction of research in information science. Professional Research on Information Operations Research in Information Science or a related discipline. Bringing research results to application.</td>
</tr>
<tr>
<td>2. Resources</td>
<td>Information Resources Development</td>
<td>The meaning and scope of development resources. The policy of supplying the selection and evaluation of information resources. Tool selection and sourcing, and vendor sources. Preparation of Documents for service. Assessment information resources to discharge. Maintenance Information Resources</td>
</tr>
<tr>
<td>4. Contents</td>
<td>Organization and Classification of Information</td>
<td>The meaning of the classification and transaction resources. Manuals and guidelines To meet international standards The posting on a computer-readable format and metadata.</td>
</tr>
<tr>
<td>5. Applications</td>
<td>Information Services</td>
<td>Principles and theories, information service User education The type of information services Planned marketing information services. Management and operation of information services. The trend of information services</td>
</tr>
<tr>
<td>7. Technologies</td>
<td>Technology and Applications</td>
<td>Software for information management. Training and operating software for information management. For storage, retrieval and dissemination services.</td>
</tr>
</tbody>
</table>

Total 22 100.00
9. Organizations
Information Center Management
Administration Informatics Institute
Principles and theory, Management Information Institute, the organization of quality assurance. Policy Formulation Money Management Personnel, facilities, supplies and equipment to office correspondence document management. The evaluation and management of information services.

10. Users
User Studies
Concepts concerning methods in information user studies, purposes and behaviors of information use by various professions, information need assessment, case studies of information user studies

Phase II Guidelines for Information science learners’ Skills in the 21st century

From the survey of the job market for undergraduates in information science education in year 2015, the labors can work in libraries, museums, information centers, publishing, etc. Librarian is the popular position (38.10 %) archives and writer are the second choices (14.29 %) and the last choice are consultant and technologist (9.52 %). The main point that found about the job market follow the goal of information science education as 5 area such as 1) Information Profession 2) Librarian 3) Information Technologist 4) Archives Personnel 5) Editor and Writer while the learners can work in other positions, including teachers, system analyze, researcher, public relations, secretary. Information Consultants, publishers, and book rental shop.

Table 3 : Job market for information science education

<table>
<thead>
<tr>
<th>Position</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Librarian</td>
<td>8</td>
<td>38.10</td>
</tr>
<tr>
<td>Teacher</td>
<td>1</td>
<td>4.76</td>
</tr>
<tr>
<td>Information Consultant</td>
<td>2</td>
<td>9.52</td>
</tr>
<tr>
<td>Information Technologist</td>
<td>2</td>
<td>9.52</td>
</tr>
<tr>
<td>Archives Personnel</td>
<td>3</td>
<td>14.29</td>
</tr>
<tr>
<td>Librarian Assistant</td>
<td>1</td>
<td>4.76</td>
</tr>
<tr>
<td>Writer</td>
<td>3</td>
<td>14.29</td>
</tr>
<tr>
<td>Graphic Designer</td>
<td>1</td>
<td>4.76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

From the result of the survey on job market, the information science education can develop the skill to reach the demand for information science labors following the framework of learning skills in 21st century n term of 4 skills - Core Subjects skills, Learning and Innovation Skills, Information, Media, and Technology Skills, Life and Career Skills- and 3R x 4C model. 3R are Reading, (W) Riting, and (A) Rithmetic. 4Cs include Critical Thinking, Communications, Collaboration, and Creativity [16]

Table 4 : Skills development for information science undergraduates in 21st century

<table>
<thead>
<tr>
<th>Skills</th>
<th>Job Market Need</th>
<th>Learning Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Core Subjects (3 R)</td>
<td>• Reading</td>
<td>• Developing habit of reading by reading in various literature, news, books, etc.</td>
</tr>
<tr>
<td></td>
<td>• Writing</td>
<td>• Writing in different forms including news, articles, interviews, books, reports, research.</td>
</tr>
<tr>
<td></td>
<td>• Arithmetic</td>
<td>• Reporting statistics of annual budget.</td>
</tr>
<tr>
<td>2. Learning and Innovation Skills (4 C)</td>
<td>• Communications</td>
<td>• The public relations skills</td>
</tr>
<tr>
<td></td>
<td>• Critical Thinking</td>
<td>• The communication skills in English.</td>
</tr>
<tr>
<td></td>
<td>• Collaboration</td>
<td>• Analytical Thinking Category Management Information System.</td>
</tr>
<tr>
<td></td>
<td>• Creativity</td>
<td>• Team working</td>
</tr>
<tr>
<td>3. Information, Media, and Technology Skills</td>
<td>• information technology</td>
<td>• The creative plot, story writing.</td>
</tr>
<tr>
<td></td>
<td>• media</td>
<td>• Using electronic library</td>
</tr>
<tr>
<td></td>
<td>• information</td>
<td>• Use of MS Office programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Website Development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Graphic Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Photography</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Design Publishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Video Editing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Information Systems Development</td>
</tr>
</tbody>
</table>
4. Life and Career Skills

| | • Flexibility | • Flexible and adaptable to the organization |
| | • Social | • The Good coordination |
| | • Leadership | • Patience to work under pressure |
| | • Responsibility | • Responsibility for service users. |

Conclusions and Discussion

Analysis of information science education for the 21st century demonstrates the preparation of information science curriculum to prepare undergraduate to meet the needs of the job market through creative economy. There are two main parts to discuss.

1. Knowledge of Information Science Students

The information science undergraduate students mean the information professionals in ten main courses:
  1. Theoretical Informatics
  2. Resources
  3. Information classification and organization
  4. Knowledge Management
  5. Information storage and retrieval
  6. Information services
  7. Technology and applications
  8. Information center management
  9. Information and Society
  10. User Studies.

The main courses of information science curriculum as following Chaim Zins (2007) studied the knowledge of the course of Information Science by using critical Delphi which had the participation of leading academics all 57 people from 16 countries. The classification of the content in information science education can divide in 10 groups as follows. [12]

1.1 Foundations related to theory, research, and history.
  1.1.1 Theory: basic concepts of information science, other disciplines, such as anthropology, art, communication, computer science, economics, education, engineering, law, linguistics, philosophy, ethics, history, psychology, sociology, semiotics methodology.
  1.1.2 Research: research on the theory of information science in theoretical research, empirical research in the form of quantitative research and qualitative research.
  1.1.3 Education: academic studies, information sciences and professional training of workers, trend of information science education.
  1.1.4 History: the study of history in information science.

1.2 Resources related to the resources, resource types, and the document content knowledge.
The primary sources are invented by human. The secondary and tertiary resources are human and other resources.

1.3 Knowledge Workers includes personal characteristics of the worker. There are theoretical knowledge, practical knowledge, work experience, the human knowledge, and professional knowledge in various areas such as medical informatics.

1.4 Contents related to the type of content knowledge by organized structure, content, knowledge and classification systems, such as LCC, DDC, UDC, CC, BC, and disciplines such as archeology, biology and computer science.

1.5 Applications related to the research of the needs and interests of user to support the provision of knowledge.

1.6 Operations & Processes related to the operation and procedures of processing, publishing, publication, storage, control, evaluation and use of knowledge.

1.7 Technologies related to the use of technology to facilitate and mediate the transmission document storage, processing, dissemination, evaluation and use of knowledge. Technology is focused on the dissemination of knowledge and designed to coordinate with the user.

1.8 Environments related to social issues, culture, ethics and law, including information policy, access to information, ethnic intellectual property, privacy with the public interest.

1.9 Organizations related to the nature of the organization including the type of organization, and the organization's work in libraries, museums and enterprise of information services.
1.10 Users associated with the service, users who can link to sources. There are two kinds of users - individuals and groups that divided by gender, culture, ethnicity, and the need or professional interests.

2. Skills of information science learners in the 21st Century

Information Science learners should concentrate in four skills 1) Core Subject skill includes the capability of reading, writing and arithmetic. 2) Learning and innovation skill relates in term of critical thinking, communication, collaboration, and creativity 3) information, technology and media skills include the ability to use information technology for website development, information systems development, retrieve of information, Publicity through social media, etc. 4) Life and career Skills include endurance work. The result follow the challenges of education in the 21st century which is affecting the curriculum in information Science education to prepare the learners in main four skills [11]

2.1 Core Subjects Skills consists subjects as language, math, science, economics, geography, history, government and civics. Fields of Knowledge in the 21st century include global awareness, financial, economics, business and entrepreneurial literacy, civic literacy, health literacy, and environmental literacy.

2.2 Learning and Innovation Skills help the learners prepare to enter the working world with more sophisticated skills, including creativity and innovation, the critical thinking and problem solving, and communication and collaboration

2.3 Information, Media, and Technology Skills that students must have the ability to disseminate information through media and technologies, including information technology skills, and media technological knowledge.

2.4 Life and Career Skills for help learners to life and work. Students are required to develop life skills, flexibility and adaptability, social and cross-cultural skills, leadership and responsibility.

The model which is developed by the enterprise collaboration network for learning the skills of Century 21 presents the concept for learning in the 21st century by incorporating knowledge. There are specific skills expertise and knowledge about the different aspects together to ensure the success of the students both work and life. This model can be said that the skills of people in the 21st century must be life-long learning with 3R x 4C - 3Rs are Reading, (W) Riting and (A) Rithmetic and 4Cs are Critical Thinking, Communications, Collaboration, Creativity. [16]

Finally, Information science education is interdisciplinary knowledge of Library and Information Technology. This education provides learners who graduated with features of information management and information services in the enterprises of creativities. The main job markets of undergraduates are as following, Information Professional, Librarian, Information Technologist, Archives Personnel, Editor. In addition, undergraduate can also work in other positions, including teachers, researcher, public relations, secretary, consultants, publishers, book shop operators, etc.
Acknowledgements

This research was funded by the Faculty of Informatics, Mahasarakham University.

References

A Study on Problems and Strategies for Creating Awareness of Sexual Behaviors of Lower Secondary School Students

Sasithorn Kotkanta*, Prapat Pree-iam, Prasopsuk Rithidetch and Thipaporn Sujaree
Educational Management for Local Development, Faculty of Education, Rajabhat Maha Sarakham University, Thailand
(*author for correspondence, E-mail: sasithornkkt@gmail.com)

Abstract

The research aimed to investigate problems about creating awareness of sexual behaviors of lower secondary school students in the Secondary Educational Service Area office 29, Ubonratchathani Province, and to analyze needs for creating the awareness of sexual behaviors of lower Secondary school students. Mixed Methodology was employed for the research consisting of quantitative and qualitative research. The research instrument was two sets of questionnaires on problems and needs for creating the awareness of sexual behaviors of lower Secondary school students in the Secondary Educational Service Area office 29. The focus group method was used for the study. The sample subjects were 649 lower secondary school students in the Secondary Educational Service Area office 29, Ubonratchathani Province. The Krejcie & Morgan method was used to calculate the sample size. The focus group was 30 research participants consisting of students’ parents, secondary school students in the Secondary Educational Service Area office 29, Ubonratchathani Province for group discussion. The research area was in secondary schools in the Secondary Educational Service Area office 29, Ubonratchathani Province. The research statistics were percentage and the results were presented in the descriptive analysis. The research findings indicated that the most serious problems of lower secondary school students about creating the awareness of sexual behaviors included self awareness, drugs, being pregnant, poverty of the family and safe sex protection. The results of the focus group discussion of teachers, parents and high school students, the findings indicated that the students did not know and understand the save sex, and they were not shy of sexual behavior. Therefore, the efficient and effective strategies for safe sex protection of the students, a sex education curriculum and sports activities including social activities are necessary for secondary school students. Additional, the findings showed that the needs of the students for creating the awareness of sexual behaviors were regular sex education for all in schools, home visit to students’ family and warm family. The study suggested that students with good behaviors should be a good model for the students with pregnant or sexual problems.

Keywords: Awareness, Sexual behaviors, Teenagers

Introduction

The use of internet-based social media programs to make connections with friends, family, classmates, customers and clients. Teenagers are the target users of the social networks for connecting freely their friends. In case of Thai teenagers, both Thai male and female teenagers have sexual value without responsibilities and safe sex protection. Consequently, social problems, abortion, homeless children and sexual contagious disease especially Aids. The problems indicate that the attitude of Thai teenagers towards the sexual issues has been changed greatly. As a result, Thailand has encountered economic, social and cultural problems (Ram Jiti Institute. 2005: 45). The recent study of sexual behavior of Thai teenagers in 2001, the results indicate that the number of the younger teenagers in sexual intercourse have increased dramatically. In 2003, the teenagers with the age of 9-10 years have engaged in the first sexual intercourse while in 2002, teenagers with the age of 16-17 years have engaged in the first sexual intercourse. Regarding abortion of the teenagers, the findings showed that Thai teenagers aborted 300,000 babies a year (Khaosod Newspaper, 30 May 2004: 16). Ministry of Public Health (2004) reports that the age of Thai teenagers with HIV is at the 15-16 years, and eight babies were aborted a day (Thairat Post Newspaper. 10 February 2004:5).

It is important that all public and private sectors have to work together to solve the sexual problems of the teenagers in Thailand. They are important human resource for the national development in the future. Improving life quality of the teenagers is the major factor for the sustainable development of the country. Teenagers are quite flexible and changeable accordance with their previous experiences. The experiences influence the change of body,
emotion, and society. The sexual behavior, an remarkable physical change of teenagers, includes bigger testis, pennies, sperm, hair over the sexual organ for males and bigger breath, hair over the sexual organ and monthly period for females. The changes indicate that both boys and girls are fully grown up, and they are able to have a baby. The sexual hormone influences the sex drive of the teenagers, and the teenagers are independent from their family, and they have more chances to stay close to the opposite sex. Consequently, the teenagers always have sexual intercourse before their marriage (SisikarnChiangthong. 2000: 1, cited from SripatraJariyawong. 1996: 1).

Nowadays, Thailand has encountered the sexual problems of teenagers especially secondary school students. The major problems are abortion, crime, low learning achievement, and drugs. These problems cause the teenager commit suicide and get AIDS. (Report on Educational Evaluation, The Secondary Educational service Area Office 29, Uboratchathani Province, 2014: 20).

According to the problem mentioned above, the author have investigated and analyzed the problems and needs of the lower secondary school students for creating awareness of the sexual behaviors in the Secondary Educational service Area Office 29, Ubonratchathani Province.

Materials and Methods

1) Instrument was a questionnaire on problems and strategies for creating the awareness of the sexual behavior. The focus group discussion of 30 participants consisting of: students, teachers and parents of schools in the Secondary Educational service Area Office 29, Ubonratchathani Province, was employed for the study.

2) Mixed Methodology was used for the study consisting of qualitative and quantitative research.

3) Scope
   3.1 Population and Sample
   The sample subjects were 649 lower secondary school students in the Secondary Educational Service Area office 29, Ubonratchathani Province. The Krejcie& Morgan method was used to calculate the sample size. The focus group was 30 research participants consisting of students’ parents, secondary school students in the Secondary Educational Service Area office 29, Ubonratchathani Province for group discussion.

3.2 Contents
1) Problems of lower secondary school students about creating the awareness of the sexual behaviors in the Secondary Educational Service Area office 29, Ubonratchathani Province
2) Needs of the lower secondary school students for creating the awareness of the sexual behaviors in the Secondary Educational Service Area office 29, Ubonratchathani Province

3.3 Research Area
   Secondary schools under the Secondary Educational Service Area office 29, Ubonratchathani Province.

3.4 Research Period
   January – April 2015

Data Collection
   The data was collected through the documentary study and contextual study consisting of focus group method, surveys of problems and needs the lower secondary school students for creating the awareness of the sexual behaviors in the Secondary Educational Service Area office 29, Ubonratchathani Province.

Data Analysis
   The data were results of the documentary study, problem and needs analysis of the lower secondary school students for creating the awareness of the sexual behaviors in the Secondary Educational Service Area office 29, Ubonratchathani Province. The results were presented in the descriptive analysis.

Statistics: percentage

Results

1. The findings indicated that the problem of the lower secondary school students about the awareness of the sexual behavior included self awareness, drugs, and being pregnant (100%), poverty of the family (80%) and unsafe sex protection (90%). The results of the focus group discussion of teachers, parents and high school students, the findings indicated that the students did not know and understand the save sex, and they were not shy of sexual behavior. Therefore, the efficient and effective strategies for save sex
protection of the students, a sex education curriculum and sports activities including social activities are necessary for secondary school students.

2. The findings showed that the needs of the students for creating the awareness of sexual behaviors were warm family (85%), regular sex education for all in schools (80%), and home visit to students’ family (78%), and The results of focus group discussion of teachers, parents and students, the study suggests that results indicated that students with good behaviors should be a good model for the students with pregnant or sexual problems.

Conclusions and Discussion

1. The findings indicate that the serious problems of the lower secondary school students about creating the awareness of the sexual behaviors in the Secondary Educational Service Area office 29, Ubonratchathani Province include 1) self awareness, drugs, and being pregnant (100%), poverty of the family (80%) and unsafe sex protection (90%). The results of the focus group discussion of teachers, parents and high school students, the findings indicated that the students did not know and understand the save sex, and they were not shy of sexual behavior. Therefore, the efficient and effective strategies for save sex protection of the students, a sex education curriculum and sports activities including social activities are necessary for secondary school students. studies on the factors influencing being pregnant of teenagers, the study indicated that the teenagers dislike to have safe sex with the condom because they did not feel have realistic sex intercourse. Additionally, the teenagers like to have more free sex. Harris Interactive (2006) asserts that men always have 10.5 lovers a year and women usually have 7.2 lovers a year. (Sexual Wellbeing Survey by Harris Interactive, 2006.)

2. The needs of the students for creating the awareness of sexual behaviors were warm family (85%), regular sex education for all in schools (80%), and home visit to students’ family (78%). and The results of focus group discussion of teachers, parents and students, the study suggests that results indicated that students with good behaviors should be a good model for the students with pregnant or sexual problems. states that external factors influences internal factors of life. For instance, parents are good model for their children. Four major external factors include community power, power of friends and activities, family, and intellect. The inappropriate sexual intercourse may be cause by shortage of love from their family (SuriyadeThreepati and et al. (2006).

Suggestion

For Practical Application
Sex education should be organized for all secondary school students for safe sexual intercourse.
For Further research
An instructional model for creating awareness of the sexual behaviors of the secondary school students should be further studied.

Acknowledgement

This research was not able to success without the kind patronages of Prof.Dr.SriroengKaewgangwan, Prof.Dr.SampanRittidet., Dr.SuwanBuapan, Asst.Prof.Dr.TipapornSujaree, Asst.Prof.Dr.ChayakanRuangsuan

References


Knowledge Management Development on Organic Agriculture Marketing of Farmer Group, Makha Sub-District, Kantharawichai District, Maha Sarakham Province

Wongpattana Sriprasert

Faculty of Political Science and Public Administration, Rajabhat Maha Sarakham University, Maha Sarakham Province, Thailand.
Mobile: 081-7399018, Tel: 043-723555.
E-mail: wongpatt.s@gmail.com

Abstract

This research aimed 1) to study current conditions and problems of agricultural organic marketing of farmer groups who grew organic vegetables in Khrainun village, Makha Sub-District, Kantara Wichai District, Mahasarakham Province, 2) to analyze agricultural organic marketing strategies of the farmer groups in Khrainun village, Makha Sub-District, 3) to investigate agricultural organic marketing knowledge management for the farmer groups in Khrainun village, and 4) to develop knowledge management of organic agriculture marketing for the farmer groups. The data was collected by interviewing fifty farmers from two villages: Khrainun village 10 and Khrainun village 15, and 106 participants from the government sectors consisting of representatives from Makha Sub-District Agriculture Office, Kantara Wichai District Development Office, Ban Khrainun Public Health volunteers, chief executives of Makha Sub-District Administrative Organization, and village headmen of Khrainun village 10 and 15. The participatory action research was employed for data collection and data analysis of agricultural organic marketing strategies of the farmer groups in Khrainun village focusing on products, price, channel of distribution and marketing promotion. The marketing mix and marketing knowledge management was analyzed to identify indicators for creating, searching and analyzing knowledge including managing knowledge systematically, learning and sharing knowledge.

The research findings showed that the clay soil with absorbing water in Khrainun village is proper for agriculture. There is water all year from the Chi River Main for organic farming of the farmer groups in Khrainun village. The total cultivating area of the farmer groups was 15 rais consisting of 10 rais of growing corn, two rais of growing chilies, one rais of growing papaya, 0.5 rais of growing cucumber, and 0.5 rais of growing tomato. Two kinds of corn were cultivated in the area. The sticky and sweet corns were planted for two and three months in the area. The majority of farmer group members were female. Most of the members were 51-60 years old with primary education level. The farmers of Khrainun village 10 and 15 got the financial support from the Mahasarakham Provincial Cooperative for Agriculture, Kanthara Wichai branch (40,000 baht). The support aimed to enhance the farmers to grow organic vegetables for consumption and sale. The farmers could not earn more money from selling the organic vegetables because of low quality vegetables and low price.

Regarding the analysis of agricultural organic marketing strategy for products, the study showed that the farmers planted cowpea, eggplant, corn, cucumber, and chili and packed the vegetables with an organic label. The findings showed that the farmers encountered the problems of quality and insufficiency of vegetables for consumption and sale. In case of the price of vegetables, the farmers could not control the price, and they directly sold the vegetables to the middlemen with the low prices: about 10-15 baht per kilogram of all vegetables; 70 baht per kilogram of chili, 10-15 baht per kilogram of eggplant, 70 baht per kilogram of cowpea, and 20 baht per bag of 3 pieces of corn. Regarding the channel of distribution, the study indicated that two channels were wholesale at the villages and retail distribution in KantaraWichai District bazaar, and Mueng Mahasarakham District bazaar in Mahasarakham Province. Marketing promotion, the farmers usually give one or two more agricultural products to customers such as if a customer buys 10 bag corns, he usually gets two free ears of corn.

Regarding marketing knowledge management, the research findings showed Knowledge Identification that most of the farmers used organic fertilizer to grow vegetables. As a result, the organic vegetables are very popular for consumers. Selling organic vegetables provides better life of the farmers. However, some farmers use chemical fertilizer in farming which will make a negative impact on the products in long-term period. Knowledge creation and acquisition, consumers knew well free toxic vegetables of Khrainun village with the local brand of farmer groups. The members rarely shared and learned new experience with other groups, but they only studied the principles of sufficient economy project. Knowledge management and analysis, the farmers used chemical fertilizer, and insecticide in farming, and the use of the chemical substance affected the sale of their agricultural products.
organic marketing structure in the future with a packing bag and an organic label by some local government sectors. Knowledge Sharing, some farmers did not coordinate with other farmer groups. They usually sold their products freely to customers after crop harvest. Lastly learning experience, the study showed that the farmer learned and recognized that they produced high cost products, but they sold their products at a low price under circumstance of the serious marketing competition.

In conclusion, the study suggests that the farmers in Khairainun village should learn more organic agriculture marketing and organic vegetables for the better life of both the farmers and consumers.

Keywords: Marketing, Knowledge management, Organic agriculture, Farmer group

Introduction

In the present time, several agriculturist groups try to change own agriculture route from original focus commercial production policy to organic agriculture. (Office of Agricultural Economics, 2014). This is to solve problem of agriculturist are essential who depend on outside production factor, and solve problem the decadence of resources that agricultural production activities. (Chanun Ratanavaraha, 2014). In cooperation of agriculturist within community, and agriculture network with resemble objective, and push from organization both government and private sectors agriculture organic trend accompanies will meet requirement in the market and consumers.

Ban Khairainun 15, and 10 Makha Sub-district, Kantarawichai District, Maha Sarakham Province. The community selected agricultural organic trend to decrease production capital and agricultural production following market demand by applying advantage of nature. The main crops were vegetables, cowpeas, eggplants, chilies and corns which have good quality and large quantity for requirement of market. Besides, farm is supporting occupation by the majority of villagers like to plant rice for consuming. Ban Khairainun member accept organic agriculture trend since there are some agriculturists who start mixed farming, and succeed in one level. Agricultural productivities have been increasing a variety of crossings. It can be self-reliant. They are planting organic, as vegetable to restore and maintain soil fertility, and avoid use of all chemicals. Can be seen from Ban Khairainun member farmer groups who plant non toxic vegetables. Modified agricultural way by learning exchange, and networking are linked to learning both inside and outside by attending studies, training, and seminars as well as exchanging experience.

Although, increasing demand of Ban Khairainun non toxic vegetables groups has been positive responded from market at satisfactory levels. But group has undergone many problem in agriculturist group such as debt problem, health, decadence, and production of commercial agriculture, etc. The phenomenal initial observation, indicated that member in group can appreciate knowledge and develop skill to potential production. It is essential to gather knowledge existing in farmers, community, agencies or document, which can be developed to reduce manufacturing steps and operating system. This will result in group’s competitive ability. Thus, there should be knowledge management development on organic agriculture marketing of Ban Khairainun farmer groups, Makha Sub-District, KantaraWichai District, Mahasarakham Province. There are seek for knowledge that can generate income. Now agricultural area of Ban Makha, has only 2 grounds including Ban Khairainun 15, and 10 due to problem with water used cultivating.

Thus researcher is interested in studying circumstances of agricultural organic market of Ban Khairainun farmer groups in order to analyze situation and problems, analyse agricultural organic marketing strategy of Ban Khairainun farmer groups and to synthesize marketing mixes as appropriate and accordance with requirement of market. The research is also aimed at studying agricultural organic marketing knowledge management of Ban Khairainun farmer groups that knowledge, and practices in character are procedure systemically, or not, including knowledge management development on organic agriculture marketing of Ban Khairainun farmer groups, Makha Sub-District, KantaraWichai District, Mahasarakham Province in terms of modern knowledge and management to encourage and support local development processes, build strong community to support themselves, and create high added value to needs of market. This will generate income for community toward sustainability.

Research Objectives

This study has objectives on knowledge management development on organic agriculture marketing of farmer group, Makha Sub-district, Kantarawichai District, Maha Sarakham Province. in the following 4 aspects:

1. Study current conditions and problems of agricultural organic marketing of farmer groups who grew organic vegetables in Khairainun village, Makha Sub-District, Kantara Wichai District, Mahasarakham Province
2. Analyze agricultural organic marketing strategies of the farmer groups in Khainun village, Makha Sub-District
3. Investigate agricultural organic marketing knowledge management for the farmer groups in Khainun village
4. Develop knowledge management of organic agriculture marketing for the farmer groups

Materials and Methods

Research Limitation

The researcher purposively choose a target group of 50 keypersons from Ban Khainun 15, and 10 Makha Sub-district, Kantharawichai District, Maha Sarakham Province, interested in non toxic vegetables with the criteria of both directly and indirectly related persons who have roles and duties on converted agricultural organic market in the local area. 6 participants were conducted into qualitative research which have general and in-depth interview as research instruments.

The research settings were selected for group discussion and interview to gain informal and comfortable knowledge exchanges. Agricultural organic market groups were conducted in non toxic vegetable plantation, workshops, and brain storming, including focus groups

Research Methods

This is qualitative research via general and in-depth interview as the research tools. Data of Ban Khainun member farmer groups who plant non toxic vegetables were compiled and analyzed. The researcher organized meeting to form understanding and research step co-planning for knowledge management development on organic agriculture Marketing of Farmer Group, Makha Sub-district, Kantharawichai District, Maha Sarakham Province via 2 following phases as ;

<table>
<thead>
<tr>
<th>Research steps</th>
<th>Research step Co-planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1.</td>
<td>Inquire for agricultural organic marketing knowledge management of Ban Khainun farmer groups by qualitative method was collected and analyzed while running this process in target area via both primary data and secondary data following phases as ;</td>
</tr>
<tr>
<td></td>
<td>1. Study producing context of Ban Khainun farmer groups</td>
</tr>
<tr>
<td></td>
<td>2. Compile data on problems and barriers of agricultural organic market the target area</td>
</tr>
<tr>
<td></td>
<td>3. Analyse and compile data on agricultural organic marketing strategy</td>
</tr>
<tr>
<td></td>
<td>4. Study and compile data on agricultural organic marketing knowledge management</td>
</tr>
<tr>
<td>Phase 2.</td>
<td>Knowledge management development on organic agriculture marketing of Ban Khainun farmer groups, Makha Sub-District, KantaraWichai District, Mahasarakham Province.</td>
</tr>
<tr>
<td></td>
<td>1. Conduct public hearing via seminar leading to learning opportunities, experience and related paradigm sharing</td>
</tr>
<tr>
<td></td>
<td>2. Analyse and synthesize agricultural organic marketing strategy in Product aspect, Price aspect, Place aspect and Promotion aspect</td>
</tr>
<tr>
<td></td>
<td>3. Analyses and synthetic marketing knowledge management in Knowledge Identification aspect, Knowledge Creation and Acquisition aspect, Knowledge Codification and Refinement aspect, Knowledge Organization aspect, Knowledge Sharing aspect, and Learning aspect</td>
</tr>
<tr>
<td></td>
<td>4. Inductive content analysis was applied leading to descriptive presentation connected among each of related issues by interviewing, workshops, brain storming, and focus groups</td>
</tr>
<tr>
<td></td>
<td>5. Data analyze with conclusion, co-examine to gain conclusion by target group</td>
</tr>
</tbody>
</table>
6. After that the researcher wrote full research report up following with research distribution and expanded research networks out reaching into public.

Research Instruments

For qualitative data collection, the researcher applied the following instruments as follows;

1. Questioning frame (Constructed questionnaire/pattern) for general interview and in-depth interview.
   The researcher constructed questioning frame via general questions and question frame for the target group interviewing. They covered research questions and objectives to collect a.) general data of status of Ban Khrainun non toxic vegetables groups in the target area about personal information as first-last name, gender, age, education level, and marital status, b.) their context in as situation and agricultural organic market problem of Ban Khrainun non toxic vegetables groups, and c.) their agricultural organic marketing strategy in as Product aspect, Price aspect, Place aspect and Promotion aspect, including d.) their marketing knowledge management in as Knowledge Identification aspect, Knowledge Creation and Acquisition aspect, Knowledge Codification and Refinement aspect, Knowledge Organization aspect, Knowledge Sharing aspect, and Learning aspect.

2. Questioning frame (Semi constructed questionnaire/pattern) for In-depth interview.
   The researcher constructed questioning frame through experts from the target group workshops, brainstorming, and focus groups based on concepts and theories about knowledge management development on organic agriculture marketing of the target group in the such Identification, Knowledge Creation and Acquisition, Knowledge Codification and Refinement, Knowledge Organization, and Knowledge Sharing as well as Learning. Gained data confirmation with data from general interviewing to reassure research results and fulfillment.

Data Collection

The researcher collected data from two kinds of sources comprising secondary and primary data. The primary source gave data details about the steps of agricultural organic marketing strategy and marketing knowledge management. These data were gained by general interview and in-depth interview from Ban Khrainun non toxic vegetables groups. Then the researcher made appointments with interviewing issue preparation following questioning frame of interview.

The interview was conducted under natural conversation and comfortable knowledge exchange. Research interviewees comprised Ban Khrainun non toxic vegetables groups, and the others who were interested in running agricultural organic marketing in the target area in Ban Khrainun, Ban Makha, Amphoe Kantara Wichai, Changwat Mahasarakham by workshops, brainstorming, and focus groups.

This research collected the data by interviewing for 2 months.

Data analysis

From all of the research objectives, the researcher did qualitative data analysis by descriptive result presentation from agricultural organic marketing strategy and marketing knowledge management analysis to explain various connected issues inside context analysis about knowledge management development on organic agriculture marketing inside Ban Khrainun non toxic vegetables groups at Makha Sub-district, Kantharawichai District, Maha Sarakham Province. The gained data were merged together with related various theories and researches via systematic analytic process and data record. The steps were as follows;

1. Data compilation from general data in-depth interviewing narrators which was non toxic vegetables groups in Makha Sub-district, Kantharawichai District, Maha Sarakham Province. The record was done through observation, farmers’ narration, activities and projects running in the target area and related documents.

2. Examination data correctness, classify, order, grouping, sequence and precedence on desired data.

3. Data analysis and synthesis under the research frame for context in as situation and agricultural organic market problem of Ban Khrainun non toxic vegetables groups, agricultural organic marketing strategy as well as marketing knowledge management inside non toxic vegetables groups at Makha Sub-district. The statistics used for data analysis were percentage and frequency.

4. Descriptive analysis were applied for validation by data comparison internally, externally
and holistic aspects from many sources of data of information, data collection, concepts and theories as well as under Participatory Action Research: PAR. To get knowledge principle to develop agricultural agricultural organic market of Ban Khrainun non toxic vegetables groups.

**Research Frame**

This research will help in finding ways of knowledge management development on organic agriculture marketing in Ban Khrainun non toxic vegetables groups at Makha Sub-district, Kantharawichai District, Maha Sarakham Province via analyzing from context in as situation and problem on agricultural organic market of Ban Khrainun non toxic vegetables groups, agricultural organic marketing strategy as well as marketing knowledge management inside non toxic vegetables groups at Makha Sub-district both inside and outside the target with the following research frame (Chart 1.1) as;

**Results**

The researcher had concluded results following each objective as follows;

1. Ban Khrainun farmer groups, mostly they struggle situation and problem on agricultural organic market. Since they can’t determine their own sales prices because output were sold mostly wholesale price for merchant middleman. Some were sold at markets and communities such as Kantara Wichai District bazaar, and Mueng Mahasarakham District bazaar. Now consumers are increasingly interested in health. Thus, there sales of non toxic vegetables remained satisfactory. Farmer never take courses or study on organic agriculture marketing, only their own research and knowledge of King’d development in growing organic vegetables. The benefits from economic self-sufficiency project, gain knowledge of using water, choose area grows, and seed as well as marketing moderately.

2. Analyse agricultural organic marketing strategy of Ban Khrainun farmer groups were found farmer groups produce and sell cowpeas, eggplants, corns, cucumbers, and chilies by packing under Ban Khrainun non toxic vegetables groups brand. The label indicates that message “No chemicals and insecticide”. Most farmer can’t set prices of productivity by themselves. They sold vegetables to middleman about 10-15 baht per kilogram. Distribution are two channels to merchants and market by cash sales to both wholesale and retail in Kantara Wichai District bazaar, and Mueng Mahasarakham District bazaar in Mahasarakham Province. Some sales promotion such as customer buys regularly and greatly productivity, discount for retention continuously, satisfaction, and profitability.
3. Regarding marketing knowledge management process Ban Khraintun farmer groups were found most consumer well known as non toxic vegetables under brand of group. But someone farmers used chemical fertilizer in farming becoming obstacle for products of themselves in long term which may have affected revenues from vegetable sale. Member also lacked cooperation from other groups, but only studying sufficient economy project. Ban Khraintun lack of bargain power as well as competition in market.

4. Ban Khraintun farmer groups should also learn to live together with their crop production without toxic, be ethical and responsible for consumers as well as society. They can develop knowledge management on organic agriculture marketing.

Conclusions and Discussion

Main problems of non toxic vegetables groups in Ban Khraintun consuming were 1.) non toxic vegetables small insects/animals 2.) Distribution channels was having no place for ready cooked made of non toxic vegetables 3.) Sale promotion knowledge understanding was not enough in how to choose the product in consuming and no findings for real promoting to prevail non toxic vegetables consuming. Its consumers’ suggestions comprised 1.) Value/benefits in non toxic vegetables consuming should be promoted, 2.) Development and improvement of non toxic vegetables for more easy to consume should be considered,3.) There should be development of closed packing to prevent small vegetables animals/insects which were easy reproductive in non toxic vegetables,4.)There should be various product types of converted non toxic vegetables, 5.)There should be consumers’ assurance via quality guarantee mark/signal for non toxic agent contamination and standard of non toxic vegetables, and 6.) Various marketing channels should be expanded.

The researcher presented conclusions following with discussion as follows;

1.) According to related internal context when focusing on situation and problem on agricultural organic market of Ban Khraintun farmer groups were found there were lower goods prices comparing to competition because they can’t set their own price, and control fungi, and insects. Moreover, the weakness revealed as no quality control, residual chemical substance left in contaminated sand.

This happened because the farmer groups in the target area there were lacking of development and conversion for vegetables from chemical fertilizer, lacking advertisement and public relation, plan for marketing with advisors and supporting fund from outside units while only small amount gained from government ones. The distinct of non toxic vegetables from this target area is coming from its fertile geographical area suitable for planting organic vegetables which respond to majority needs of target customers especially expanded ones who keep on healthy. Although there are increasing quantity of organic vegetables resulted from using technologies and machines substitute to using labour power, in the same time, it must to be careful not to lowering quality of organic vegetables as decreasing investment cost which may impact to its quality products.

Relevant to Tidarat Chaimongkol, and Busara Limnirunkhol (2014) who studied expansion agricultural organic trend of Pothongchoren village, Chongdoi Sub-district, Doisget District, Chiang Mai Province, her findings revealed that the production look at niche market as their own. This was the same idea of Sanich Viliyakitsothong (2009) who studied creating alternative economic operations of the network of Thai organic farmers, Songkhla Province, her findings revealed that farmers have difficulty in traditional farming and want to find better solution. These problem such as high production costs, while price weren’t balanced. Some cases include problems with health.

2.) According to related agricultural organic marketing strategy of Ban Khraintun farmer groups were found the farmer groups struggled along on four main areas of marketing competition, supports from government and private sectors and technological changes. Firstly of product competition, they were on the lacking of tangible vegetables breed development, marketing mediators, marketing concepts and customer providing, customers behaviour and attitude from no converted products, although there were own brand and tasting of non toxic vegetables which not in common mode as it should. Secondly of the supports, the struggles were on no policy of price, no supports reaching neither converted products promotion. Thirdly, there were issues in lacking of community network building, active public relation and technological knowledge. The fourthly, commercial channel fluctuation. In addition, there were lacking of development advertisement and public relation, plan for marketing with advisors and supporting fund from outside units.

This may cause from having high competition in organic vegetables at the moment. Therefore, network developing in this local target area needed times to culture relationship for information exchange which was enable them to unite group and to protect them in critical time. It needed many factor aspects for enterprise survivals. There have to be learning innovation for organic vegetables producing and utilised new ideas as well as using effective
producing technology and also using socio-economic by products. Then the target group in this target area can decrease investment such as on harvest producing time via using organic fertilizer instead of using chemical fertilizer, on using machines instead of using hand sticks, on packing instead of using labour for that.

This was relevant to Witoon Punyakul (2010) who studied Introduction to organic farming for expansion of agricultural organic goods market report in the South-east Asia. The study revealed organic goods market follows as; health entrepreneur begins to turn to import health food products and organic agriculture from the foreign countries, and directly sell. Now they are more than 200 stores and supermarket in Malasia, especially in the city such as Kuala Lumpur and Penang, etc.

3.) According to related marketing knowledge management process of Ban Khrainun farmer groups were found most consumer well known non toxic vegetables of Ban Khrainun was been known under brand of group, but someone use chemical fertilizer in farming becoming obstacle for products of themselves in long term which may have affected revenues from vegetable sale. Members also lack cooperation with other groups, but only studying sufficient economy project. Ban Khrainun had no bargain power as well as competition in market goes up more before high production cost but low compensation.

This marketing knowledge management process was built which may cause from farmers in this local target area produced only non toxic vegetables for middle merchants to be converted. Those middle merchants built sale price averagely 10-15 bahts/kilogram. Moreover there were no choice for distribution channels. This made farmers stopped organic vegetables planting. From this situation might come from uncertainty for price of non toxic vegetables of Ban Khrainun and found only small number in planting non toxic vegetables planting in Ban Khrainun.

Relevant to Vichan Panich (2011) who claimed that knowledge management was procedure goes to fine applied in operating and creating knowledge in true practice, can efficiently pass on knowledge, and potential advantage competition. In the same relevance to Wongpattana Sripresert (2012) who revealed knowledge management related to ability on within organization administration procedure. It should enhance capability in competition for develop and adjust customer database, understand tendency of customers such as requirement, and contentment as well as taste.

4.) According to related knowledge management development on organic agriculture marketing inside Ban Khrainun non toxic vegetables groups at Makha Sub-district, Kanthara Wichai District, Maha Sarakham Province. Ban Khrainun farmer groups should also learn to live together with their crop production without toxic by being ethical, and responsible for consumers as well as society. Then they can develop knowledge management on organic agriculture marketing.

This may be because the non toxic vegetables groups in Ban Khrainun can produce main breeds such as cowpea, eggplant, corn, cucumber, and chili by focusing on its non toxic substance to response to expansion of consumer group who keep healthy. Although agricultural technology and machines were placed on human labour but concerning to quality of such products have to be maintained. Lowering producing investment may impact quality of non toxic vegetables.

Relevant to Kotler, P., & Armstrong, G. (2011) who claimed that the development should focus on market by responsibility consciousness on social in long term. There were permanent contentment to consumer or call that the social marketing concept by consider consumers and society, sometimes called Green Marketing.

Suggestions for research results utilization

From the research results in knowledge management development on organic agriculture marketing inside Ban Khrainun non toxic vegetables groups at Makha Sub-district, Kantharawichai District, Maha Sarakham Province, the research concluded suggestions to be guidelines to establish supporting policies and to encourage non toxic vegetables business, and the converted products as follows;

1. The Suggestions for adoption
   1.1 Makha Sub-district agricultural office should be responsible for training non toxic vegetables producing groups in the target area to learn the advantages of the organic fertilizer and drawbacks of the chemical fertilizer.
   1.2 There should be supporting non toxic vegetables product conversion along with product package developing in various sizes to attract more product marketing partners in order to create long-term profitability.
   1.3 There should be area expanding for non toxic vegetables producing as at present, people highly realize in health importance and increasingly consumed agricultural organic products.
   1.4 There should be public relation to consumers about non toxic vegetables of producing group in the target area as well as benefits from non toxic vegetables consuming.
1.5 There should be planning about budget system for the target area group and making right budget system and more properly to maximize related advantage.

2. The Suggestions for future research

1.1 There should be guiding for Ban Khrainun’s non toxic vegetables producing development of the quality plant to compliance with demands of the consumer market.

1.2 There should be studying on building network to grow non toxic vegetables at Makha Sub-district, Kanthara Wichai District, Maha Sarakham Province. To gather and have established group of growers. That the knowledge exchange agricultural planning inception in purchasing seeds of membership.

1.3 There should be the issue of selling non toxic vegetables for Ban Khrainun. In accordance with purchasing behavior in order to facilitate customers to make choice to distribution the best for non toxic agricultural vegetables growers.

1.4 There should be studying for quality of output that developed can be respond needs of consumers, or not.

Acknowledgements

This research is completed by kindness and help from many persons and associates. Researcher thanks committee very much for supporting research asset. Thank you, experts who inspect research tools until this research was complete and met that objective.

The researcher particularly thanks everyone who were informant agriculturists who producer non toxic vegetables processing products of Ban Khrainun at Makha Sub-district, Kanthara Wichai District, Maha Sarakham Province, and specialists who gave important data to make the research completed.

The researcher would like to express her appreciation to parents and teacher for their morals supports and everyone involved for their encouragement.

References


Constructing A Model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in Renunakhon District, NakhonPanom Province, Thailand and Khammuan Province, Lao People's Democratic Republic

Warit Rasri
Faculty of Humanities and Social Sciences MahaSarakham University
Thailand
sanowa_cmu@hotmail.com

Abstract

The research aimed to analyze and synthesize Constructing a model for Thai-Lao cultural tourism promotion in preparation for the ASEAN Community in Renunakhon District, NakhonPanom Province and Khammuan Province, Lao People’s Democratic Republic, to design a model for Thai-Lao cultural tourism promotion in preparation for the ASEAN Community in Renunakhon District, NakhonPanom Province and Khammuan Province, Lao People’s Democratic Republic, and to evaluate and verify the model for Thai-Lao cultural tourism promotion in preparation for the ASEAN Community in Renunakhon District, NakhonPanom Province and Khammuan Province, Lao People’s Democratic Republic. The mix research was divided into four phases. Phase 1: the qualitative research emphasized documentary study and interview of twenty experts including the community forum approach. Phase 2: The quantitative research was employed for collecting data from two groups of 200 target population by questionnaires. The statistics used were frequency, percentage, mean, standard deviation, and MANOVA (Repeated Measure). Phase 3: the quantitative research was employed for collecting data from two groups of 1000 target population by questionnaires. The LISREL program was employed for factor analysis, correlation and confirmatory factor analysis. Phase 4: the quantitative and qualitative research was employed to evaluate and verify the model by twenty experts and the community forum approach. The statistics used were frequency, percentage, mean, standard deviation, and MANOVA (Repeated Measure). The research findings showed that the indicators of five components for Thai-Lao cultural tourism promotion in preparation for the ASEAN Community consisted of 13 key indicators and 52 sub-indicators as follows.

1. The Joint Project included 1) traditions with two indicators, 2) festivals with five indicators, and 3) tourism with two indicators.
2. The joint service consisted of 1) transport with four indicators, 2) media with four indicators, 3) facilitation with five indicators and 4) tourist attractions with four indicators.
3. The cooperation was composed of 1) the joint committee with five indicators, and 2) relationships with four indicators.
4. The state support consisted of 1) local government with five indicators and 2) national government with five indicators.
5. The international strategies were composed of infrastructure development for tourism with two indicators, and 2) product development for tourism with five indicators

Keywords: A Model, Thai-Lao Cultural Tourism Promotion, ASEAN Community

Introduction

"Tourism" is related to human lives ancient times such as mutualism, pursuit of products, pursuit of new land or worship the holy things which some traveling still appeared at present. The touring is relaxation together with getting knowledge about cultures and festivals, experiencing geography and creating relation with foreigner. At the time the transportation is comfortable for travelling and visiting many interesting places. Therefore, there are various businesses to support tourism industry: such as transport business, tourism business, souvenir, hotel, restaurant, agricultural products and construction company. These businesses create jobs and new occupations for people local areas and stimulate economic growth of the country (Tourism Authority of Thailand. 1998). At present the tourism business is the largest and fastest growing industry of the world which provides major incomes to countries immensely, income circulation and also stimulates economic growth, employment, and various occupations. The tourism's expansion has been continuous, World Tourism Organization: UNWTO predicted that number of tourists in the world have increased to 1 billion people since 2010 and the tourists have been increasing to
1.56 billion in 2020 (World tourism organization: UNWTO: 2007). Thailand realized that tourism industry is an important factor for local and national economic growth. Regarding the new paradigm of the tourism, the sustainability has become a key concept of tourism development and management. Therefore, modern world society has changed (Paradigm shift) scope of tourism development including all. Dowling (1995) states that "cultural tourism" is one important choice for attracting tourists to travel their country such as visiting the archaeological site, temples, activities of life, including traditional dance, music, fine arts, local traditions and culture etc. (Pacific Asia Travel Association – PATA, 2006). The principles and concepts mentioned show that it is a good chance of Thailand in cultural tourism development with a neighboring country: Lao People's Democratic Republic. The Thailand-Laos relations have improved greatly since 1987, the end of Ban Rom Khao war. Additionally, the similarities of Thailand and Lao People's Democratic Republic are history, race, religion, language, and culture. Moreover, Thailand-Laos signed the basic treaty of Amity and Cooperation in February 1992 to support each other for sovereignty and non-intervention domestic affairs as "Sister cities" and in preparation for the ASEAN Community. According to the 5th National Strategy, the strategy emphasizes the connection with countries in the region for economic security and tourism industry development focusing on potential quality service and hospitality. Therefore, the key factors for the cultural tourism development consist of sustainable tourism management and community participation in developing tourist attractions.

The author chose Renu Nakhon District, Nakhon Phanom Province, and Khammouan of Laos to be the research sites because the similarities of two cities are way of life, race, history, festival, historic sites. Renu Nakhon District, the city of Phu Thai with outstanding life, language, tribal costume, and Phu Thai traditional dance. In addition, Renu Nakhon District has many important tourist attraction such as Pha That Renu Nakhon near Pha That Phanom and OTOP shop including popular local products: Phu Thai clothing, khit pillow, long pillow and Lao Au. In case of Khammouane of Laos, the city is popular for outstanding culture and natural tourist attractions including Phra That Sri Khotrabrun, a historic site of the city. People of Khammouane still conserve Lao traditional costume and cultures including gentle language. Additionally, Khammouane is popular for tourism such as natural attractions, ecotourism, forest, mountain, waterfall, many other. Moreover, the 3rd Thai-Lao Friendship Bridge between Nakhon Phanom-Khammouan has provided comfortable transport between people of both countries and the research areas are important strategic points for transport and tourism route in the region to countries of the ASEAN Community and southern China.

Thailand and Laos expand production and investment in countries of the ASEAN Community and China which is called "Route 12", an important economic route linking East-North of Thailand with Guangxi (Guangxi Zhuang Autonomous Region) south of China which is able to transport products from Thailand to southern China. The agreement between Thailand and Laos solves many problems about hardware (public utility route) and software (set of regulations) of Route 12. According to the importance and appropriateness of the area, the researcher concludes that new knowledge, called "innovative research", is necessary for tourism development of both countries and the cooperation of two countries creates incomes to people in the local communities of both countries.

Material and Methods

This research was divided into 4 steps as follows.

Phase 1: Investigate and analyze a model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in Renunakhon District, NakhonPanom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic.

Phase 1: The researcher collected data by the qualitative research emphasized documentary study and interview. 1) The documentary study emphasized textbooks, literatures, researches, academic journals, newspapers, printed matte online are relate etc. 2) Phase 2: the researcher studied and interviewed ten experts and ten leaders. 3) The community forum approach was employed to give a chance to people of both Thailand-Laos to exchange knowledge about cultural tourism.

Phase 2: Analyze and synthesize a model for Thai-Lao cultural tourism promotion in preparation for the ASEAN Community in Renunakhon District, Nakhon Panom Province and Khammuan Province, Lao People’s Democratic Republic.

Phase 2: The researcher collected data from two groups of 200 target population by questionnaires as follows.

Group 1: 120 Thai target population.
- 30 experts
- 50 academicians
The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University

- 20 government executives
- 20 community leaders

Group 2: 80 Laos target population
- 30 academicians
- 30 government executives
- 20 community leaders

The statistics used were frequency, percentage, mean, standard deviation, and MANOVA (Repeated Measure).

**Phase 3:** Create a model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in Renu Nakhon District, Nakhon Panom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic.

Phase 3: The researcher collected data by human study. The quantitative research was employed for data collection from two groups of 1000 target population by questionnaires as follows.

1) 500 Thai target population consisting of 400 local people and 100 tourists.
2) 500 Laos target population consisting of 400 local people and 100 tourists.

The statistics used were frequency, percentage, mean, standard deviation, and MANOVA (Repeated Measure). The LISREL program was employed for factor analysis, correlation and confirmatory factor analysis.

**Phase 4:** Evaluate and confirm the model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in Renu Nakhon District, Nakhon Panom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic.

In final phase the researcher collected data by human study to confirm the model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in Renu Nakhon District, Nakhon Panom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic by using two steps: evaluating and verifying the model by twenty experts and the community forum approach. The statistics used were frequency, percentage, mean, standard deviation, and MANOVA (Repeated Measure).

**Result**

The research findings showed that the indicators of five components for Thai-Lao cultural tourism promotion in preparation for the ASEAN Community consisted of 13 key indicators and 52 sub-indicators as follows.

1. The Joint Project included 1.1) traditions 1.1.1 festival together 1.1.2) festival of year between local Renu Nakhon District and Khammuan Province, Lao People’s Democratic Republic together. 1.2. Festivals with five indicators such as 1.2.1) competition sports local Thailand-Laos together. 1.2.2) organized music, dancing together 1.2.3) organize foods display good products together. 1.2.4) organized show products, business, and handicrafts with together. 1.2.5) organized show traditional cultures of year together and worship Phathat 2 sides Mekong River together. 1.3) low cost tourism for attract tourists.

2) Joint Service included 2.1) transport 2.1.1) ground traffic are comfortable 2.1.2) water routes are comfortable (Mekong) 2.1.3) have especially tourism transport between Renu Nakhon District and Khammuan Province. 2.1.4) have passenger car, omnibus local transfer between Renu Nakhon District and Khammuan Province 2.2) Medias included 2.2.1) both countries have data tourism online together 2.2.2) both countries have data tourism form various documents together such as brochures, maps, travel books etc. 2.2.3) both countries have local guides of tourism point and 2.2.4) both countries have public relations tourism with thoroughly and continued. 2.3) facilitation included 2.3.1) both countries have clarity and all guide post to tourism attractions. 2.3.2) both countries have enough food shops and inexpensive. 2.3.3) both countries have public toilets be clean and enough to service tourists 2.3.4) both countries have security to safety tourists and 2.3.5) both countries have comfortable passport between Thailand-Laos with easy and quickly. 2.4) tourist attraction included 2.4.1) both countries keep clean tourist attraction 2.4.2) both countries must be organizing shopkeeper don’t force or press products to tourists 2.4.3) both countries must be organizing tourism together to protect damages and feel annoyed to tourists such as beg for money, persuade, catch etc. and 2.4.4) both countries must be specify charge be proper to visiting tourism attractions and don’t exploit tourists.

3. Cooperation included 3.1) Joint committee such as 3.1.1) both countries must be often conference committee such as conference local administration etc. 3.1.2) both countries must be have committee cooperation Thai-Laos to proceed activities in Mekong River. 3.1.3) both countries General Border Sub – Committee in province and district 3.1.4) both countries have Joint Commission in local and 3.1.5) both countries have association
Thai-Laos for friendship 3.2) Relationship such as 3.2.1) both countries must be support relationship between countries with “Sister countries” 3.2.2) both countries must be support intimate in history, race, language, culture and social etc. 3.2.3) both countries must be support interdependence and 3.2.4) both countries must be promote relationship Thailand-Laos all level.

4. State Support included 4.1) Local Government such as local government of both countries to support policies culture tourism together in short plan and long plan 4.1.2) local government of both countries to support MOU between Renu Nakhon District and Khammuan Province in culture tourism 4.1.3) local government of both countries shall support budgets to activities promote culture tourism together 4.1.4) local government of both countries shall support people have participate specify policies, work plans, activities, projects etc. and 4.1.5)) local government of both countries shall support local area community model of culture tourism between RenuNakhon District and Khammuan Province 4.2) Government such as 4.2.1 the both government must be support budgets to activities promote culture tourism together between RenuNakhon District and Khammuan Province 4.2.4) the both government must be support advertise public relations between RenuNakhon District and Khammuan Province 4.2.3) the both government must be support proceed policies between countries with friendship 4.2.4) the both government must be support develop base data and connection network tourism news between RenuNakhon District and Khammuan Province (4.2.5) ) the both government must be support culture tourism between RenuNakhon District and Khammuan Province to be central of the ASEAN.

5. International Strategic included 5.1) Infrastructure such as 5.1.1) development and improve facilities for tourism and 5.1.2) development network transport and connection system tourism all region together. 5.2) product such as 5.2.1) development local products for increase values 5.2.2) development products invest and service of tourism to extend markets 5.2.3) development people can be development occupations together 5.2.4) development and propagateidentity of the both countries with together and 5.2.5) development environment and organizing culture tourism together.

Conclusions and Discussion

Conclusions

A model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in RenuNakhon District, NakhonPanom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic is concluded following.
ทั้งสองฝ่ายต้องมีห้องสุขาสาธารณะท่ำสะอาดฯ
ทั้งสองฝ่ายต้องมีระบบการรักษาความปลอดภัยในที่พักฯ
ทั้งสองฝ่ายต้องมีการอำนวยความสะดวกในเรื่องของ
สถานที่ฯ
ทั้งสองฝ่ายต้องไม่มีการกระทำบั้นบันปัดบังหรือบังคับ
สินค้าฯ
ทั้งสองฝ่ายต้องไม่สร้างความขัดแย้งเพื่อรูปประโยค
อื่นใดฯ
ทั้งสองฝ่ายต้องกำหนดเวลาที่มีการเข้าเยี่ยมชมฯ
ทั้งสองฝ่ายมีการประชุมคณะผู้ว่าราชการจังหวัดและเจ้า
|string|
Discussion

From the results, the model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in RenuNakhon District, NakhonPanom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic, the researcher will conclude and discuss the result supported by theories and academic works and research.

In the world tourism industry is largest industry with employment 192.3 billion (World Tourism Organization, 2010) currently to importance about development tourist and tourist market wide open various of tourism attraction and type tourists, so that the countries trying contest with strategies for attract tourists the mostto their countries and be alert to cultures included various cultures of each areas to starting points of development tourist attraction become the central of tourism industry of Europe and another countries trying to develop culture tourism of their countries (Nzama, Magi, &Ngocoho, 2005).

Cultural tourism provides incomes to people in the communities and improves the economic growth of the countries. The community leaders are important persons for local cultural tourism development of Thailand and Laos. The tourism is service industry which earns the most incomes and creates jobs for people in both countries. Currently, the tourism market has been increasing dramatically. The cultural tourism development focuses on the cultural heritage sand identity, uniqueness of the two research areas. Moreover, the appropriate development of tourism industry should be based on the basic structure of community, community economic development and promotion for community identification. Cultural tourism is special because the study emphasizes history and culture in the areas such as society, humanities, history, culture, knowledge and values.

Accordingly, cultural tourism is one important economic development strategy for Thailand and Lao. Moreover, cultural tourism is provides main incomes and creates new jobs for people in both countries such as production of tradition handicraft, and service business. The successful and sustainable cultural tourism development should be based on needs and potential of people including tourist attractions in the communities of both countries.

Acknowledgements

The author deeply appreciates the office of the National Research Council of Thailand (NRCT) for the financial support of the research on “a model for Thai-Lao Cultural Tourism Promotion in Preparation for the ASEAN Community in RenuNakhon District, NakhonPanom Province, Thailand and Khammuan Province, Lao People’s Democratic Republic”. He is thankful for experts, community leaders of Thailand and Laos for data collection. Finally the researcher hopes that the research will be useful information for the cultural tourism in Thailand and Laos.

References

Beyond On-Air Language: Unraveling the Influence of Papa Jack’s Programs to the Values and Views of Regular Listeners

Ernesto Cordero Collo, Jr.
Don Mariano Marco Memorial State University, San Antonio, Agoo, La Union, Philippines
E-mail: ernest_journalism@yahoo.com

Abstract

One of the innovations of radio for it to remain “relevant” despite the popularity of other media is to reach out to the masses. This led to innovations such as the popularization of bilingualism, gay language, and even profane language. Love Radio (one of the leading radio stations in the Philippines) programs True Love Conversations (TLC)/The Letter and Wild Confessions, hosted by Papa Jack, are programs that aim to give pieces of advice on love and relationship problems.

As an innovation based on the recommendations of the regular listeners for the improvement of the programs, the researcher proposed an interactive multimedia program that aims to be an avenue for community dialogue and communication to effect social change and values formation by tackling societal issues. This program would adopt the values reflected in the programs of Papa Jack along with his hosting style which appeared as effective components to boost listenership.

Moreover, before creating a program prototype, the researcher specifically explored the influence of Papa Jack’s programs on the values and views of their regular listeners. It also determined the appropriateness of the program components and the acceptability of interactive programming as a format amongst the listeners. This study employed quantitative and qualitative methodologies with a total of 70 regular listeners interviewed using a guided survey questionnaire. Moreover, an online questionnaire was also administered to three local DJs to determine their views towards the programs.

Entertainment was the primary reason of the listeners in tuning in to the programs of Papa Jack. On the other hand, courtship, friendship, and family were the most interesting subjects for regular listeners. According to the majority of listeners, they learned the values of forgiveness, responsibility, commitment, and faithfulness from the programs.

Keywords: Regular listeners, Values, Views, Programs, Multimedia

Introduction

Radio has become a significant tool for entertainment and information. From simple radio sets to the launching of online radio, high-quality digital radio and digital satellite radio, it has undergone myriad of changes in programming in order to sustain its authority in the limelight despite its competition with the more popular media today.

Flor (1994) asserted that radio is generally acknowledged for its three functions: (1) to entertain; (2) to inform; and (3) to educate. However, the education function is the least explored and the least used. As mentioned by Hilliard and Robert (1985), the trend in the early 1980s was toward the combination of news and talk, the later concentrating on the audience-participation call-in technique. Subject areas for call-in shows are endless: arguing with a host or hostess on significant public affairs issues, discussing a topic with an interviewee, revealing personal problems, asking questions of sports experts. They added that the essence of talk stations is that much of the talking is done by the listeners, not only by the studio personalities. Listeners patronize these programs for their interesting format which is otherwise termed as Interactive Program that involves two-way communication between a radio station and its listeners.

Another communication expert, McLeish (1994), claimed that the primary purpose of the program is democratic - to let people have their say and express their views on matters which concern them. It is equivalent to the 'letter to the editor' column of a newspaper or a soap-box orator stand in the city square. The role of the presenter or host is not to take sides - although some radio stations may adopt a positive editorial policy – it is to stimulate conversation so that the matter is made interesting for the listener. He further added that the presenter must be well
versed in the law of libel and defamation and be ready to terminate a caller who becomes obscene, overtly political, commercial or illegal in accordance with the programme policy.

As manifested in observations, one of the countless strategies of interactive programs is the sudden shift of radio language that has conquered the radio scene - from a serious, smart and catalytic to funny, gay language-driven language. To sustain its existence in the modern era despite the emergence of social media, radio continues to reinvent formats for the listeners' interest by adapting gay language, bilingualism, and even profane language.

However, sound programming is also compromised. Perhaps one of the most controversial radio hosts today is the award-winning disc jockey Papa Jack or John Gemperle in real life. His programs, True Love Conversations (TLC)/The Letter and Wild Confessions air from 9pm to 2am (Mondays to Fridays), have received good reception from listeners for his critical, realistic and practical advice to callers.

His program TLC mainly focuses on critically advising callers. His style is adversarial in nature where he often plays the devil's advocate with strong use of malicious language. On the other hand, Wild Confessions accommodates stories of intimate encounters of at least two callers every night who narrate descriptively on air their sexual encounters.

This study primarily finds its importance in providing disc jockeys and radio management a lens on the perspective of the listeners towards radio programs. It is also key to finding out the opinions of the listeners by delving beyond the surface. This study explored the program components and the values learned which may engender towards values formation and education.

This study may also be significant for the regular listeners and potential target audiences. As listeners, they need to be critical and keen about the language changes and the hosting styles of disc jockeys in radio.

Further, this academic undertaking may provide readers perspectives from regular listeners and disc jockeys towards radio programming today. It also aims to provide future researchers with a study on the role of the radio as a catalyst for values formation and education.

Educators in the field of communication might also be able to consider this study as a future reference. This study may also provide groundwork for higher learning in the field of media communication especially on modern radio. From the data collected from the respondents and from other sources, the researcher produced an interactive multimedia program as an opportunity to enhance radio programming.

Objectives of the Study

1. Describe the reasons of listeners in patronizing the interactive programs of Papa Jack;
2. Determine the topics of interest to the regular listeners;
3. Determine the values influenced by Papa Jack’s interactive programs to the listeners by tuning in to these programs;
4. Find out the appropriateness of the components of the programs to the regular listeners in terms of the following:
   a. Language
   b. Style
   c. Program run-down;
5. Find out the acceptability of Papa Jack’s interactive format to the regular listeners; and

Materials and Methods

This study employed quantitative and qualitative methodologies in deriving results and discussions from 70 regular listeners of True Love Conversations (TLC) and Wild Confessions. Regular listeners refer to the avid supporters of Papa Jack who spent at least once or twice a week of tuning in to the programs served as the respondents in the study.

Guided survey questionnaire using the local language (Iloko) was used in the interview survey. The researcher also used snowball sampling. In this method, participants or informants refer the researcher to other people who could potentially participate in or contribute to the study.

Moreover, three (3) local disc jockeys as also served as key informants for the study. The radio hosts-respondents had worked in the industry for more than two years from the time of the study.

The researcher conducted the study from November 2014 to February 2015 in the Eastern municipalities of Pangasinan, Philippines – Asingan, Binalonan, Laoac, Manaoag, Pozorrubio, Rosales, San Manuel, Tayug, Umingan, Urdaneta City, and Villasis.
The researcher initially utilized pre-testing (evaluation of qualified respondents for a study) to random listeners in Panpacific University North Philippines, Urdaneta City, where the researcher worked during the study, before the questionnaires were administered to the respondents. Further, the researcher employed participant observation by listening to the interactive programs of Papa Jack from August 2014 to February 2015.

The primary tool utilized to collect pertinent data was a guided survey questionnaire to 70 regular listeners. Moreover, for additional insights, the researcher administered online questionnaire to three (3) local disc jockeys as key informants to gather their perceptions and/ opinions about Papa Jack’s programs and style in hosting.

Results

Reasons of listeners in patronizing Papa Jack’s programs

Fifty-three (75.71%) of the respondents tuned in to the interactive programs for entertainment which topped the list of the identified reasons. The discussions of the researcher with the listeners surfaced that the entertainment value of the interactive programs is reflected in Papa Jack’s ability to handle the programs with ease and humor brought about by a decade-long experience in the industry. Rosalie Abuan, 22, expressed, “Nakakatawa kasi ang delivery niya. Nakakagaan ng loob.” (His delivery is funny. It lightens the mood.)

Thirty-seven (52.86%) of the respondents agreed that the interactive programs of Papa Jack, specifically TLC, included informative content. Most of the time, the disc jockey presents helpful tips and/ advice for the callers and listeners on how to overcome their problems on love, marriage, friendship, and family, among others.

Personal identity was considered by 22 (31.43%) respondents as another reason for listening to the program because they were able to completely relate to the stories of the callers. Blumler and Katz (1974) defined this gratification as an attempt among media users to look for models of their behaviour that they can identify with. According to a post-graduate student-respondent Isaiah Miguel Supnet, 25, “Listeners sometimes depend on radio to look for individuals having the same problem as they have.”

Table 1. Reasons of listeners in patronizing Papa Jack’s programs True Love Conversations (TLC) and Wild Confessions*

<table>
<thead>
<tr>
<th>REASONS</th>
<th>FREQUENCY</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entertaiment</td>
<td>53</td>
<td>75.71</td>
</tr>
<tr>
<td>Information</td>
<td>37</td>
<td>52.86</td>
</tr>
<tr>
<td>Personal identity</td>
<td>22</td>
<td>31.43</td>
</tr>
<tr>
<td>Integration and social interaction</td>
<td>19</td>
<td>27.14</td>
</tr>
<tr>
<td>Escape from reality</td>
<td>18</td>
<td>25.71</td>
</tr>
</tbody>
</table>

*multiple response

On the other hand, 19 (27.14%) of the respondents are convinced that integration and social interaction were fulfilled in patronizing the interactive programs. This result can be attributed to our culture of being sympathetic to the circumstances of the people around us. It can also be observed that “pakikisawsaw” (involving one’s self to other people’s concerns) is very common among Filipinos which could explain this gratification.

Eighteen (25.71%) of the 70 respondents listened to the programs for escapism in order to deviate their attention from personal problems. They believed that tuning in to these programs temporarily brought them into a different world of isolation.

This result is corroborated by Dominick’s (2011) claim that programs in the 1930s reflected a need for diversion and escape. The regular listeners believe that Papa Jack’s programs serve as diversionary or temporary company when personal matters and issues seem to be overbearing.

The results are supported by the theory of McQuail, Blumler and Brown (1974) by suggesting the following individual needs categories: (1) Diversion – emotional release; (2) Personal relationships – substitute of
media for companionship; (3) Personal identity or individual psychology – value reinforcement, self-understanding; and (4) Surveillance – information that may help an individual accomplish tasks/goals.

Topics of Interest of the Regular Listeners

Courtship (94.29%), friendship (91.43%), and family (91.43%) were the most appealing topics for most of the respondents. The disparity in the preferred topics – from family to romance – shows the openness and good reception of the regular listeners to varied topics.

However, 56 (80%) and 53 (75.71%) of the regular listeners agreed that sex and marriage, respectively, interested them because they are at the legal age to understand mature topics. Sex and marriage as topics were disliked by some regular listeners but more than half of them agreed to its acceptability as topics. Topics on sex are often tackled in the program Wild Confessions where callers chronologically narrate and describe their sexual encounters.

Table 2. The topics of interest of regular listeners

<table>
<thead>
<tr>
<th>TOPICS</th>
<th>FREQUENCY</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courtship</td>
<td>66</td>
<td>94.29</td>
</tr>
<tr>
<td>Friendship</td>
<td>64</td>
<td>91.43</td>
</tr>
<tr>
<td>Family</td>
<td>64</td>
<td>91.43</td>
</tr>
<tr>
<td>Sex</td>
<td>56</td>
<td>80.00</td>
</tr>
<tr>
<td>Marriage</td>
<td>53</td>
<td>75.71</td>
</tr>
<tr>
<td>Work conflicts</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>Homosexual relationships</td>
<td>1</td>
<td>1.43</td>
</tr>
</tbody>
</table>

*multiple response

In the discussions with the regular listeners, some of them opened up about the topics. Randy Galzote, 38, expressed that frequently airing this topic in the programs is contradictory to his personality and religious beliefs. Randy is a priest in the Aglipay church and he opposed the popularity of this topic in the radio. Nevertheless, he still patronizes Papa Jack for his straightforwardness in advising and hosting.

The Values Influenced by Papa Jack’s Interactive Programs to the Regular Listeners in Tuning in to these Programs

The results in Table 3 showed that Papa Jack’s interactive programs are a good avenue that strengthens their values and beliefs which, as many believe, are no longer observed in some radio programs these days.

The value of forgiveness, according to 51 (72.86%) regular listeners, was most manifested in listening to the programs of Papa Jack. According to them, whenever a caller asks about granting second chances to their partners after committing adultery, the DJ advises the caller to grant forgiveness.

Responsibility and commitment followed as values influenced to the majority (70% and 65.71% respectively) of regular listeners. Papa Jack often entertains stories on romantic relationships and other related topics and he frequently injects the importance of these values to sustain good relationships among couples.

Results also showed that faithfulness, honesty, and patience were some of the values inculcated to the regular listeners. Faithfulness, according to the DJ in one of the participant observations, is a timeless characteristic of a relationship that always sustains both parties. The regular listeners agreed that honesty is another value reflected in the program. Some stories that attract the listeners focus on the struggle of caller/s from keeping a secret of marital affairs or adultery. At the end of the call, Papa Jack emphasizes that the hallmark of a healthy relationship is honesty between partners.

Results also showed that family issues and values on close family ties are strongly embedded in their culture as individuals who agreed on their firm inclination to their family values.
Further, 32 (45.71%) regular listeners stressed the significance of dignity. Some problems on air involve women who, according to the DJ’s words, out of “pagpapakatanga” (stupidity), cannot leave their partners. Sometimes, they call the program to get a seemingly obvious answer from the DJ whether or not to continue meeting their partners for sex. From these stories, the importance of dignity among women is often underscored.

On the other hand, 20 (28.57) regular listeners regarded the value of perseverance as an influence of the program to them. Based from the participant observation, this value is manifested when men call the program to ask for a piece of advice from Papa Jack regarding courtship/love problems. As observed, the callers sometime solicit advice/tips on how to make amends with their loved ones or partners. In the end, the disc jockey encourages them to persevere and find innovative ways to win the hearts of those they are courting and to gain again the trust of their partners.

Four regular listeners added justice, respect/self-respect, acceptance, and accuracy, as the other values which they learned from the programs.

Moreover, acceptance as cited by Arabelle Reyes, 25, as an interesting topic is manifested in the struggles of homosexuals in the society and some of the respondents consider their stories to be thought-provoking and timely as they continue to find themselves in the open.

Rahman and Thomas, as cited by Khan (2011), proved that cultural continuity depends on the survival of a society’s values and customs, achieved through the passing on of traditional practices to the next generation. Over the years, radio has become a vehicle in extending society’s values to every generation.

Romaine (2007), as mentioned in Rahman and Thomas’ (2011) paper entitled The Media as an Instrument of Change, contended that the media continue to be used as a vehicle of cultural representation, sending powerful verbal and visual messages about the lifestyles, practices, and symbols of people, forging identity, encouraging unity, creating impressions, and reinforcing stereotypes.

Bagano (n.d.) confirmed that the social role of media communication, in the case of this study – radio, is to help strengthen the social fabric of the nation and influence its pattern. In other words, it also contributes to the dissemination of information and popularization of practice that all add up to the cultural heritage of a nation.

**Appropriateness of the Program Components to the Regular Listeners**

Contextualizing the definition of the program components identified in this study, the researcher defined them for the understanding of the regular listeners. The language component of the program is composed of (1) Word Expressions; (2) Choice of Words; and (3) Use of Profane Language. Word expressions refer to constant or habitual use of words or phrases that uniquely identifies the program. Choice of words, on the other hand, refers to the manner of selecting words to form phrases and sentences. While the use of profane language refers to the general language used in the programs.

### Table 3. The values influenced to the listeners in tuning in to the programs*

<table>
<thead>
<tr>
<th>VALUES</th>
<th>FREQUENCY</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forgiveness</td>
<td>51</td>
<td>72.86</td>
</tr>
<tr>
<td>Responsibility</td>
<td>49</td>
<td>70.00</td>
</tr>
<tr>
<td>Commitment</td>
<td>46</td>
<td>65.71</td>
</tr>
<tr>
<td>Faithfulness</td>
<td>36</td>
<td>51.43</td>
</tr>
<tr>
<td>Honesty</td>
<td>34</td>
<td>48.57</td>
</tr>
<tr>
<td>Patience</td>
<td>33</td>
<td>47.14</td>
</tr>
<tr>
<td>Family ties</td>
<td>32</td>
<td>45.71</td>
</tr>
<tr>
<td>Dignity</td>
<td>32</td>
<td>45.71</td>
</tr>
<tr>
<td>Perseverance</td>
<td>20</td>
<td>28.57</td>
</tr>
<tr>
<td>Justice</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>Respect</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>Acceptance</td>
<td>1</td>
<td>1.43</td>
</tr>
</tbody>
</table>

*multiple response

---

111
Table 4 presented that almost 70% of the regular listeners approved the word expressions while the rest (31.43%) resisted its popularization in the programs. Alyssa Tacpal, 21, expressed that “the DJ has too much trash talk. Some of the DJ’s word expressions are too harsh, foul, improper, rude, but funny.”

The 22 regular listeners who opposed Papa Jack’s word expressions suggested that the radio host should minimize the use of offensive words, although, they are also amused at the same time.

On the other hand, 47 (67.14%) regular listeners expressed their approval to the choice of words while 23 (32.86%) disapproved.

Meanwhile, 38 (54.29%) of the regular listeners approved the use of profane language. During the discussions with the regular listeners, they raised that the use of profane language added to their interest in patronizing the programs. Melliza Acosta, 17, shared, “Nakaka-excite para sa akin ‘yong language niya. Sobra nga totoo at nakakatawa nga eh.”

Lady Gracia, believed that “Radio jocks often forget that having a wholesome talk program is no longer viewed as a fun one.” Aaron, another DJ-respondent, admitted that he personally advocates good entertainment in radio.

Table 4. Appropriateness of Papa Jack’s language use

<table>
<thead>
<tr>
<th>LANGUAGE</th>
<th>FREQUENCY</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appropriate</td>
<td>Not Appropriate</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Word Expressions</td>
<td>48</td>
<td>22</td>
<td>68.57</td>
</tr>
<tr>
<td>Choice of words</td>
<td>47</td>
<td>23</td>
<td>67.14</td>
</tr>
<tr>
<td>Use of profane language</td>
<td>38</td>
<td>32</td>
<td>54.29</td>
</tr>
</tbody>
</table>

The issue on language use eventually led to a complaint. GMA News reporter Lapena (2011) reported on the complaint of Sorsogon Bishop Arturo Bastes who called the attention of Kapisanan ng mga Brodkaster ng Pilipinas for profane and naughty language by some disc jockeys on FM radio.

B. Style

Table 5 revealed that the frankness of Papa Jack in facilitating the programs was generally the most appropriate approach for 68 (97.14%) of the listeners with only two (2.86%) participants who disagreed. The respondents commended Papa Jack’s ability to identify the mistakes and advise them in the most straightforward manner.

Further, his adversarial style was acceptable to 59 (84.29%) regular listeners while 11 (15.71%) of them opposed this hosting style of the DJ.

Wilby and Conroy (1996) who recognized that radio discussions call on the participants’ ability to articulate a point succinctly and convincingly and to follow up with interesting responses to questions or counterpoints raised by the presenter.

Table 5. The appropriateness of the hosting styles of Papa Jack

<table>
<thead>
<tr>
<th>STYLE</th>
<th>FREQUENCY</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appropriate</td>
<td>Not Appropriate</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Frank</td>
<td>68</td>
<td>2</td>
<td>97.14</td>
</tr>
<tr>
<td>Adversarial</td>
<td>59</td>
<td>11</td>
<td>84.29</td>
</tr>
<tr>
<td>Tactless</td>
<td>54</td>
<td>16</td>
<td>77.14</td>
</tr>
<tr>
<td>Humorous</td>
<td>5</td>
<td></td>
<td>7.14</td>
</tr>
</tbody>
</table>
However, many regular listeners still expressed the excitement and entertainment which his adversarial style brought to the programs. These listeners were hooked to the program because Papa Jack always opposes his caller which even leads to some listeners hating how he handles the programs.

While his lack of tact in advising the callers was opposed by 16 respondents due to carelessness in his language, 54 (77.14) of them still agreed that this style was generally acceptable.

Five regular listeners added that Papa Jack’s humor is another style of the DJ which they admire. However, Lady Gracia shared, “We have observed that the pieces of advice of Papa Jack are repetitive or formulaic. It’s just the story that changes. But he is great because he can make the program exciting even if his technique is repetitive.

C. Program Run-down

Every radio program follows a standard program run-down/flow to carry out in order to achieve its goals for its listeners.

Results showed that majority (94.29%) of the respondents found the program flow appealing and interesting. Jenelyn Ubaldo, 20, said, “Maganda ang flow ng program. Simple lang pero nakakaengganyong makinig.” (The flow of the program is good. It is simple but it entices me to listen.)

Although four (5.71%) of them disagreed to the assertive attack of the DJ when giving solutions to the callers’ problems. Isaiah Miguel Supnet, 25, opposed the third step of the program flow because “there are problems that do not need solutions but pieces of advice where the listener can weigh [the options].”

Acceptability of Papa Jack’s Interactive Format to the Regular Listeners

Table 6 showed that majority (90%) of the respondents were receptive to the interactive format of Papa Jack’s programs while seven (10%) insisted for other radio programming formats. Few respondents resisted interactive programming as a radio format as they prefer pure music and greetings over talk and informative programs.

Wilby and Conroy (1996) explained that the discussion in an interactive or phone-in program constitutes the essential ‘excitement’ of live radio – considerably more so than the single presenter or DJ format – partly because it is not scripted and nobody.

Lawrence Kincaid’s Convergence Theory of Communication (1979) represented communication as (1) a process rather than a single action; (2) sharing or exchange of information rather than one-way transmission; (3) two or more participants in dialogue; (4) a means to clarify the confusion between information, knowledge, messages, symbols, and meaning; and (5) a self-correcting feedback process, defined dynamically as a diminishing series of corrections that enable communicators to converge on a goal. The five distinct characteristics of Kincaid’s Convergence Theory were all reflected in the components of the interactive programs of Papa Jack but specifically magnifying the last two characteristics where the program serves as a platform in understanding the callers’ dilemmas and getting feedback from the DJ until they arrive at specific solutions to help solve the problems.

Conclusions

1. People become avid listeners of interactive radio programs because of the values that can be learned. Interactive radio programs may be used as a conduit in learning and strengthening the listeners’ values as individuals.
2. The style and delivery of the disc jockeys of the interactive radio programs contribute to the patronage of the listeners partly based on their cultural context by using varied hosting styles and with entertaining delivery that all add excitement in tuning in.
3. Interactive programs that deal with real-life situations engage listeners to tune in and learn more about these situations. Listeners immerse their attention to programs that reflect their personal circumstances and problems.

Recommendations

1. Disc jockeys and radio management may explore other informative topics alongside the identified topics in the study that may lead towards educating the listeners but adapt different styles that can engage more audiences; serve as an avenue for values formation that fortifies the listeners’ sense of identity; and comply strictly with the use of language on air in conjunction to the KBP Code of Ethics.
2. Regular listeners should be keen about the modern trends and changes in the language use on air such as the popularization of gay lingo, bilingualism, and use of profane language that may influence their values, views, and even their behaviors.
3. Communication educators and students may adapt and improve the interactive multimedia program developed by the researcher and study its acceptability.
4. Future researchers may enrich this study by obtaining a first-hand interview with Papa Jack to confirm the values identified by the researcher of this study; and employ case study with random program callers to present a different point of view regarding the influence of the programs.

**Proposed Interactive Multimedia Program**

**Program Objectives:**
- To lead a forum that would entertain, educate, inform, and inspire listeners;
- To be a vehicle for transformation among listeners by serving as a conduit for communication and exchange of ideas; and
- To provide interesting stories to listeners that can serve as an inspiration for call to action.

**Rationale:**
This program is an offshoot of Papa Jack’s programs as a result of a study conducted by the researcher of this paper entitled “Beyond On-Air Language: Unraveling the Influence of Papa Jack’s Interactive Programs to the Values and Views of the Regular Listeners.”

This innovation is an interactive multimedia program based from the results and recommendations of the respondents of the study. It aims to be an avenue for community dialogue and communication to effect social change.

Servaes (2008) identified several distinct development communication approaches that can be adapted by practitioners to involve the people in bringing about change in the society. One of these approaches Entertainment Education (EE) or Edutainment approach. It is a hybrid of participatory communication strategies and the diffusion model of communication. It combines the attraction of entertainment with educational messages to help educate, inform, and encourage behaviour change to achieve development and social progress. This approach can employ traditional or indigenous media to promote issues in health care, literacy programmes, environmental protection, and introducing agricultural practices.

This program would specifically explore personal problems and social concerns that affect the general welfare of 17 and above, male and female listeners.

It is a two-hour interactive program which consists of two main parts – the call-in discussion and letter reading/advising. This will be aired from Mondays through Fridays, 8-10 in the evening. The call-in discussion will serve as an avenue for listeners to seek advice issues on problems regarding love, relationships, marriage, courtship, family, friendship and work-related problems. Results from the study showed that these topics are engaging and interesting. The program would accommodate two callers from 8-9PM. Reactions and comments gathered through SMS, telephone calls, facebook page, e-mail, and tweets from listeners would be read by the host after each call. According to Media UK Managing Director Cridland (2013), an initiative to engage the audience in an interactive program would entail the potential of the technology or social media to its maximum.

The second part of the program is reading of one letter from a sender which will be aired from 9-10PM. The letters would be lifted from e-mail or hand-carried letters to the station. This portion of the program would raise awareness on the more serious and sensitive issues such as adultery, homosexual relationships, human rights concerns, and health issues. These topics surfaced as good topics on air based from the results of the study conducted by the researcher. Further, it aims to advance development communication values such as equality, freedom, compassion, and respect for human dignity. The highlight of this portion of the program is an interview with an expert that can talk and give advice regarding the issue or concern at hand. The interview that would add to the credibility of the program could be conducted live or phone-in discussion.

This program differs from other radio programs today by combining call-in and letter reading and the integration of a variety of social concerns. It serves as a platform for effective dialogues that aligns its course of discussions towards values formation that promotes values of honesty, responsibility, commitment, patience and close family ties, among others. This program would also popularize good-natured humor on air which appeared to be a good approach for listeners.
References

Books Sources

Internet Source
Reality of Tourism Development in Lao Cai, Vietnam

Le Quoc Thang

Lao Cai Teacher Training College, Vietnam
E-mail: lequocthangtq@gmail.com
Mobile: (+84) 0972 162 177

Abstract

Tourism is a global industry promising of income and job for the host and experiences for tourists but it also seriously ruins the environment, the culture and the community. Sustainable tourism development plays very an important role for any country, and tourism providers understand that if tourism develops too fast, consequences resulted from it will be very serious. Lao Cai tourism development has changed the awareness of the local people and ethnic minorities in terms of their community and personal responsibility during the participation in the tourism development in their residence, associated their rights to the obligations of environmental protection, security, order and behavior culture. In particular, the socialization of communication and promotion for Lao Cai tourism is carried out effectively through directly communicating Lao Cai tourism on handicrafts of the hamlet residents. As such, tourism has become a common phenomenon that attracts millions of participants as tourists or tourist servicepersons. Tourism development thanks to positive and active participation by all economic sectors, growth rate of direct services and additional services shows the level of social consideration in this sector and the importance of tourism in the provincial socioeconomic life. This has been indicated clearly through the investments in and construction of technical and supporting facilities. Together with the active participation by the walks of life, it contributes to improving life quality for everyone including ethnic minorities. For the sustainable development of tourism, it is necessarily required to respect principles so as not to injure natural environment, economic environment and social environment. Sustainable tourism will exert active influence on the social and economic life. Tourism actually plays an important and leading role only when it is developed in a sustainable manner.

Keywords: Tourism, Development, Lao Cai, Sustainable development

Introduction

Lao Cai province has worked out preferential and open-door policies for domestic and international investors to come to Lao Cai. Upon investment in Lao Cai, investors are provided with favorable conditions in terms of business place, site clearance, land rental exemption, labor training, tax exemption as well as property rights, stay rights, travel and immigration rights. Therefore, in recent times, foreign investment projects in Lao Cai have been in general diversified both in field and form of operation. Domestic investment has also developed strongly with construction, agricultural - service - commercial and tourist projects in Lao Cai province. However, big tourist projects are still moderate. With a view to establishing quality and sustainable tourism, Lao Cai tourism needs to attract experienced and talented investors to consider investment.

Tourism is a global industry promising of income and job for the host and experiences for tourists but it also seriously ruins the environment, the culture and the community. Sustainable tourism development is not a new concept to many countries and tourism providers understand that if tourism develops too fast, consequences resulted from it will be very serious. Therefore, what to do and how to do so that our country’s tourism in general and Lao Cai tourism in particular will have a sustainable development?

It can be said that tourism is a general economic sector with significant resources orientation and profound, highly inter-regional, interdisciplinary and socialized cultural contents. Therefore, the sustainable tourism development requires common efforts and comprehension of the entire society. The sustainable tourism development must always orient towards assurance of three following basic goals: 1) Assurance of sustainable development in term of economy; 2) Assurance of natural resources and environment sustainable; 3) Assurance of the social sustainability.

Lao Cai is the border mountainous province located in the North of Vietnam, at the center of Kunming - Lao Cai - Hanoi - Hai Phong economic corridor; it is the big and favorable gateway between Vietnam, the ASEAN countries and the Southwest of China where the tourism is well developed. Lao Cai has diversified and abundant...
natural resources with thousands of valuable and rare animals, row on row of mountains, pure and cool climate that creates many attractive and gigantic landscapes for Lao Cai.

**Research Mission and Methods**

* Research mission:
  - Point out the reality of tourism development in Lao Cai province, Vietnam.
  - Point out the role and importance of the sustainable development of tourism in Lao Cai province, Vietnam currently and future.
  - Propose solutions for of the sustainable development of tourism in Lao Cai, Vietnam.

* Research method: Interdisciplinary research method, attendance observation method, method of comparison, analyze, and generalization.

**Research Results**

With the population of 55.69 thousand of people, 25 ethnic groups living together in which the minor ethnic groups account for 65%. Lao Cai is a place having 3 of 4 biggest families of languages in Vietnam which are Nam A (Viet, Muong, Kbang, Mong, Dao, La Chi), Han - Tang (Hoa, Ha Nhi, Phu La), Tay - Thai (Tay, Nung, Giay, Bo Y, etc.) with a multi-ethnic culture. Mountainous ethnic groups with traditional cultural character are special tourism product attracting international tourists coming to Lao Cai. Breaking fresh ground to create terraced fields and caring plants use the traditional farming techniques gained from thousands of historical year that creates mountain and forest landscape greatly attracting tourists. Along with the natural resources, there are humanity resources, cultural and historical relics, living places of 25 ethnic groups in which each ethnic group has individual specific characteristics so it brings Lao Cai the diversity of a multi-ethnic culture. Convergence of potentials is an advantage for Lao Cai to develop as a tourism center. These resources include tangible cultural values such as cultural historical relics, archaeological sites, artistic architecture, traditional handicraft products, and intangible cultural values such as folk performance, festivals, cuisines expressing the typical character of Lao Cai culture and attracting tourists.

Lao Cai has abundant and diversified tourism resources with typical features in term of both natural resources and humanity resources which are allocated in a concentrative manner with Sa Pa, Bac Ha, Bat Xat and Lao Cai City as the prominent places. From its advantages in term of geographical location, the tourism resources will help Lao Cai development many types of tourism such as cultural tourism, resort, ecotourism, sightseeing tourism, sport tourism, and science research tourism, etc. This is clearly proved by the quantity of tourists coming to Lao Cai in recent years and the growth rate of tourist turns of the following year compared to the previous year. Lao Cai has some types of transport like road, railway, waterway in which road and railway play an important role. At present, Civil Aviation Authority of Vietnam has conducted a survey to make plan and Lao Cai airport is expected to be built soon. In recent years, the transport system has a great development from the road system to quality of vehicles. But in fact, tourists claim much about the transport system due to the lack of signal board system, traffic lamp, overload transportation, and over-speed. Especially, international tourists criticize severely the lack of first aid service in case of accidents.

Lao Cai currently has 348 places for stay with 4200 rooms including many rooms qualified to serve international tourists. The places for stay concentrate mainly in Sa Pa (about 70%), Lao Cai City (about 20%), and the remaining is located in Bac Ha, Bao Yen and Bao Thang. Currently, in some mountain villages exists the type of homestay concentrating in some places like Ta Van, Than Phu, Ban Ho and Sin Chai, etc. However, except big hotels, big companies invested with high quality such as Victoria, Singapore joint venture, Lao Cai Tourism Company, etc., the remaining places for stay have poor quality, non-synchronous investment and do not follow one standard leading to the fact that quality of these places fails to satisfy international standards, therefore, the average capacity of room is not high.

Places serving food and beverage in the province develop in a rather abundant and diversified manner with hundreds of specialized restaurants and restaurants in hotels having thousands of seats meeting demand of the tourists. However, menu in such places for food and beverage is simple and staff in some restaurants is unprofessional.

The system of sport and entertainment places is invested but fails to meet current demand of the tourists. At present, the main amusement activity of the tourists is based on natural landscape such as walking, sightseeing, going to the market and visiting to gain knowledge about the culture of ethnic groups. Therefore, planning of investment and development for sport and entertainment facilities is very necessary.
Purchase of goods, local special food and souvenirs is attractive to the tourists, especially brocade products of Lao Cai. The system of markets, shops, trading centers in the province in recent years has been invested but mainly focused in some big urban areas in the province and districts. However, typical products and souvenirs of the locality are lacked and not diversified.

For domestic tourists, Sa Pa is known as a place to stay away from hot weather in big cities; learning about ethnic groups is not their purpose of coming here. At present, the attractive product for the domestic tourists coming to Lao Cai is mainly visiting tours to Sa Pa, Bac Ha, some ethnic villages and visiting tour to Hekou - China. The majority of tourists coming to Lao Cai visit historical relics like Thuong Temple, Cam Temple, Bao Ha Temple, the ancient rock ground, Muong Vi Cavern, Hoang A Tuong Palace, etc.; for the domestic tourists, visiting historical and religious relics is coming to spiritual world, remembering ancestors and praying for blessings for people. These relics are the places attracting the highest number of domestic tourists not only in festival seasons.

Tourists from Hanoi account for 40%, other places including southern provinces and Ho Chi Minh City account for a half of the number of domestic tourists. So tourists coming to Sa Pa are citizen with rather high income. They mainly use passenger car, train and private vehicle depending on their finance and point of departure. The tourists coming to Sa Pa are mainly young tourists (74% is under 35 years old), 96% of tourists is under 50 years old. The majority of domestic tourists travel with their friends or families (average 5 people/group). The duration of stay in Lao Cai is from 2 days to 1 week, particularly 4-5 days accounting for 35%; 3 days accounting for 31%; weekend accounting for 27%; more than 1 week accounting for only 4% and 1 day accounting for 3%.

The domestic tourists coming to Sa Pa do not want to walk too long, they only walk to sightsee in Lao Cai and the surrounding villages provided that the journey can be ended in some hours. Therefore, it is not surprising that, in the statistical data, villages usually visited by these tourists are villages near Sa Pa town and they usually use some means of transport like motor taxi, mini bus or rent motorbikes to visit beauties of nature like Thac Bac, Ta Phin, etc. and return to Sa Pa. The average expense is 500,000 VND/day; their average expense for purchasing local handicraft products is 50,000-60,000 VND/person/day.

International tourists coming to Lao Cai are not only for enjoying beautiful views but mainly for discovering, learning about development history of ethnic groups and lifestyle, manners and customs of the local people. This is a great difference between the demand of the domestic tourists and the international tourists; therefore, historical relics and traditional festivals of the locality are cultural values with great attraction to the tourists. The international tourists include two types which are general foreign tourists and foreign tourists with great purchasing power.

Among general foreign tourists, European tourists account for 58%, and then American, Australian and Canadian tourists account for 16%, 13% and 6% respectively. Chinese tourists only account for 4% and they only visit for very short time to places like Thac Bac without concerning about the culture and ethnic groups. The tourists at under 35 years old account for 51% and at 35-40 years old account for 44%. The foreign tourists usually go in couple (45%) and with friends (38%). The remaining tourists travelling alone are organized in groups which are usually smaller than groups of Vietnamese tourists; groups of less than 3 people account for 57%, groups of 4-10 people account for 36% and groups of more than 10 people account for 7%.

But the most important reason making villages attract many tourists is that these villages can be visited in one day and roads are favorable; the possibility of travelling by motor taxi is the most important to many tourists. The majority of foreign tourists (72%) choose non-overnight 1 day sport tour to villages. Averagely, tourists visit 4 villages. For tourists using long-time sport tour, homestay in villages is the main motivation; some travel companies usually offer 3 or 4-day tour including overnight stay at villages.

Australian tourists (accounting for 13% of the international tourists) highly appreciate Sa Pa and trekking routes in the area. They also travel in couple (41%) and in group; they buy package tour (means of transport, hotel, hostel, tour) directly in Hanoi. Only 20% of them have homestay in villages.

The American market is mainly USA (16%), Canada (6%) except tourists to Victoria Hotel (37%); the majority of American tourists stay for 3 days and they want to try homestay in ethnic villages. For tourists in group, they usually buy tour via companies in Hanoi. Canadian tourists like to try many different tours rather than travelling to Sa Pa in several days to sleep in villages. They usually stay in Sa Pa for 3 days and they want to discover 1 journey per each day such as Ta Phin, Lao Chai, Ta Van, Sin Chai, etc.

One important type of tourists is the European people living in Vietnam and traveling for some days in Sa Pa. These people live in Hanoi; most of them are under 35 years old and come to Sa Pa many times in year but mainly in form of trekking tourism. After many different tours, they rent motorbikes to travel for the simple purpose of resting at the weekend in form of discovering the nature by motorbikes. These people do not buy tour from
companies but only book train, car tickets. The market share of foreigners living in Vietnam also needs concerning because they are both swanky and regular tourists.

The foreign tourists spend 20-70USD/day in the locality and about 35USD/day for movement. The average duration of stay is 3 days; average expense for handicraft products is 50-60 USD.

The foreign tourists with great purchasing power: age from 45 to 50 years old accounting for 36%; age from 35 to 45 years old accounting for 20%; age from 25 to 35 years old accounting for 20%; age over 60 years old accounting for 17%; age less than 25 years old accounting for 7%.

Occupation: 34% is senior officers or freelancers; 18% is employees of industries, commerce and service sectors; 21% does not work; 15% is state officers; These four groups of job account for 88%; merchants account for 8% and students account for 4%.

In term of income: 28% has income of more than 60,000 USD/year; 30% has income of 40,000-60,000 USD/year; 22% has income of 20,000-40,000 USD/year; 20% refuses to answer. Therefore, the number of tourists having income of more than 40,000 USD/year accounts for 58%.

Spending amount: 5% of tourist expects to spend 1,000 USD at site; 27% spends 300-700 USD; 24% spends 200-300 USD; 25% spends 100-200 USD; 19% spends less than 200 USD. Therefore, the tourists having great purchasing power are potential in term of finance. The actual expenditure of tourists in the locality is around 230 USD; the average duration of stay is 2 days (equivalent to 115 USD/day). These tourists sometime do not know what to spend; they complain about the lack of activities and handicraft products. While the average expenditure of general foreign tourists is about 35 USD/day, the one of high-income tourists is 115 USD/day equal to the ratio of 1-3.3. So the class of high-income tourists in particular brings about 3/4 of income from international tourism of Sa Pa at present.

Market share of tourists: European, Australian and South American tourists account for 92%; the remaining 8% of tourists is from other countries like Israel, Japan, Korea, and China. The majority of tourists are European tourists with 63% (in which French tourists leading with 40%. English, German, Netherland tourists accounting for 7%, 4% and 4% respectively); Australian tourists rank second with 19% and American tourists rank third with 8%. Canadian tourists only account for 2%.

The difference for foreign tourists is that these tourists often travel in groups (65%) and travel individually (35%). The rate of travelling in groups including 1 to 4 people holds 40%; the rate of travelling in groups including 5 to 10 people holds 33% and the rate of travelling in groups including over 10 people is 27%.

The reason for foreign tourists with great purchasing power to come to Lao Cai is that: 75% of them come to Lao Cai for landscape and ethnic minority tourism, 18% for sport tourism. As such, foreign tourists with great purchasing power are European people, especially France and Australia. They are officers or employees, self-employed who have abundant financial capacity, great purchasing power and old age. They buy tours in their local countries to Sa Pa through the reference of companies or their friends with the purposes of sightseeing, ethnic minority. They stay there for about 2 days and Sa Pa is only one point in the whole tour program. They spend 115 USD/day in Sa Pa. They don’t spend their expected money because this locality lacks tourist products. Tourists are interested only in few beauty spots near Sa Pa. Even Bac Ha market attracts only 10% foreign tourists and 5% of total tourists (approximately 3,000 tourists/year). However, in 5 hamlets around Sa Pa, there are 60,000 tourists/year. Therefore, the first priority is to distribute such tourists to other places by holding new tours and new beauty spots outside Sa Pa.

The high-income tourists are the most interested people in the present social and cultural context of Lao Cai. Their purchasing power in the locality is very great. Developing the tourists of this kind and limiting the tourists of other kinds are meant to remarkably increase the number of tourists who can bring great income source for the tourism. This is also meant that it is possible to limit negative effect exerted by too many tourists coming to the hamlets and build high quality image of the destination. As such, it is necessary to give priority to meeting the demands of these tourists.

The low-income tourists including many “backpack foreign tourists” are often fond of trekking, home stay, using few services or using services of poor quality. From commercial aspect, these tourists are not the target because they spend little money at tourist points, even in hamlets. It is necessary to limit the development of such tourists because the negative effect brought about by them for hamlets cannot be offset.

Domestic tourists and international tourists complain about building guesthouses and hotels everywhere not in harmony with landscape. The construction of tourist facilities doesn’t take into consideration height, materials, color, architecture, landscape and local culture. The fast growth of tourists has exerted serious influence on cultural heritages. Due to the demand for development and exploitation for tourism, some architectural works have been
Domestic and international tourists wish to understand more about nature and ethnic minorities. In fact, however, they are quite disappointed with the knowledge of tours in the fields of traditional dance, customs, traditional clothes, type of stay, lifestyle and cultivation system. Tourists complain not only about guides who lack assistance ability, foreign language skills or knowledge about ethnic minorities, history, culture and ethnic residential areas but also about that the fact that guides often pay no attention to ethnic groups and sometimes don’t bother to ask permission before leading tourists to visit their relatives or even give bad comments on the local people. This activity is badly considered by the tourists, which sometimes causes unforeseeable consequences.

Guide training is a quite serious matter at present. Some of these ethnic minorities become unpleasant “attackers” when they try to sell handicrafts on streets or in restaurants. Some of these tourists complain that they are followed by vendors during their visit to hamlets. These activities contribute to deteriorating the attraction of tourist resorts and ethnic hamlets because tourists feel inconvenient when they are disturbed in such manner. This bad phenomenon is partly caused by untactful behavior of tourists, which creates bad requisite in the offer by the ethnic people when they see tourists. Therefore, solving the follow by the local people and providing tourists with correct behavior towards the local people is an urgent requirement for tourism.

Some community tourist points have gradually lost their natural landscape due to fast urbanization rate or building developments (for example, the construction of hydropower plant in Coc Ly risks losing Chay River tourist route or the construction of hydropower plant in left and the middle parts of Sa Pa Lake risks losing Ban Ho tourist resort due to devastated forest and mountain). The tourism, backed by the social positive participation and many walks of life, contributes to transforming occupational orientation of the society and improving life quality for many objects including the community of ethnic minorities. Over the past years, Lao Cai tourism has exerted positive influence on the provincial economy, thereby promoting agriculture, forestry and small-scaled industry of the locality. It also helps to develop and create direct and indirect jobs for the people and increase incomes for the labors. In particular, ethnic minorities have known how to invest in and organize production of many souvenirs to sell to tourists, improve their living conditions and reduce poverty. At the same time, tourism development has made positive contribution to the restoration and promotion of national cultural identity.
Over the past years, Lao Cai province has worked out preferential and open-door policies for domestic and international investors to come to Lao Cai. Upon investment in Lao Cai, investors are provided with favorable conditions in terms of business place, site clearance, land rental exemption, labor training, tax exemption as well as property rights, stay rights, travel and immigration rights. Therefore, in recent times, foreign investment projects in Lao Cai have been in general diversified both in field and form of operation. Domestic investment has also developed strongly with construction, agricultural - service - commercial and tourist projects in Lao Cai province. However, big tourist projects are still moderate. With a view to establishing quality and sustainable tourism, Lao Cai tourism needs to attract experienced and talented investors to consider investment.

Conclusions and Discussion

In short, it is necessary for Lao Cai province to pay attention to preserving and bringing into full play national cultural identity, creating a close link between national culture preservation and sustainable tourism development, contributing to reducing poverty for the people. To achieve such target, it is important to follow some principles:
- Tourism development should pay attention to sharing benefits with ethnic minorities in the locality.
- Special attention should be paid to training and developing human resources to meet the requirements of tourism development.
- Tourism resources should be exploited and utilized appropriately. It is also imperative to limit excessive use of tourism resources and minimize tourist waste into environment.
- Tourism development must be in accordance with the socioeconomic development plan.

References

Limited Contexts and Leadership of University Leaders in Northeastern, Thailand in Twenty-First Century

Hatai Noisombut¹,* and Sr. Caroline Joy Luz²

¹Graduate School, Roi Et Rajabhat University, Roi Et Province, Thailand
²Educational Leadership and Management, De La Salle University-Manila, Philippines
(¹author for correspondence, E-mail: hatainoi@gmail.com, Tel./Fax 043-556231)

Abstract

The study aimed to discover the leadership practice of university leaders in Northeastern, Thailand. The study sought to answer following questions: 1) How do university leaders practice their leadership in limited contexts in Northeastern, Thailand? ; and 2) How do they sustain their commitment to continue to serve in universities in limited contexts in Northeastern, Thailand? The multiple case studies approach was the adopted methodology for this research. The participants were six presidents from six universities in limited contexts in Northeastern Thailand as units of analysis. Important stakeholders namely vice-presidents, deans, vice-deans, chairs and vice-chairs of departments, staff and faculty members, students and leaders of communities were included for triangulation. The data were gathered in 2011-2012 through a variety of methods including in-depth interviews, focus group discussions, and documentary analysis. Other data sources included field notes and the documents provided by each university. The major findings revealed that university leaders in Northeastern Thailand provide educational opportunities to students, people, and communities that have the least opportunities. They do not abandon local wisdom; on the other hand, they strengthen local wisdom to be recognized in a global world. As well, they play significant roles to end a cycle of poverty by using education to develop rural areas. The limited contexts are not obstacles for university leaders to practice their leadership effectively. On the other hand, limited contexts are challenges that bring out significant contributions for university leaders in the Northeastern Thailand.

Keywords: Limited contexts, Leadership, Twenty-first century

Introduction

Leadership is not a quality of a particular individual but rather a relational process that takes place over time and in particular settings. Leaders do not stand alone, but rather negotiate power with others in their school communities. These negotiations allow for leaders of different types that meet the requirements of their constituents. There is no one-size-fits-all model to successful leadership (Gordon & Patterson, 2006). There are many different forms of leadership, such as those that are positioned within communities of difference, thus there is a role for context in the determination of approaches to leadership (Gale & Densmore, 2003). All contexts contain positive elements that could support learning, teaching and leadership; therefore, an effective leader will recognize that context matters and that context can provide opportunities (Levin, MacBeath & Wong, 2006).

In the context of Northeastern, Thailand, limited context refers to the biggest, but poorest region with major problems of poverty, malnutrition, diseases, severe educational disadvantages, widespread lack of awareness of the changing world, as well as the outflow of migrants to the big cities (Jitsuchon, 2004). In contrast, the Northeastern has a large potential to gain from trade as it is well-placed in the middle of the Great Mekhong Sub-region (GMS) which comprise Cambodia, Lao PDR and Vietnam (World Bank, 2008).

Therefore, an improvement in education outcomes is the key to upgrading skills and knowledge which includes improving the quality of education at tertiary levels in Northeastern as well. Many universities in limited context in Northeastern Thailand are deprived, if not excluded from services, policies and programs to the detriment of the institutions and the higher educational system in general. Moreover, higher education institutions in the provinces often fail to respond to the increasing demands for internationalization and fall short in meeting the global standards for higher education (Thai National Education Commission, 2003).

Such aforementioned context of Northeastern Thailand is interesting to understand especially how university leaders in limited context exercise their leadership, why do they continue to serve in universities in limited context, and how do they sustain their commitment. The very limited number of studies done in Northeastern...
Thailand on university presidents and the growing recognition of the need for their leaderships have motivated the researcher to work on this topic. Therefore, the researcher was inspired to pursue this research. The study provided an analysis the importance of university leadership in each of the universities that operates under different contexts as well as the leadership of individual key movers in these institutions. This study also asserts the investigation of particular leadership that are best suited to these universities in the limited context in Northeastern Thailand.

Materials and Methods

Research design and Methodology

This study made use of multiple case studies methodology of Yin (2003) to determine the factors that are associated with educational leadership in limited contexts that focus on six presidents in six universities located in Northeastern Thailand as unit of analysis. Yin (2003) identified five components of research design that are important for case studies: research questions, its propositions (if any), its unit(s) of analysis, the logic linking the data to the propositions, and the criteria for interpreting the findings as shown in Figure 3. The figure indicates that the initial step in designing the study must consist of theory development and then shows that case selection and the definition of specific measures are important steps in the design and data collection process. Each case study consists of a whole study, in which convergent evidence is sought regarding the facts and conclusions for the case; each conclusion cases are then considered to be the information needing replication by other individual cases. Both the individual cases and the multiple-case results can and should be the focus of a summary report. For each individual case, the report should indicate how and why a particular proposition was demonstrated or not demonstrated. Across cases, a report should indicate the extent of the replication logic and why certain cases were predicted to have certain results, whereas other cases were predicted to have contrasting results.

An important part of Figure 3 is the dotted line feedback loop. The loop represents the situation in which important discovery occurs during the conduct of one of the individual case studies did not in fact suit the original design so redesign should take place before proceeding further. According to the case study method of Yin (2003), there are three main steps starting from step one which is called define and design, step two consists of preparing, collecting and analysis data. The final step is analyzing and conclusion.

Research Participants

There are a total of six participants from six contexts in this study which are identified by main criteria of marginalization; rural area, employment in agricultural careers, exclusion from services and resources, and poverty. The case study emphasized on six presidents in universities of the Northeastern, Thailand where the contexts for the study were used.

Research Instruments

This study employed three (3) kinds of instruments to gain sufficient data, namely: in-depth interview, a focus group discussion, and documentary analysis. The researcher developed three sets of open-ended questions, which were used for interview sessions. The first set was used in the interview sessions with the presidents, vice-presidents, deans, vice-dean, and chairs and vice-chairs of departments. The second set of questions was used for interview leaders of communities, and another set of interview questions was used in the focus group discussion with faculty members, staff, and students.
The participants were six presidents working in six universities in limited contexts in Northeastern Thailand. These presidents were units of analysis. Important stakeholders namely vice-presidents, deans, vice-deans, chairs and vice-chairs of departments, staff and faculty members, students and leaders of communities were included for triangulation. The researcher used multiple forms of data to achieve triangulation and to draw valid conclusions. These forms of data included in-depth interviews, focus group discussions and archival documents.

The methodology employed in the study was the multiple case studies design. The multiple case studies research was developed through several stages. The figure below summarizes the multiple case studies research approach (Figure 2).

**Results**

The participants were six presidents working in six universities in limited contexts in Northeastern Thailand. These presidents were units of analysis. Important stakeholders namely vice-presidents, deans, vice-deans, chairs and vice-chairs of departments, staff and faculty members, students and leaders of communities were included for triangulation. The researcher used multiple forms of data to achieve triangulation and to draw valid conclusions. These forms of data included in-depth interviews, focus group discussions and archival documents.

The methodology employed in the study was the multiple case studies design. The multiple case studies research was developed through several stages. The figure below summarizes the multiple case studies research approach (Figure 2).

**Figure 1. Case Study Method**
Stage 1: Embedded case studies of presidents A, B, C, D, E, and F

<table>
<thead>
<tr>
<th>Limited Contexts in Northeastern Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment in Agricultural Careers</td>
</tr>
<tr>
<td>Rural Area</td>
</tr>
<tr>
<td>Poverty</td>
</tr>
<tr>
<td>Exclusion from Services and Resources</td>
</tr>
</tbody>
</table>

- A
- B
- C
- D
- E
- F

Stage 2: Cross-case analysis according to an initial framework

- Personal capabilities
- Capacity for relationship with people
- Environment in/out of universities
- Culture, social values & norms

Stage 3: Emergent framework

- Personal capabilities
- Capacity for relationship with people
- Environment in/out of universities
- Culture, Social values & Norms

Stage 4: Conclusion

Figure 2
Multiple case studies research approach

Main Findings

Proposition 1: Leadership characteristics, programs offering and management strategies of university leaders are influenced by elements of limited contexts.

Proposition 2: University Leadership in the 21st Century under the limited contexts in Northeastern Thailand do not allow limitation (poverty, rural areas, employment in agricultural careers, and exclusion from services and resources) to hinder their leadership practice.
Proposition 3: University Leadership in the 21st Century under the limited contexts in Northeastern Thailand faces challenge and meets the standard regulation requirements of university and government level despite the constraint in their limited contexts.

The framework of university leadership in limited contexts in Northeastern Thailand is presented in the interrelationship of four key elements of limited contexts which are affected by leadership characteristics, programs offering and management strategies of university leaders in limited contexts in Northeastern Thailand.

The following figure shows how a framework of university leadership in limited contexts in Northeastern, Thailand has emerged.

Figure 3
The model of university leadership in twenty-first century under limited contexts in Northeastern, Thailand

According to cross-case analysis, the researcher derived the framework of innovative university leadership in limited contexts in Northeastern Thailand.

University Leadership in the 21st Century requires personal capabilities which lead to leadership characteristics. These personal capabilities manifested and strengthened leadership characteristics and practices of university leaders in limited contexts.

Limited contexts influence leadership characteristics, program offering and management strategies of university leaders and innovative university leadership practices.
Leadership characteristics and practices of university leaders are affected by limited contexts. First of all, the evidence showed that university leaders need to be academicians who are experts in their area of study. This is because education institutions especially in higher educational level have educators, professors or lecturers as personnel. Innovative university leaders need to be the academicians in order to be academic leaders of those personnel and university, as well as gain trust and credibility from students, parents, and society.

Secondly, university leaders in the 21st Century need to be change agents because limited contexts have a lot of limitation and inadequacy. Thus, the change agent is required in such situations. Fundamental leadership characteristics of the change agent are bravery and proactiveness which will push educational organizations in limited contexts to the goal.

Thirdly, university leaders in the 21st Century require facilitative characteristics. University leaders in limited contexts have to deal with diversity of situations, various groups of people, and unstable circumstances, thus facilitative leaders are essential for these universities. The evidence proved that university leaders apply participation, collaboration, and good governance for university administration as well.

Fourthly, on one hand, university leaders in the 21st Century need freedom in university administration; on the other, they work strictly on rules of law, regulation, and disciplines of university and government levels. The study proved that freedom in university administration is crucial because far flung universities require flexible management and fast decision making. However, independence of administration requires accurate regulations and disciplines in order to meet standard requirements of university and governments.

Finally, university leaders in limited contexts have satisfaction, sufficiency, and sincerity. The study revealed that most of them are not from these areas; however, when they become university leaders in the areas, they are satisfied and willing to improve education in the areas. Furthermore, in contexts of limitation, university leaders live their lives sufficiently. Importantly, university leaders in limited contexts of Thailand promote and operate respectful Thai culture in universities, not only to preserve good Thai culture among university personnel, but the good manners also brought about the good behaviors of students.

**Conclusions and Discussion**

Through this study the researcher identified university leadership in marginalized contexts as the key to practice in selected universities and to define limited contexts according to theories.

This study drew on the theories of Zigarmi on contextual leadership (2005), Levin, MacBeath and Wong’s (2006) focus on effective leaders recognize that the context can provide opportunities. Billot on leadership in the context (2005) and on previous research by Dimmock and Walker (2005) focused on educational leadership which remains a socially bounded process; Lambert (2003) on leadership as a creation of a learning organization.

The first question sought to explore the leadership practices that were utilized by university leaders in limited contexts in Northeastern, Thailand. The study concluded that leadership practices in limited contexts in Northeastern, Thailand were practiced by innovative university leadership. This leadership is shaped by strong personal capabilities which are manifested by educational preparations, work ethic, experiences, belief, inspiration, and seniority as well as contexts or situations of limitation.

The second question sought to explore reasons and operations that university leaders do in order to serve in universities in limited contexts. The study concluded that the reason that made university leaders continue to serve in universities in limited contexts were intention to enhance good quality of education to communities and develop agricultural course studies and careers in limited contexts. As a response to this, the innovative university leaders practice their leadership on academic aspects by offering programs of studies based on specific contexts of universities. According to the university contexts, therefore, the university leaders use management strategies to enhance higher education from local to international level.

**What then is university leadership in the Twenty-First century under limited contexts in Thailand?**

University leadership in the Twenty-First century under limited contexts in Thailand refers to the competency of leaders to manage and administer universities in limited situations. Leaders display characteristics of expert academicians, change agents, bravery, and proactiveness.

University leadership in the Twenty-First century under limited contexts in Thailand is revealed by facilitation, participation, and collaboration which the university leaders apply through good governance.
University leadership in the Twenty-First century under limited contexts in Thailand is found in university leaders who need freedom in administration, but always work strictly on rules of law, regulations, and disciplines of universities and government.

University leadership in the Twenty-First century under limited contexts in Thailand is also exemplified by university leaders who show satisfaction, sufficiency, and sincerity. These university leaders promote and operate respectful Thai culture in universities in marginalized contexts in Thailand.

Thailand has educational leaders who have proficiency, courage, and creativity to manage and administer universities to challenge and confront limitations in order to accomplish the goals of universities. University leadership in the Twenty-First century under limited contexts in Thailand never discard local wisdom and Thai culture; on the other hand, they are able to discover values of the wisdom and culture as well as advantages of contexts and turn them to benefit the universities, communities, and society which are still in state of limitations.

Recommendations for further study
This study focused on exploring and conceptualizing university leadership practices in limited context, effective leadership practices of university leaders in limited contexts in Northeastern, Thailand. There are questions for a further research that should be asked about localization to globalization. For example, how do university leaders create local universities to attain a global context? In addition, future research can also focus on educational leadership effectiveness in a local context to solve problems of poverty and conflict of politics in Thailand. It may be worthwhile to address on how do university leaders in local context can use their roles in response to problems of poverty and political conflict. In terms of gender can be asked; how gender of leaders influence leadership in context?

Interestingly, a further research can focus on the issue of the AFTA policy which will be implemented in 2015 among Asean member countries. An issue that can be addressed is how educational leaders can prepare their organizations and personnel for the AFTA implementation in terms of policy and practice?

Acknowledgements
The researcher wishes to extend sincere thanks and appreciation to the following individuals for their valuable contribution to the successful completion of this study.

References


Factors that attract to Foreign Direct Investment in the Thai Automotive industry

Prodige Feizoure
Graduate School of Business of Assumption University of Thailand
Asst. Prof. Dr. ChittipaNgamkroeckjoti
592 Ramkhamhaeng 24 Road, Hua mark, Bankapi, Bangkok 10240 Thailand
feizoureprodige@gmail.com

Abstract

This research is conducted to find out the factors that attract to Foreign Direct Investment in the Thai automotive industry in Thailand from 2009 to 2013 and examine the relationship between these factors and Foreign Direct Investment in the Thai automotive.

This research used seven variables comprising: market size, labor cost, geographical location, political and government regulations, openness, finance and technological, these factors explain the attractiveness towards the Thai automotive industry.

The data used in this research are secondary data collected from official government website of Thailand such as: Thailand Board of Investment, Thai Automotive Institute and several international organization such as: United Nations Conference on Trade and Development, International Organization of Motor Vehicle Manufacturers and also some regional organization in Asia like ASEAN Automotive Federation.

This research used multiple linear regression model, multicollinearity, stationarity by applying into Statistical Package for Social Science (SPSS) which is serve to analyze the main factors that attract to Foreign Direct Investment in the Thai automotive industry. On the other hand, the results of this research discovered the existence of high degree of correlation with the variables exports and interest rate with Foreign Direct Investment in the Thai automotive industry, and these two variables are the main factors which attract to Foreign Direct Investment in the Thai automotive industry.

The results of this research can be used in the further research and can be used as a guideline for investors who want to invest in Thailand, precisely in the Thai automotive industry. On the other hand, this research can be used only in the Thai context and also for specific period of time.

Keywords: Indonesia, Malaysia, Thailand, ASEAN, BOI, Multinational Enterprises, Foreign Direct Investment, the Automotive Industry.

Introduction

Foreign Direct Investment or FDI becoming an important factor for a country to bring capital, technology and knowledge from the host country into their economy and the number of FDI have no cease to increase during the year 1986-1990, the amount of global FDI grew at an annual rate of 24 percent, rising from $78 billion to $184 billion (United Nations, 1992, p.14).

Moreover, most of the FDI flow in 1990 goes into developed countries such as: Western Europe which is received 54 percent of the global FDI, follow by North America 23 percent and Japan received only 1 percent of the global FDI. On the other hand, the developing countries received 17 percent of the FDI and the most of the amount going into the top ten newly-industrializing countries (NICs) which are: Argentina, Brazil, Egypt, Indonesia, Malaysia, Mexico, Singapore, Taiwan and Thailand and these newly-industrializing countries command large domestic markets and serve as dynamic exports platforms, (Chan, 1995).

A number of researchers describe the relationship between FDI and trade performance of the country. Erickson and Leichenko (1997) in their empirical study explained “The economy of United States (US) showed the positive relationship between FDI and exports”.

However, FDI could bring precious resources including capital, technology, management skills, R&D capabilities, and a network of international trade for the host country. Besides advantages they bring to the host economies, FDI might cause serious matters. For example, technology spillover effect is ambiguous, as sometimes these spillovers negatively affect the productivity of local companies (Kindoshita, 1998), and the Outward FDI Performance Index captures a country’s relative success in investing elsewhere in the global economy via FDI. To evaluate a country performance relative to other countries, it is important that this country should be compared with
competitor locations for FDI. Therefore, the FDI strategies of Multinational Corporations (MNCs) are in more cases regionally specific (Ruigrok and Tulder, 1995; Thomsen, 2000) and often geographical proximity at the sub-regional level is a key factor in investment location.

The aims of this paper is to find out the main factors that attract to FDI in the Thai automotive industry and examine the relationship, if any, between these factors to FDI in the Thai automotive industry. This paper is organized as follows. The second part presents the materials method used in this research. The third part shows the results of this research. The fourth part is about the conclusion and discussion and the last part is about acknowledgement.

Materials and Methods

In this paper, researcher used secondary data from Thai government official website such as Thailand Board of Investment (BOI), Thai automotive institute, ASEAN automotive industry and international organization official website such as the International Organization of Motor Vehicle Manufacturers to collect information. On the other hand, this research used multiple linear regression model, multicollinearity and Stationarity by applying into Statistical Package for Social Science that serve to find out the main factors that attract to FDI in the Thai automotive industry. The general formula of this study is:

\[
FDI = m + d_1 \text{(domestic sales)} + d_2 \text{(average annual wage)} + d_3 \text{(annual income tax)} + d_4 \text{(annual exchange rate)} + d_5 \text{(annual import and export)} + d_6 \text{(annual interest rates)} + d_7 \text{(total number of patent applications and invention)} + n
\]

Where:

- \( FDI \) = total foreign direct investment in Thai automotive industry.
- \( m \) = population FDI intercept
- \( d_1, d_2, d_3, ..., d_7 \) = population regression coefficient variables
- \( n \) = model error

In this paper, the population of this study is all foreign direct investment which investment in the Thai automotive industry such as Toyota motor company limited, Honda motor company limited, Bavarian Motor Works (BMW) and General Motor Company and the data used in this study are secondary data.

Moreover, the conceptual framework of this study is based on five major models that this study used to create the conceptual framework. The first research model is about research by Kreppel (2012), who studied the “Determinants of outward foreign direct investment from BRIC (Brazil, Russia, India and China) countries: an explorative study”. The second research model, which was developed by Lightfoot (2009), concerns “Determinants of foreign direct investment at the regional level in China”. The third research model was made by Heinz and Heise (2002), “Foreign direct investment and employment in host regions”. The fourth research model is research by Jan and Witteloostuijn (2007), “Multinational Enterprises, Foreign Direct Investment and Trade in China: the Chain of Causality in 1980 and 2003”. The last research effort was developed by Chen (2009), "The impact of FDI on regional technological capabilities: evidence from China".
Table 1 shows that there is high degree of correlation between the variables exports, interest rate and Foreign Direct Investment in the Thai automotive industry and these two variables can enter into to the regression model. On the other hand, these two variables consist on the principle factors that attract to FDI in the Thai automotive industry.

Table 1 Multiple Linear Regression Model outputs by using SPSS

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized</th>
<th>S.E</th>
<th>Standardized</th>
<th>T-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export</td>
<td>2.266</td>
<td>0.679</td>
<td>0.888</td>
<td>3.338</td>
<td>0.044</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-140.679</td>
<td>325.524</td>
<td>-0.081</td>
<td>-0.140</td>
<td>0.898</td>
</tr>
<tr>
<td></td>
<td>2.754</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>280.798</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N= 0.679, R= 0.838, R²= 0.788, F= 11.143, Sig= 0.044 (Exports)

Table 2 shows that two variables in this study are constant which are exports and interest rate. On the other hand, the result of the Variance Inflation Factor (VIF), Tolerance and Eigen value in this study show that there is not...
multicollinearity problem because the exports and interest rate value have value which are less than VIF, Tolerance and Eigen value require standard value which is less than 5 or 10.

Table 2 Collinearity Statistics

<table>
<thead>
<tr>
<th>Model</th>
<th>VIF</th>
<th>Tolerance</th>
<th>Eigen value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Exports</td>
<td>1.000</td>
<td>1.000</td>
<td>1.975</td>
</tr>
<tr>
<td>2. Interest rate</td>
<td>1.174</td>
<td>.851</td>
<td>.025</td>
</tr>
</tbody>
</table>

Conclusion and Discussion

Thai automotive industry contributed considerably to the economy growth in the Thai economy and employed about 500,000 workers in the industry which ranks the industry as the second largest exports industry in Thailand. On the other hand the industry have no cease to bring a considerable number of FDI into the Thai economy and according to the recent statistic of the Global Greenfield Investment about Thailand’s FDI performance shown that Thailand receive about $4.27 billion in 2013 of FDI. The great result toward the Thai automotive industry is partly due to the government policy which facilitate the market entrance of many investors into the Thai automotive industry and the biggest investor in the automotive market in Thailand is Japanese firm Toyota with about $273 million in 2012.

Moreover, the government agency of Thailand which is the Thailand Board of Investment with his political of tax incentives and several favourable policies that it set up in order to promote Investment and doing business in Thailand which have an important impact for bringing foreign investors through Thailand, particularly in the automotive industry.

Finally, through the degree of attractiveness of Thai investment sector, investors can take many benefit such as: cheap labor cost, strong industries support, high market potential, skilled labor and competitive cost. On the other hand Thailand can benefit from the high technology systems that can improve Thai competitiveness in term of production capacity and also the country itself may create many jobs opportunities for its citizens.

Acknowledgement

I would like to acknowledge my tutor Assist. Prof.Dr.ChittipaNgamkroeckjoti who gave me her precious time and help for the success of this paper. I would like to express my sincere thanks to Dr.ThongdeeKijboonchoo, Dr.VorapotRuckthumand Dr.Gerard White for their precious comments.

My special thanks go to every person who contributed for the success of this paper and particularly to RajabhatMahaSarakham University that give me the privilege to attend this 5th the conference on Sciences and Social Sciences 2015.

References


The Application of Three Major Investor’s Approaches on the Tehran Stock Exchange

Marjan Bahramabadian¹ and Witsaroot Pariyaprasert²

¹Student of MBA Finance, School of Business, Assumption University, Bangkok, Thailand
²MBA Program Director, School of Business, Assumption University, Bangkok, Thailand
E-mail: marjan_bahramabadian@yahoo.com

Abstract

The researchers examined approaches of two value investors who are Benjamin Graham and Peter Lynch and approach of one Growth investor who is Philip A. Fisher. The researchers attempted to find out which investors’ approach can generate higher returns on the Tehran Stock Exchange (TSE). The secondary data used in this research were the fundamentals of companies listed on the TSE from 2011 to 2013. The stocks listed on the TSE were filtered by fifteen screening rules in each year separately, and then equal-weight portfolios were set up with stocks which passed the rules. The returns of the portfolios were compared with the market return each year. It was found that the portfolios created by all three investors generated higher returns than the market in 2011 to 2013. The researchers were not able to identify which approach could perform better in this research. Fisher’s approach earned a higher return when compared with value investing approaches and worked better in periods when stock market prices increased. However, Graham and Lynch’s approaches had higher returns than the market when stock markets prices both increased or decreased on the TSE during 2011 to 2013.

Keywords: Value Investing, Growth Investing, Return, Portfolio, Stock

Introduction

This study concentrated on strategies that involve the fundamental analysis approach in order to find stocks that would outperform the market. The study conducted in this paper looks at the two opposing strategies of investing in value stocks and investing in growth stocks. The value investing approach is where investors seek for securities where their current prices are less than their intrinsic value. Just like as bargain hunters, value investors delved for undervalued stocks which have low price to book ratios, low price-earnings ratios and other measures of fundamental values (Truong, 2009). Investors investing in value stocks pay attention to the market value of the firm. Therefore, these types of investors have higher safety margins towards investment in growth stocks. Value stocks are pertaining to companies which have suitable profitability positions, but the market gives their stocks interim valuations that are below the intrinsic value. Thus, investors expect that the market will discover this mistake in stocks pricing (Petkova & Zhang, 2005). In contrast, the growth approach investors seek to find shares that have high book values (High Price to book ratio) or annual earnings (high price-earnings ratios). Also they select companies which expect to grow higher than the market (Zhang, 2005; Montier, 2009). Moreover, growth investors sought that the stock price increased. Since companies have fast growth, its profits are ploughed into the company and therefore the profits are recognized through capital growth (Hirschey & Nofsinger, 2010). Growth investors seek to select stocks of companies which had higher growth than average. Growth is measured here by factors such as where benefit increase or sales amounts of the company grow (Fama & French, 2007).

Many studies have been made on growth versus value stocks but only a few on the Iran Stock Market. Sareewiwatthana (2011) studied the impact of two value investment approaches from Benjamin Graham and Joel Greenblatt on stock portfolios and indicated that the formed portfolios can outperform the Thai market. And also, Ye (2013) studied seven value selection methods which were employed form Benjamin Graham’s criteria, two selection methods were used from Peter Lynch’s criteria, and two selection methods were used from Joel Greenblatt’s Magic formula. He concluded that a portfolio which is filtered by Peter Lynch, Benjamin Graham and Joel Greenblatt’s approaches generated greater return than market. Since Iranian Economy is getting improved by removing sanction. It may bring some investing opportunities especially in the Stock Market. So far there have not been considerable researches regarding the comparison of different investing approaches in Iran. This lack of study stimulates the researchers to conduct research to test value and growth investing approaches in Tehran Stock Exchange.

Benjamin Graham and Peter Lynch are two of the most famous value investors and they all agreed with investing in undervalued stocks. In contrast, Philip Fisher is one of the most famous growth investor who prefers to
invest in companies which experience faster growth than last period. Each of these investors has different methods to find stocks. This study intends to test each of this value and growth investing approaches in the Tehran Stock Exchange during 2011 to 2013. And if these approaches work, then the researchers will compare and identify which method can get the highest return from the Tehran stock exchange. Emamgholipour et al. (2013) found that there is negative correlation between price-to-earnings ratio and stock return in TSE. Yazdi and Ardekani (2014) studied that value and growth stock investing approaches work in TSE but growth stock selecting approach is more risky than value stock selecting in TSE. Ramezanali et al. (2014) determined a positive and meaningful relationship between value portfolio and market return in TSE during 2008 to 2011. Raie and Shwakhizaware (2006) studied the impact of various investment strategies in the TSE. They concluded that growth investment strategy can make higher return than value investment strategy in same companies.

**Materials and Methods**

Jegadeesh et al. (2005) mentioned that there have been studies of numerous researches in favor of relative performance of growth stocks with value stocks. Results of the study of Sri (2010) revealed that the portfolios of glamour stocks are higher than the portfolios of value stocks. In contrast, many researchers have studied the value investing strategy overtakes the growth investing strategy and have endeavored to explain all anomalies (Montier, 2009). Athanassakos (2009) implied that the value investing approach assists investor to defeat benchmarks and accomplish better long-term performance. Petkova and Zhang (2005) implied that investors achieve higher returns by investing in value stocks than in growth stocks, even when return is adjusted by risk (Beukes, 2011; Ye, 2013; Kwag & Lee, 2006).

The goal of this study is a comparison of the return averages made on value stocks with growth stocks. In approaches of Value investors which applied in this research, financial ratio same as P/E ratio utilized. Both value investors in this research believe should select stocks with less P/E ratio and also each one has different criteria for screening stocks. Approach of Growth investor which applied in this research concentrated more on sale growth and profitability of stocks.

In the book of *The Intelligent Investor*, Graham suggested seven screening rules as it mentioned in table 1 to filter stocks. If one stock can pass the aforementioned seven criteria, it should be on the list of a portfolio. The researchers used the total asset, current ratio, net income, price-to-earnings ratio, dividend yield and price-to–book ratio to filter the stocks. Even though the researchers slightly adjusted some criteria, it was not possible to use all of the criteria in this research. Therefore, the researchers excluded earnings growth which required historical data over the last ten years (Graham & Zweig, 2004).

In the book of *Common Stocks and Uncommon Profits and Other Writings*, Fisher recommended five quantitative criteria which are consistently strong profitability, consistent sales growth, growth exceeding industry norm, little or no dividend payout and price-to-earnings-to-growth ratio. Although in this study some criteria are slightly adjusted to fit the market, it was not possible to use all of the criteria. Therefore, the researchers used sales growth and net profit margin to filter the stocks (Fisher, 1996).
Table 1: The three investors’ approaches

<table>
<thead>
<tr>
<th>Benjamin’s criteria</th>
<th>Peter Lynch’s criteria</th>
<th>Philip A. Fisher’s criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sufficient size of enterprise</td>
<td>1. Percent of sales</td>
<td>1. Consistently Strong profitability</td>
</tr>
<tr>
<td>2. Strong financial condition</td>
<td>2. The formula of price/earnings ratio compared with growth ratio</td>
<td>2. Consistent sale growth</td>
</tr>
<tr>
<td>8. Inventories</td>
<td>8.</td>
<td></td>
</tr>
<tr>
<td>9. Pension Plans</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the book of *One Up on Wall Street: How to Use What You Already Know to Make Money in the Market*, Lynch mentioned nine famous criteria for selecting a value stocks which showed in table 1. Since he did not mention details about the number and computing method for some criteria in his book, the researchers filtered stocks with price-to-earnings ratio, earning per share growth, debt-to-equity ratio and Lynch’ special formula which is a slightly more complicated formula for comparing growth rates to earnings, while also taking the dividends into account (Lynch&Rothchild, 1990).

Research Data

Most secondary data for this research were obtained from the website of the TSE, descriptive notes and given data in fiscal years provided by information software of “Rahavard-e novin” and “Aria sahm” by the TSE, fiscal information DVDs from companies accepted in the bourse, and also research, development and Islamic administration information database for period of 2006 to 2013.

The researchers used daily and monthly returns data from the TSE in this research. The all share price index is called the Tehran Stock Exchange Price Index or TEPIX. The TEPIX is utilized to get an insight of the overall price movement in the market and is used to compute sum ratio of the value of all the shares accommodated through the TSE.

The researchers put all data of the companies which are categorized in 43 industries till end of 2013. All companies in the Tehran Stock Exchange are the statistical population for this study. This population is selected because the fiscal data from accepted Tehran Stock Exchange companies are accessible and all those data are homogenous due to regulations as well. The researchers used all the industries because those industries which are not involved in studied criteria will be automatically excluded.

The selected companies have the following characteristics:

1. Their stock has been traded actively between 2006 and 2013. In other words they excluded companies which did not work continuously in the stock market during these years.
2. During the time span of research, their financial period may not be changed.
3. Companies are accepted in the Tehran Stock Exchange from 2006 and were never omitted till the end of 2013.
4. Required financial information of companies exists in the studied period.

Considering the above limitations, the researchers are able to select 244 companies, without sampling. So, all of the companies listed at the Tehran stock exchange during 2006 to 2013 with the mentioned criteria were studied.

Screening Rules and Portfolio Construction

Companies are screened according on three investing approaches which included 15 screening rules. The first screening rule is the approach of Benjamin Graham; which included total asset of companies that should be more than the average of the industry, the current ratio should be more than or equal to 1.5, select companies which have 3 years uninterrupted dividend yield, Price-to-earnings ratio should be more than 15, Price-to-book ratio should be less than 15 or the result of multiplying Price to book ratio by price to earnings ratio should be less than 22.5 and
select companies should have uninterrupted 5 years of sales growth. The researchers filtered companies with these criteria. The stocks which meet all the requirement can be selected for Benjamin Graham’s portfolio.

The Second screening rule is the approach of Philip A. Fisher; which included sales growth that should be more than the industry average in the same year, net profit margin should be more than the industry average of last 3 years and the company should have continuous sales growth within the last 5 years. The researchers filtered companies with these criteria. The stocks which meet all requirements can be selected for Philip A. Fisher’s portfolio.

The third screening rule is the approach of Peter Lynch which included price to earnings ratio that should be less than the industry average, annual earnings per share growth should be more than zero and less than 50%, the results of summation of earnings per share growth with dividend yield divided by price to earnings per share should be less than 1, debt to equity ratio should be less than 1, debt to equity ratio should be less than the industry average and price to earnings ratio should be less than the average price to earnings ratio for the last four years. The researchers filtered companies with these criteria. The stocks which meet all requirements can be selected for Peter Lynch’s portfolio.

The researchers computed all the financial ratios which were related to all of criteria in each investor’s approach. The researchers filtered stocks according to each investor’s criteria separately based on each year. After passing through the screening criteria in each year, the number of companies that remained in a portfolio differed for every year. The minimum number of companies should be 5 and the maximum was 244. The number of companies that remained depended on the strictness of the screening rules. The stricter the screening rule, the lower the number of companies remained.

In this research return on each selected stock at time \( t \) is calculated as follows:

\[
R_t = \frac{P_t}{P_1} * 100
\]

\( t \) = Quarter \( t \)

\( P_t \) = Average price of stock during the selected quarter

\( P_1 \) = Average price of stock in quarter one

The return a portfolio can be calculated from the average of returns on all stocks in that portfolio, under the assumption of equal weight investment for every stock. The researchers calculated returns of screened stocks based on first quarter of each fiscal year. One-quarter return of 2011 means comparing the return of quarter one in 2011 with return of quarter two in the same year, two-quarter return of 2011 means comparing return of quarter one in 2011 with quarter three in the same year, three-quarter return of 2011 means comparing return of quarter one in 2011 with quarter four in the same year, four-quarter return of 2011 means comparing return of quarter one in 2011 with return of quarter one in 2012. Also, one-quarter return of 2012 calculated by comparing the return of quarter one in 2012 with return of quarter two in the same year, two-quarter return of 2012 calculated by comparing return of quarter one in 2012 with quarter three in the same year, three-quarter return of 2012 calculated by comparing return of quarter one in 2012 with quarter four in the same year, four-quarter return of 2012 calculated by comparing return of quarter one in 2012 with return of quarter one in 2013. Likewise, one-quarter return of 2013 calculated by comparing the return of quarter one in 2013 with return of quarter two in the same year, two-quarter return of 2013 calculated by comparing return of quarter one in 2013 with quarter three in the same year, three-quarter return of 2013 calculated by comparing return of quarter one with quarter four in the same year. The researchers couldn’t calculate four-quarter return of 2013 due to data limitation of this research. Consequently, the researchers got return of each company and summed up all the returns in each fiscal year separately and then divided by the total number companies from the list. This provides a mean return on a portfolio in studied year. The portfolio’s returns are then compared to the market average using the stock index in each fiscal year separately.

Results

The last stage is to calculate the significance of the returns. In this case, a one-tailed \( t \)-test is used. The portfolio return is tested for significance in order to draw a conclusion if there is enough evidence to reject or not to reject the hypotheses.

If the number of stocks selected is one or zero, the hypothesis cannot be tested, because the standard deviation of the \( t \)-test cannot be calculated. However, in the case that there is only one stock that was selected for the method, the return of that stock can be directly compared with the market return, and gain the compared result, although the hypothesis cannot be tested technically.
Table 2: Summary of one-quarter returns in 2011

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>1- quarter returns(%) in 2011</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>-9.14</td>
<td>-11.96</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>-9.14</td>
<td>2.48</td>
<td>7</td>
</tr>
<tr>
<td>Lynch</td>
<td>-9.14</td>
<td>-6.70</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 2 shows that the one-quarter return of the portfolio was created by some of Peter Lynch’s criteria is higher than average market return. In contrast, one-quarter return of the portfolio which was created by some of Benjamin Graham’s criteria is not significantly higher than the average return of the Market in 2011. Thus the portfolio that was created by some of Philip A. Fisher’s criteria gained the highest return among the three portfolios.

Table 3: Summary of two-quarter returns in 2011

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>2- quarter returns(%) in 2011</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>-9.77</td>
<td>-6.40</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>-9.77</td>
<td>19.54</td>
<td>7</td>
</tr>
<tr>
<td>Lynch</td>
<td>-9.77</td>
<td>4.81</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 3 shows that the two-quarter of the return of the portfolio which was created by some of Peter Lynch’s criteria achieved greater return than market in 2011. Although the null hypothesis of the two-quarter returns of the portfolio created by Benjamin Graham’s criteria cannot be rejected, it achieved a higher return than the average market return. Therefore, the portfolio that was created by some of Philip A. Fisher’s criteria gained the highest return among the three portfolios.

Table 4: Summary of three-quarter returns in 2011

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>3- quarter returns(%) in 2011</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>-11.61</td>
<td>1.43</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>-11.61</td>
<td>38.04</td>
<td>7</td>
</tr>
<tr>
<td>Lynch</td>
<td>-11.61</td>
<td>23.38</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 4 shows that the three-quarters of the returns of the portfolios which were created by the three investors’ criteria are significantly higher than the average market return in the same period in 2011. The portfolio that was created by some of Philip A. Fisher’s criteria gained the highest return among the three portfolios.
Table 5: Summary of four-quarter returns in 2011

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>4-quarter returns (%) in 2011</th>
<th># of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>-8.80</td>
<td>1.30</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>-8.80</td>
<td>35.80</td>
<td>7</td>
</tr>
<tr>
<td>Lynch</td>
<td>-8.80</td>
<td>31.85</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 5 shows that the four-quarter returns of the portfolios which were created by the three investors’ criteria are significantly higher than the average market return in same period in 2011. The portfolio that was created by some of Philip A. Fisher’s criteria gained the highest return among the three portfolios.

Table 6: Summary of one-quarter returns in 2012

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>1-quarter returns (%) in 2012</th>
<th># of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>-13.21</td>
<td>-3</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>-13.21</td>
<td>-17.17</td>
<td>5</td>
</tr>
<tr>
<td>Lynch</td>
<td>-13.21</td>
<td>-1.36</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 6 shows that the one-quarter of the return of the portfolio which was created by some of Philip A. Fisher’s criteria was not significantly greater than the average market return in 2012. The portfolio that was created by some of Peter Lynch’s criteria gained the highest return among the three portfolios.

Table 7: Summary of two-quarter returns in 2012

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>2-quarter returns (%) in 2012</th>
<th># of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>5.73</td>
<td>21.28</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>5.73</td>
<td>-0.51</td>
<td>5</td>
</tr>
<tr>
<td>Lynch</td>
<td>5.73</td>
<td>33.51</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 7 shows that the two-quarter return of the portfolio created by Peter Lynch’s criteria was significantly higher than market average return. Figure 5.6 shows the differences between two-quarter returns of the portfolio created by three investors’ approaches relative to the market return. Although the null hypothesis of the two-quarter return of the portfolio created by Benjamin Graham’s criteria cannot be rejected, it achieved a higher return than the average market return. Thus, the portfolio created by some of Peter Lynch’s criteria gained the highest return among the three portfolios.
Table 8: Summary of three-quarter returns in 2012

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>3-quarter returns(%) in 2012</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>26.39</td>
<td>40.06</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>26.39</td>
<td>20.65</td>
<td>5</td>
</tr>
<tr>
<td>Lynch</td>
<td>26.39</td>
<td>26.97</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 8 shows that the three-quarter return of the portfolio which was created by some of Philip A. Fisher’s criteria are not significantly higher than the average return of the Market in 2012. Although the null hypothesis of Three-quarter returns of the portfolios which were created by some of Benjamin Graham’s criteria and some of Peter Lynch’s criteria cannot be rejected, they achieved higher returns than the market in the same period. Thus the portfolio which was created by some of Benjamin Graham’s criteria gained the highest return among the three portfolios.

Table 9: Summary of four-quarter returns in 2012

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>4-quarter returns(%) in 2012</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>41.20</td>
<td>64.85</td>
<td>5</td>
</tr>
<tr>
<td>Fisher</td>
<td>41.20</td>
<td>31.31</td>
<td>5</td>
</tr>
<tr>
<td>Lynch</td>
<td>41.20</td>
<td>71.38</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 9 shows that the four-quarter return of the portfolio created by Peter Lynch’s criteria is significantly higher than the market average return in the same period in 2012. Although the null hypothesis of the four-quarter return of the portfolio created by Benjamin Graham’s criteria cannot be rejected, it achieved a higher return than the average market return. Therefore, the portfolio which was created by some of Peter Lynch’s criteria gained the highest return among the three portfolios.

Table 10: Summary of one-quarter returns in 2013

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>1-quarter returns(%) in 2013</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>23.72</td>
<td>48.68</td>
<td>11</td>
</tr>
<tr>
<td>Fisher</td>
<td>23.72</td>
<td>60.39</td>
<td>21</td>
</tr>
<tr>
<td>Lynch</td>
<td>23.72</td>
<td>48.12</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 10 shows that the one-quarter returns of the portfolios which were created by the three investors’ criteria are significantly higher than the average market return in the same period in 2013. The portfolio that was created by some of Philip A. Fisher’s criteria gained the highest return among the three portfolios.
Table 11: Summary of two-quarter returns in 2013

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>2-quarter returns(%) in 2013</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>62.69</td>
<td>91.81</td>
<td>11</td>
</tr>
<tr>
<td>Fisher</td>
<td>62.69</td>
<td>126.25</td>
<td>21</td>
</tr>
<tr>
<td>Lynch</td>
<td>62.69</td>
<td>101.51</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 11 shows that the two-quarter returns of the portfolios which were created by the three investors’ criteria are significantly higher than the average market return in the same period in 2013. The portfolio that was created by some of Philip A. Fisher’s criteria gained the highest return among the three portfolios.

Table 12: Summary of three-quarter returns in 2013

<table>
<thead>
<tr>
<th>Screening approaches</th>
<th>3-quarter returns(%) in 2013</th>
<th>#of stocks in portfolio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>75.64</td>
<td>121.48</td>
<td>11</td>
</tr>
<tr>
<td>Fisher</td>
<td>75.64</td>
<td>140.90</td>
<td>21</td>
</tr>
<tr>
<td>Lynch</td>
<td>75.64</td>
<td>144.71</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: *10% significant, **5% significant, ***1% significant

Table 12 shows that the three-quarter returns of the portfolios which were created by the three investors’ criteria are significantly higher than the average market return in the same period in 2013. The portfolio that was created by some of Peter Lynch’s criteria gained the highest return among the three portfolios.

Conclusions and Discussions

This research combined 15 screening rules based on the approaches of three investors who are Benjamin Graham, Philip A. Fisher and Peter Lynch. The researchers established the hypotheses based on each investor’s approach and compared the return of each portfolio with the return of the Tehran stock exchange. This research found that the portfolios created by all three investors can generate higher returns than the market in 2011 to 2013. And just 5 hypotheses (showed in tables 2, 6, 7, 8 and 9) out of 33 hypotheses couldn’t achieve higher return than the market. So, the researchers were not able to identify which approach can perform better in this research.

The researchers found that the portfolio created by some of Peter Lynch’s criteria obtained a higher return than the market over all studied quarter in 2011 to 2013. The criterion of low P/E was supported by Rousseau and Ransburg (2004), Truong (2009). These researchers studied that stocks with low price-to-earnings tended to produce higher returns than the market. Ye (2013) found that portfolios which are filtered by Peter Lynch’s criteria generated greater returns than market in the Shanghai Stock Exchange.

The researchers found that the portfolio created by some of Benjamin Graham’s criteria can gain higher returns than the market. Abdul Fatah and Wan Mahmood (2007) supported the criterion of dividend yield. They found that there are positive relationships between dividend yield and stock returns in the Malaysian’s Stock Index. Sareewiwatthanaka (2011) and Ye(2013) found that the return of a portfolio which was formed by Benjamin Graham’s approach can outperform the market return.
The researchers found that the portfolio created by some of Philip A. Fisher’s criteria can gain a higher return than market. Ball and Sadka (2009) found that earnings had a high correlation with returns on the New York Stock Exchange. Pourkandand Babayazar (2013) found that financial ratio such as profitability ratios have a significant relationship with stock returns. The researchers studied eleven portfolios which generated the highest return among other portfolios from 2011 to 2013. The portfolio that was created by some of Philip A. Fisher’s criteria got the highest return six times out of eleven, the portfolio that was created by Peter Lynch’s criteria got the highest return four times out of eleven, the portfolio which was created by some of Benjamin Graham’s criteria got the highest return of one time out of eleven. Therefore, the portfolio created by some of Philip A. Fisher’s criteria got the highest return in the Tehran Stock Exchange from 2011 to 2013. This result was supported by Raie and Shwakhizaware (2006) who studied the impact of various investment strategies in the Tehran Stock Exchange. They concluded that growth investment strategies can make higher return than value investment strategies in the same companies. Opposed to Ramezanalier et al. (2014), in this study the growth investing approach achieved the highest return compared to the value investing approach while stock prices increased in TSE. In contrast, both value investing approaches almost had higher returns than the market when both stock prices increased or decreased on the TSE. Mir and Hatami (2013) implied that the average return of value stocks are more than growth stocks on the Tehran Stock Exchange in the years 2007-2011. Sorensen and Fabozzi (2008) indicated that during shorter periods (quarters or years), value and growth returns often alternate in substantially higher performance over the cycle. Some managers seek to dynamically allocate stocks to growth versus value to have the best of both worlds over time. This timing strategy, however, requires considerable skill and discipline.

**Recommendations for Further Research**

This research aims to test if the three investors’ approaches work for investors who want to invest in the Tehran Stock Exchange. The returns of most hypotheses used in this research are higher than the return of the stock market. Therefore, these three investing approaches can be used in the Tehran Stock Exchange to choose stock to invest in.

In consideration of value and growth investing approaches, the return of the portfolio created by some of Philip A. Fisher’s criteria, who is a growth investor, got the highest returns among the three investors’ portfolios. This result was supported by Sri (2010) who implied that the returns of portfolios of growth stocks are higher than the portfolios of value stocks.

In this research of one-quarter, two-quarter, three-quarter and four-quarter returns of portfolio created by Philip A. Fisher in 2012 were not higher than the market. The researchers suggest that investor should pay more attention to political policies issued by Iranian government, because it can deeply affect stock prices and returns. The non-market events, such as sanctions, terrorism, war or drastic changes in economic policy or leadership have significant impacts on returns on the Tehran Stock Exchange (Yazdi & Ardekani, 2014). Based on this fact, the researchers suggest that if investors would like to choose growth stocks for investing they should not intend to take unnecessary risk and invest in the stock market when the economy is turbulent. Otherwise, Investors should apply the value investors’ approaches, building portfolios created by some of Peter Lynch’s criteria and Benjamin Graham’s criteria which achieved higher returns than the market when stock prices both increased or decreased on TSE during 2011 to 2013. Athanassakos (2009) implied that the value investing approach assists investors to defeat benchmarks and accomplish better long-term performance. Also, Yazdi and Ardekani (2014) implied that investing in value stocks are less risky than growth stocks in the TSE.

This research was conducted to help investors to get the maximum return and provide academicians a guideline for using different investing approaches. Due to the limitations and scope of this research, there may be some points which could be covered in further research.

Further research can test different and more of criteria of each investors’ approach to determine if greater returns can be found. Future researchers can find the screening criteria used in this research to obtain the maximum possible return from investing in the Tehran stock Exchange.

In the future, researchers who wish to extend this research can increase the number of years in which their researches are carried out. This can further explore how long the three investors’ approaches really work and if they also work in differing economic situations. This research can benefit academics whose majors are in finance or investment. It can also be used as a case study for educational purposes. The other academics can do further researches based on this research in the future. They can test different indices in Tehran Stock Exchange or in different countries.
References


The Religious Sculpture and Politics of Cultural Business Space in Maha Sarakham

Kittikorn Bumroongboon
Faculty of Humanities and Social Sciences, Rajabhat Maha Sarakham University, Thailand

Abstract

The objectives of this research were to study Mahasarakham sculpture as an sculpture based on religious beliefs in the context of the politics of the region and in the context of business-oriented culture that was made in the current situation. The methodology of the study was qualitative research and used 20 citizens who live in the Na Dune district and 10 officers employees from centre Maha Sarakham province for targets if this research. The study used observation and interviews as the main instruments. The results showed that the Na Dune sample used to fight and negotiation for preservation of the Phra That Na Dune as well as housing and livelihood through religious faith and respect for the sacred annual celebration to become a tourist attraction today is: 1) to produce a new meaning to the Phra That Na Dune become "the Buddha symbol 2) prompting the identity in the Isan past in surrounding areas to show the lifestyle of the Isan ancient and 3) the establishment of a cultural heritage and religious beliefs become a tourist attraction that people have come to celebrate the season at the Phra That Na Dune. However, there was a conflict between trying to build a positive image of the sculpture based on religious beliefs against reality. When the capital and those who have interest in the Phra That Na Dune. They contributed significantly to the cultural relics, overlaid with elements of capitalism. A conflict of interests of the local people, who have the discretion to take care of the Phra That Na Dune with the chief of the province's efforts to become a beneficiary of the Phra That Na Dune. There is a belief that understanding the history and beauty of religious sculptures have been changed through the area of the usurpation of interest income and capital become a political space of the dispute between the stakeholders of the Phra That Na Dune today.

Keywords: Religious sculpture, Space, Cultural business, Politics

Introduction

"Na Dune Relic" is an ancient civilization with a long history is presumed to Chamba Sri town house in a prosperous Dvaravati era about a century later, in AD 13-15. In 2522 the Department of Fine Arts and people in Na Dune District unearthed relics from the mound to the ruins. The pagoda unearthed relics of flake shaped glass fabrication facilities in three layers in a gold casket, the middle layer is silver and the outer layer is a bronze psalm stacked sequentially and packaged in a reliquary stupa models layer of metal spheres subsequently be conducted to Na Dune pagoda relics. The area around the Na Dune pagoda Dunes; the application of simulation stupa enshrining relics. The nature of the fine arts Dvaravati designed and implemented by the Department of Fine Arts, its high 50.50 meters and 35.70meter squared base.

Na Dune Relic and the surrounding area are a cultural tourism destination, one of the most famous and recognized by the government as well. Production area was created as a learning center, historical and cultural Northeast retro model of physical space objects, belongings and livelihoods of the Northeast in the past into the present. As well as the privatization of the importance of Na Dune Relic as cultural attractions to be a selling point to attract tourists leading to consumer culture and history in this area.

However, such action is not only creating meaningful and dressing area to tourism for generate income for the people in the relics of Na Dune but a tactically of the Na Dune community used as a tool to fight and preserve this area for housing and livelihood from their ancestors being on a new meaning and a conflict of interest with the authority in the province, so the production building area is to becoming the area of social and economic resources. The cultural tourism related to the history of ancient sculpture and architecture. It is a way of fighting the local people who do not yield to beat. Imagination and the authority of the state and impact their communities, both directly and indirectly. With the return of the area had been defined. It is an area of history and ancient sculptures. Not as a space of their own business entrepreneur and state authority.
Such a phenomenon has made Na Dune Relic in the context of politics and business areas oriented culture minister. Researcher usethis case study in this research to better understanding communities that are transforming the business community of the cultural tourism. The researchers have taken the concept of "space and political space" of Henri Lefebvre as a key concept for the analysis. This concept looking at the meaning of the space is not fixed but mankind has a new meaning for the area as well.

Objective

To study the Na Dune relic is a sculpture based on their religious beliefs in the context of the politics of the region and in the context of the business culture.

Materials And Methods

This research is qualitative research. The study focuses on a phenomenon associated with the "people" and the interplay of various groups and people in the area. The research aims to study and collect by a fieldwork with data field at the research area and related areas in the Na Dune district MahaSarakham province.

Data collection, interviews with key informants including experts and sample living in Na Due district as 30 staff officers and government officials in the MahaSarakham province. The observation participatory and non-participatory including study of documents and audio-visual media materials using a structured interview recorded the audio-visual field and an important tool in research.

Results

Na Dune Relic identity in the past that is meant to produce building Na Dune Relic today.

Na Dune Relic From :http://board.postjung.com/667840.html

Until 2530, Na Dune district in the past was rural Northeast, people had a simple way of life. In 2522, the Department of Fine Arts has unearthed relics from the mound of the ruins. From the former East community of Na Dune people interacted through barter and subsistence rice farming, horticulture and livestock, as well as the subsistence of the forest and to exchange the goods. Then, Na Dune district was known widely by the construction of the sculpture Lagka on behalf of the relics Na Dune up. It is a major cause of the rise "Botanical Garden and Centre for Plant Information East. Later Mahasarakham University requested the establishment of a department of the university. The grace of Her Royal Highness Princess Chulabhorn called "WalaiRukhavej" On 22 October 2535, the main objective of establishing a space to exhibit the technology life people between science and culture.
As a result of such importance as a major tourist attraction Na Dune relic of the Lord Buddha as well as a chance to excavate the Ku Na Nune. The importance of relics are not only a place of relics but also a paradise for collectors amulets. The sequel to the news of the theft of an ancient tablet panels age older than 1,200 years known as the Ku Na Dune more than 90 pieces from KhonKaen National Museum. The tablet found mainly shows Dvaravati telling a story about Buddhism and the Lord will be the most bombastic which means bigger than the palm-sized tablet. Art shows the influence of the Mon Dvaravati published by the central and distributed in the Northeast. Demonstrates the interaction Buddhist markedly a print found as 40 prints made some statues sit on the throne. Also known as the seat of the city (Phar NungMuang). It also appears NangProk both double and single concentrated. Sometimes that has been cut to a smaller the only one there. Ku Na Dunes in this first phase, the group found appears that a lot of the locals flock came to excavate. As a result, the Ku Na Dunes entered widely to the public was know.

Ku Na Dunes
From: http://oceansmile.com/E/Mahasarakam/PhatadNadun

From a social phenomenon that occurs with Na Dun Relic believe that the definition of power, as well as geographic areas to establish dominance of the Lord. When people come to worship the Lord, they also visit the ancient Khmer architecture in Ku Santrarat is only three kilometers away. It is important to try to build a stupa for Na Dune Relic in order to learn the culture and history of the people. In the other hand the dimension of Na Dune Relic area has become a tourist adventurer collector's wearhouse. People came to dig everywhere, and bought the land around areas to dig for the unremitting. Evidenced by the amount of small shops, many amulets are for rent in the district.

Na Dune Relic Festival From : http://nkr.mcu.ac.th/tour/?p=281

Na Dune Relic: the controversy foe meaning areas and transitional identity in the past to cultural products. Physical space of Na Dune Relic identity is a small lowland, dry-forest and wild small hump in the area. The area is relatively dry but you can also grow and feed the animals. However, there is archaeological evidence that people have lived since prehistoric times and continuing to the present day. It is a transition area where a group of people who have authority over the area for generations. Considering the social memory of history, culture, myth and ritual is a group of traditional people in Na Dune district. Local officials and the group that own the authority to manage in
province level and will come to power instead. The identity of the area defined by the ancient castle of the lender’s relationship to become the land of the holy and filled with spiritual matters. When a group of high-ranking officials of the province had an important role in dealing with the relic conjunction with the local directors, try to establish the identity of the relic by linking the myths of the sanctity of the Lord. (As the incident that took place on 3 June 2547 at 21:30 hours at the relic, when the ceremony was held on the eve of Visakha Puja Day. It appears that many small slither snake hanging down from the relic) connected with the history of archeology of medieval castles Jayavarman 7, a Khmer art. This is the relationship of the physical and social space of the relic to become identities that have been designed to create and reproduces it becomes. 'Heritage' is contributing to. 'Na Dune Relic' today.

Under such context Mahasarakham use 'history and sculptures by the faith of the elements associated with identity against globalization by offering a historical and cultural attractions. The relic also fall under the fantasy and action. 'Buddhist Counties East’ and cultural tourism industry into a whole set of physical space, which is 'pinned' to the 'sacred stories of the past' as 'social space' to change rapidly. With a people to wrest money creating and managing scrum relic increasingly high proportion. So the overall of phenomenon, in addition to the condition that the identities. Na Dune Relic has become a new social space has resulted in a ‘chanted the ritual of the Ku Na Dune and areas of cultural tourism. Which are all manner of controversy and creating meaningful change and take up physical space, social rituals and local authorities.

Acknowledgements

This research was funded by Office of the Higher Education Comission and Research and Development Institute, RajabhatMahaSarakham University. I would like to thank people at Ban Mo MahaSarakham for assisting with data for this study, Department of Art and Political Science, RajabhatMahaSarakham University for their role in the establishment of this research.

References

The Accused Student Identity Development

Piyaluk Potiwan

Faculty of Political Science and Public Administration, Rajabhat Maha Sarakham University, Thailand

Abstract

This qualitative research aims to study the accused student identity development. I will apply qualitative research method and was conducted by in-depth interviews among 5 post-treat accused students. The findings showed that the social life of post-treat accused students is still not able to live as normal person. They have not been understood accepted by society, even going through drug treatment. This life still have problem such as social relation with other. Moreover, stigmatization of them as crime it was revealed through this research as part of social construction processes that result in bias, prejudice, abhorrence, exclusion and social discriminations by members of the society against them. This structure and symbolic violence mirrors the marginality of them in Thai society all time.

Keywords: Social space, Drug, Identity
Introduction

Among the fluctuations that occur in globalization including a variety of phenomena in the world combined with modern communications technology, Thailand has been challenged on the cutting edge of global geographical diversity. The factors that have long since come into effect on Thailand. That also was in a state of being harassed in economy, society and technology.

The threat of the drug problem is an important that caused the problems in society, especially in the current drug problem become a threat serious undermine the stability of society in every sector global, state, community, and family. Today drug problem in Thailand was crisis by the spread of drugs has intensified dramatically. Because drugs are produced locally and are smuggled in from abroad, such as heroin, amphetamines and ecstasy. Making it more difficult for authorities arrested also in the implementation of drug control officials still have little or no benefits and have been involved in the drug trade itself and anti-drugs is not.

From such a situation have a severe impact on the prosperity of the country. In particular, the economic and social problems that counts is deteriorating even further. Should have statistics showed that the number of drug addicts is causing serious offense. It also caused problems for transnational criminals and national security issues and if ignored will cause serious social crisis cannot be solved. The drug problem is not going to be controlled to limit any longer. But it is a national issue that raged Endless therefore agreed that all parties should give priority to such issues as well as measures to prevent and suppress the drug to achieve serious results.

Research and many studies have tried to report them to kick the perils of drugs and dealing with the drug problem, but part of the study to the identity of those involved with drugs users and drug sellers. But the fighting against social discourse of these groups has been neglected or small. In particular, the understanding of the lifestyle of the youth and students to look like a normal life and get the chance from society. But on the other hand, they must live in the midst of being classified as a person with a list of educational institutions. Who is to undergo treatment or be reported throughout the day. Sometimes, they become a target of research conducted on the drug. But these they have tried to create an identity to be accepted by society. Try to create a virtuous in itself, as intended to obtain a grade higher than others.

Research Question

In the current circumstances, students who have gone through rehabilitation, probation in drug cases. How to barriers and limitations in their quality of life in society among the differences are diverse and among these is the process of developing identity and self, however.

Purpose

The purpose of this research are study the effects that occur after the rehabilitation of probation in drug cases affecting the development of identity, and the identity of the students who uses the drugs.

Research Methodology

This research used the qualitative method for collect information related to the rehabilitation of probation in the drug case. With the development of identity and integration social behavior using the principles of the oral history research methods for study of life history under the paradigm of society. In telling or narrative that had previously been ignored or refused to give a mention in order to know the daily life and the struggles of everyday life.
Students who uses a drug case who have a list of student groups at risk in university. Including through the rehabilitation of probation in the drug case of five people.

**Results**

Under the power relations of Thailand must set on social orientation relationship by values of the people on the standards established mainstream society. Especially with children and young people must be willing to learn virtuous conduct, and live in morality. If you have done any different from the norm of society such as using drugs or involved in the drug trade. It was seen as a bad person. Deserved to be managed or operated by law. Many times these groups faced restrictions on their livelihood. They are so weak and paranoia, including loss of opportunity to develop themselves these are caused by the act of social policy, state regulation of education and law enforcement, including the unfair prejudices, values and social norms that dominate their lives. They must be judged and punished. There are no exceptions, even though these groups are still a minor and there are students who require long-term future but faced with a social structure that makes them unable to determine their own destiny. It also makes it more vulnerable to violence recurred in various forms in the future.

**The efforts to development an identity**

Since the enactment of the Medicines Act Narcotics 2522 origins as a primary law to punish offenders with drug offenses. That has been amended several times, until the last Drugs Act (No. 5) BE 2545 to improve the sanctions to be consistent with the current situation. More that is not correct penalty for an offense related to possession for distribution and distribution of drugs to a minor is punishable by a penalty of advanced decline. This is to ensure that people who need to undergo drug rehabilitation as a law on the rehabilitation of drug addicts 2545 and increase measures to prevent and suppress the drug is to blame for the people without search warrant. The authority or testing that the person has a drug in the body to blame or not.

Joe, a student who was arrested on drug cases and is in the healing process. Joe has told me that getting into the healing process. Joe has made social life conditions change. That is, in the first three months Joe not turn interfere with another drug. Joe was rotund more perfect physical condition and back to school as usual. But Joe had to report to the committee monitoring the drug problem continued for at least one year. Joe expectations and a promise to myself to continue to live like a normal college student. But society does not understand the beauty of the thing. Joe told the agency reported in the treatment of Joe to know in the university. Some of the teachers and friends already know the story of Joe. But that's not as important as the environment around Joe's behavior changes. In the motorcycle rented dormitory disappeared. There were rumors that Joe was missing and that it is in fact Joe was not the thief. Dorm administrator said Joe stole it. That was taking Joe to
keep mentions to police for questioning as a suspect in the theft of a motorcycle. Both police and administrative hostels cast questions for Joe and set the flag slander charges for Joe. In the past, Joe involved drugs and although Joe is also the only suspect was not apprehended them. But Joe had been ordered to move to another dorm to study. What happened to Joe, Joe's life after treatment of depressed and discouraged but that's not as important as the parents of Joe also tend to believe that involvement with motorcycle missing.

... I regret very much and feel bad I have tried to keep myself was then accepted.
He is usually a sign to me before, although the car has already gone to catch criminals.
But none of them, I'm sorry. Everyone aside as if it never happened.
I had to move out of the dorm. A new dormitory because everyone is afraid, and I distrust. It's not easy for me to live life to get other people in general feel good ...

(Interview: Joe 19-year-old student).

The incident with Joe as a real phenomenon in society. Such is the stigma that comes from attitude negative beliefs and actions of individuals towards others. Stigma in the context of Joe highlights the structural violence and social violence, drug parties involved have to face. Moreover, in a society where sex is believed the man was still making violent action against the drug is more concentrated. Women who take the drugs were offset value and being bullied mentally unable to defend themselves.

Noi is a students were drug litigation. Noi rent an apartment with a boyfriend but Noi does knew that my boyfriend career that is sent amphetamines. When police arrested the boyfriend of Noi. Noi need to testify and confirm that at no part of my girlfriend sees the drug trade. However, the police have let the university know. After, boyfriend was arrested, Noi just to rent house with a friend who studied in the same university. The rental house is located in a small alley not far from learning too much. One day the police came to search the house and searched the property. Police have found the middle of the little girls. Female police officers conducted body searches of female students themselves. Because no female officers woman friend's Noi need to turn everything to make him look more to the middle.

... I used to have a boyfriend who involved in the drugs trade.
But he was arrested and then prosecuted. When I live with friends, another friend was involved. One day police searched my friend turned everything to find the middle. I asked him to wait no women officers.
I do not think he was that much trouble. ... and tell them have sex in exchange for drugs.

(Interview: Noi 20-year-old student).

The story of Joe and Noi an event that reflects the social reality in the lives of students who are involved in drug cases, both intended and unintended. In addition to the social stigma the intensity of prejudice and acts of violence against these people, both directly and indirectly affect their lives. Although they are trying to create a new image for themselves in order to be recognized as an outstanding talent shows. The study was intended as a reward. But that did not make the value and dignity of their being raised. Sometimes, some social event that is sacred and noble was reserved for individuals with a history of only pure.

Summary

Among the social life that gives meaning and crowding those involved in drug addiction, whether it is short. Will not be prosecuted as a result, these people have been in a state of marginalization. It is not clear in providing opportunities or equal rights for these people. Identity vulnerable to structural violence of conservative faith traditions also fall under the power of myth in society. The stigma and stereotyping are also important to make these people have become marginalized.

However, data collection and the conclusions in the article, this is only the findings that are part of “The Processes of Social Space Construction of Student Who Accused the Drug”

Therefore, the information about these people through therapy drugs are not able to represent the accused student life drugs every country. Due to the limitations of life and diversity that these people face. The level of class and professionalism as well as the quality of life in the economy and society at different levels. These people may have a better quality of life after treatment. While, some people have worse quality of life.
Some people succeed in life after treatment. While, some people do not receive social opportunities as their expectations as a key condition to turn into a process of the drug again.

Acknowledgements

This research was funded by Office of the Higher Education Comission and Research and Development Institute, Rajabhat Maha Sarakham University. I would like to thank people at Ban Mo Maha Sarakham for assisting with data for this study, Department of Art and Political Science, Rajabhat Maha Sarakham University for their role in the establishment of this research.

References

The Sensitivity of Ramshorn Snail, *Marisa cornuarietis*, Embryos to the Pesticide Chlorpyrifos and Methiocarb

Banthita sawasdee* and heinz-r. Köhler\(^2\)

\(^1\)Faculty of Agricultural Technology, RajabhatMahaSarakham University, Thailand
\(^2\)Animal Physiological Ecology Department, University of Tübingen, Germany

(*author for correspondence, e-mail : banthitas@yahoo.com)

Abstract

The purpose of this study was to examine the sensitivity of the *Marisa cornuarietis* embryo toxicity test (MariETT) to selected pesticides in comparison with literature data on other biotests. Embryos were exposed to chlorpyrifos and methiocarb. The exposure concentrations ranged from 100 to 350 µg/L for chlorpyrifos and 100 to 500 µg/L for methiocarb. Results revealed chlorpyrifos to be more toxic than methiocarb to embryos of *M. cornuarietis*. At the lowest observed effect concentrations (LOECs), 150 µg/L chlorpyrifos affected the snail embryos by reducing the rate of tentacle and eye formation, and hatching success. A significant mortality was observed at 200 µg/L chlorpyrifos. Methiocarb-exposed embryos showed an increase in the percentage of mortality and a delayed formation of tentacles at 500 µg/L. Compared to other biotests, the MariETT displayed particular sensitivity to selected pesticides.

Keywords: chlorpyrifos, embryo toxicity test, *Marisa cornuarietis*, methiocarb,

Introduction

Since the *Marisa cornuarietis* embryo toxicity test (MariETT) has been introduced some years ago by Schirling et al. (2006) it has to be regarded equally as more sensitive to environment chemicals compared with other biotests. Particularly for some metals and insecticides, it has been shown that concentrations causing toxicity on *Marisa* embryos can be orders of magnitude lower than the effective concentrations in other biotests (Sawasdee and Köhler, 2009; Osterauer et al., 2009). Here, we describe the sensitivity of this rather new biotest to selected pesticides with different models of action: the organophosphorous insecticide chlorpyrifos and the carbamate methiocarb.

Chlorpyrifos (O, O-diethyl O-3,5,6-trichloro-2-pyridylphosphorothioate) is an organophosphate insecticide, and miticide used to control foliage and soil borne insect pests on a variety of food and feed crops. It exerts toxicity through inhibition of the enzyme acetylcholinesterase (AChE) in the nervous system (Roberts et al., 1999). Chlorpyrifos is one of the most widely used organophosphate insecticides; about 5000 tons are applied annually in agricultural settings in the United States (US EPA, 2002). After a risk assessment review (US EPA 2000), the US EPA decided to ban all home use of chlorpyrifos in the United States (Franz, 2000). Concentrations of chlorpyrifos found in surface water reach up to 10.8 µg/L (Marino and Ronco, 2005). The effects of chlorpyrifos on fish and invertebrates have been studied in a wide variety of species (Borthwick et al., 1985; Goodman et al., 1985; Hansen et al., 1986; Cebrián et al., 1992; Ankley and Collyard, 1995; Lund et al., 2000; Rao et al., 2003; Li et al., 2006; Scheil and Köhler, 2009). However, there is little information concerning the toxicity of chlorpyrifos on the early development of invertebrates.

Methiocarb (4-Methylthio-3,5-xylyl-N-methylcarbamat) is a carbamate that has been used as an insecticide, molluscicide, and bird repellent. It affects the nervous system by reducing the ability of cholinesterase to function properly in regulating the neurotransmitter acetylcholine (US EPA, 1994). Mesurol® snail and slug pellets (product number 33274) containing 4% of the effective substance 4-Methylthio-3,5-xylyl-N-N-methylcarbamat, is one of three registered products that contain methiocarb (Bayer CropScience). It is used in a range of cropping situations including nurseries and cut flower production. A reregistration eligibility decision (RED) document was prepared by the US EPA in 1994. The US EPA fact sheet notes that methiocarb is highly toxic to fishes, and very highly toxic to aquatic invertebrates. Methiocarb has been detected in Nebraska groundwater, at concentrations below 0.5 µg/L (APVMA, 2005). Unlike organochlorine pesticides, carbamate pesticides do not persist in the environment for long, and they do not tend to bioaccumulate. However, carbamate pesticides are toxic to non-targeted wildlife and fish. Although methiocarb is used in low volumes compared to other pesticides, it still could have major impacts in areas where there is concentrated outdoor use.

The purpose of this study was to quantify the toxicity of these selected insecticides on the embryonic development of *Marisa cornuarietis* by monitoring the following endpoints: mortality, formation of tentacles and eyes, heart rate, hatching, and weight after hatching. This toxicological information is needed to assess the
degree of sensitivity of the *Mariscornuarietis* embryo toxicity test (MariETT) comparing to other established biotests.

**Materials And Methods**

Adult ramshorn snail, *Marisa cornuarietis* (Ampullariidae) (strain originated from a breeding stock of the Zoological Institute in Frankfurt/Main, Germany) were kept in the laboratory in 120 L aerated and filtered aquaria containing tap water. Culture conditions were 24 ± 1°C, conductivity ~ 800 µS/cm, pH ~ 7.5 at 12 h:12 h light:dark cycle. The adult snails were fed once a day by a commercial fish flake food (TretraMin, Tetra GmbH, Germany) or fresh vegetables.

**Embryo toxicity test**

*M. cornuarietis* lays its eggs in relatively large, soft, gelatinous egg masses. Eggs masses are usually laid at night on the side wall of the aquaria. Freshly laid egg masses were removed from the aquaria in the respective morning and divided with a razor blade. Eggs were transferred to glass Petri dishes (20 eggs per Petri dish, 9 dishes per tested concentration of a chemical) containing different solutions or aquarium water (control group). The tests were performed in a climate chamber at a 12h:12h light:dark cycle, the control water as well as the solutions were replaced at 24 h intervals to avoid possible effects of evaporation or biodegradation. All experiments were performed using glass Petri dishes. Embryo development was monitored using the following endpoints during the exposure period using a stereomicroscope at specified time points: mortality (%), formation of tentacles and eyes (%), heart rate (min⁻¹), hatching success (%) and weight after hatching (mg wet wt.). Furthermore, possible malformations of the embryos were recorded as well.

**Chemicals and test concentrations**

Chlorpyrifos (Sigma-Aldrich, Germany) was dissolved by constant overnight stirring in double distilled water at a water temperature of 35°C. A stock solution (1 mg/L) was prepared in a glass bottle directly before every exchange of test media. The stock solution was diluted with the same water as used for animal stock maintainance to the final nominal concentrations of 100, 150, 200, and 350 µg/L. Methiocarb (Sigma-Aldrich, Germany) was dissolved in double distilled water in a glass bottle. The stock solution (10 mg/L) was diluted with the same water as used for animal stock maintainance to the final nominal concentrations of 100, 250, and 500 µg/L.

**Data analysis**

The software JMP® 7.0 (SAS) was used for statistical analysis. Normally distributed data (checked by Shapiro-Wilk’s test) were analyzed using a Student’s *t*-test to determine if there were significant (*p* ≤0.05) differences among treatments. Data that were not normally distributed were analyzed using Wilcoxon’s test. Significance here was tested at *p* ≤0.05 as well.

**Results**

**Chlorpyrifos exposure**

Toxic concentrations of chlorpyrifos to *M. cornuarietis* embryos ranged from 150 µg/L to 350 µg/L. Chlorpyrifos at 350 µg/L caused 100% mortality of snail embryos, whereas 100 µg/L did not induce significant changes on any investigated endpoint. Fig. 1(a) to (d) shows the reduction in the integrity of embryogenesis, assessed as percentage of alive embryos, as the formation of tentacles, the formation of eyes, hatching success, and weight after hatching. At days 5 and 6, embryos exposed to 150 µg/L chlorpyrifos showed a significant delay in the formation of both tentacles and eyes. Chlorpyrifos in concentrations of 200 µg/L was found to induce significant changes on the weight of newly hatched animals.

**Methiocarb exposure**

No significant changes could be recorded at embryos for concentrations of 100 and 250 µg/L. In embryos exposed to 500 µg/L, the mortality was shown to significantly increase from 6% in the control to 14% in the 500 µg/L treatment group (Fig. 2a). Also a significant delay in the formation of tentacles was found: the percentage of individuals with developed tentacles at day 5 decreased from 95% in the control to 82% in the treatment group (Fig. 2b).
Our study showed clearly that chlorpyrifos is dramatically increased mortality rates and affected embryonic development in *M. cornuarietis*. While chlorpyrifos at 150 µg/L induced adverse effects in the snail embryos. Already, several fish were less sensitive to chlorpyrifos: according to Kienle et al. (2009), zebrafish (*Danio rerio*) larvae exposed to chlorpyrifos showed a significant increase in the percentage of individuals with morphological deformations at 250 µg/L or higher concentrations. As well, the heart rate in the developing gambon damsel, *Pomacentrus amboinensis*, was significantly affected by chlorpyrifos concentrations at or above 500 µg/L (Humphrey et al., 2004), whereas chlorpyrifos at 350 µg/L already caused 100% mortality of snail embryos in this study. However, the lowest chlorpyrifos concentration that caused significant reduction in viable hatch and length in embryos of *P. amboinensis* was 125 µg/L (Humphrey et al., 2004), indicating a similar sensitivity to this endpoint and the MariETT assay. In respect to mortality, the MariETT assay exhibited a higher sensitivity than established fish tests (Varó et al., 2000; Humphrey et al., 2004). On the other hand, a few reports on highly sensitive endpoints do exist. In the eastern rainbow fish *Melanotaenia splendida splendida*, embryos exposed to chlorpyrifos at concentrations at or above 25 µg/L were significantly smaller than the control group at hatching; however, embryos exposed to chlorpyrifos at 12.5 and 6.25 µg/L showed no significant difference (Humphrey and Klumpp, 2003). In 96h juvenile toadfish *Opsanus beta*, 520 µg/L chlorpyrifos resulted in significant mortality (Clark et al. 1985). Furthermore, embryos of *M. cornuarietis* appear to be more sensitive to chlorpyrifos compared to the few other species for which data are available. On early life stage of the amphibian *Ambystoma mexicanum*, chlorpyrifos did not cause any lethal effect, even at the highest concentration tested (2.5 mg/L) (Robles-Mendoza et al., 2009), whereas the median lethal concentration (LC₅₀) calculated for larval *Rana boylii* was 3.0 mg/L (Sparling and Fellers, 2007). In one of the rare studies on invertebrates, Varó et al. (2000) observed increased mortality of *Artemia parthenogeneticanuclii* at concentrations >18 mg/L. In contrast, in the present study, concentrations of chlorpyrifosat 350 µg/L caused significant effects on the survival rate. The differences observed between the current study and previous reports indicated a particular sensitivity of *M. cornuarietis* embryos to chlorpyrifos in comparison to other established test organisms. The highest methiocarb concentration we tested (500 µg/L) affected the survival, and the formation of tentacles and eyes in *M. cornuarietis* embryos. Considering methiocarb concentrations of up to 100 µg/L in surface water from rice fields in The United States (Primus et al., 2001) and a safely factor of just 10 our study showed environmental relevance. In comparison to Altinok et al. (2006) who reported concentrations of 4.82 to 5.43 mg/L methiocarb to kill 50% of juvenile rainbow trout (*Oncorhynchus mykiss*) within 24 to 96h we found *M. cornuarietis* to be about one order of magnitude more sensitive to methiocarb. Even in histopathological studies with *O. mykiss* exposed to 3.75 mg/L methiocarb, the only lesion observed was in the gill (Altinok and Capkin, 2007). In contrast to sole methiocarb, dissolved in water, Mesurol® snail pellets at 1 times application rate did not reveal any effects on *M. cornuarietis* embryos. It is reasonable that the methiocarb pellet formulation is less effective as a contact poison than after ingestion. Comparative toxicity evaluation is an important aspect in risk assessment of pesticides, as it may help identify appropriate sensitive species for a particular group of substances. This study showed that the MariETT assay is particular sensitivity to selected pesticides, especially to chlorpyrifos and methiocarb. As shown earlier for metal ions (Schirling et al., 2006; Sawasdee and Köhler, 2009), our data point out the suitability of *M. cornuarietis* embryos as invertebrate models for embryo toxicity testing. The authors hope that this present study contributes to the knowledge of environmental monitoring of pesticides and their risk assessment.

Acknowledgments

The authors are grateful to thank Jörg Oehlmann, University of Frankfurt/Main, Germany, for providing animals from which our *Marisa cornuarietis* stock has originating.

References


The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University

******************************************************************************


---

**Fig. 1** Effects of chlorpyrifos on *M. cornuarietis* embryonic development, means ± SD. (a) mortality (%); (b) formation of tentacles and eyes after 5, and 6 days exposure to chlorpyrifos (%); (c) hatched snails (%) after 10, and 12 days exposure to chlorpyrifos; (d) individual weight after hatching (mg). Asterisks designate differences where *p* ≤ 0.05 (Student’s *t*-test).
Fig. 2 Effects of methiocarb on M. cornuarietis embryonic development, means ± SD. (a) mortality (%); (b) formation of tentacles and eyes after 5 days exposure to methiocarb (%). Asterisks designate differences where $p \leq 0.05$ (Student’s t-test).
Abstract

A study of traditional fishing gears and fish species of the fisherman’s in Nong Bo Reservoir, Borabu, Maha Sarakham Province. The objective was to study the fishing gears and fish species. The samples of 50 households by semi-structured interviews. The results found that the types of traditional fishing gear in the reservoir there were 16 gears types in 7 groups. Found cast net, gill net, lift nets and hook, single hook and trap were the most common gears used and found in the entire study area. The fishing time into 3 periods which are summer season (dry), rainy season (wet) and cool season. It shows that they fishing hold the year. There were 21 species of fish was found.

Keywords: Traditional fishing gears, Fish species, Fisherman

Introduction

Traditional fishing gears and fishing methods have been developed through time to adapt to local fishing conditions including the types of fishing areas and the desired and targeted species and size of fish. Accordingly, the most successful methods at a given locality are those that have stood the test of time. Some of these methods have evolved and improved to the technical level appropriate to local conditions. (Facundo et al., 2014)

The commercial of freshwater fisheries on flood plains along the principal rivers. Generally, the villages in the northeast Thailand are located near or around a water source such as a swamp or flood plain area. These areas are vulnerable to flooding during the monsoons. During the same season, fish migrate to upstream for breeding. People who are living in rural areas were recognized the importance of conserving habitats in breeding areas and allowing the young fish in the main water body to grow to marketable sizes. Thus, they have traditionally harvested fish only once they have grown to requisite sizes. Harvesting is done by the whole community and the resource is shared by all. Occasionally, when there is enough surplus, people from the neighboring villages are invited to fish for a small fee and the sum collected in this way is used for community purposes (Sanitchon and Thalerngkietleela, 2008). So, this study aim to : 1) to study type of fishing gear in Nong BO Reservoir 2) to study fish species in Nong BO Reservoir.

Materials and Methods

A Study area the research was performed in Nong Bo Reservoir, Borabu, Maha Sarakham Province, Thailand an area of 1,883 rai (Figure 1). The Data was collected during October – December 2011 by survey and interview on 50 households. The sample was selected from 300 households who are the local fisherman using the fishing gears and caught hold year. Data and information gathered were mainly on the designs, mode of operation, traditional fishing gears types and species of fish. Mainly qualitative method data analysis and a few of quantitative like percentage.
Results

Types of fishing gear: local fishing gear in the reservoir there were 16 gears types. Found, Cast net (34.78%), Gill net (22.83%), Round scoop basket Single Hook (1.09%), Trap (11.96%), Drop door trap (15.22%), Dragged Gears (1.09%), Small Lift Nets (1.09%), Attracting Devices, Brush Parks (1.09%), Plunge basket (2.17%), Scoop net (6.25%), Pronged barbless spear (1.09%), and Eel Trap (1.09%). were the most common gears used and found in the entire study area. For example; Cast net, Gill net, Drop door trap and Trap. (Table 1)
Table 1 Types of fishing gears and numbers of household using fishing gear of fish hunters in each village

<table>
<thead>
<tr>
<th>Common name</th>
<th>No. of household using fishing gear</th>
<th>Percentage of household using fishing gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gill net</td>
<td>21</td>
<td>22.83</td>
</tr>
<tr>
<td>Cast Net</td>
<td>32</td>
<td>34.78</td>
</tr>
<tr>
<td>Round scoop basket Single Hook</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>Trap</td>
<td>11</td>
<td>11.96</td>
</tr>
<tr>
<td>Drop door trap</td>
<td>14</td>
<td>15.22</td>
</tr>
<tr>
<td>Dragged Gears</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>Small Lift Nets</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>Attracting Devices, Brush Parks</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>Plunge basket</td>
<td>2</td>
<td>2.17</td>
</tr>
<tr>
<td>Scoop net</td>
<td>6</td>
<td>6.52</td>
</tr>
<tr>
<td>Pronged barbless spear</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>Eel Trap</td>
<td>1</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Species of fish catch: There are 15 species were classified into the following on table 2

Table 2 Species of fish cashing by fishing gears of fisherman

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Local name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oreochromis niloticus</td>
<td>Nile Tilapia</td>
</tr>
<tr>
<td>Barbounymus gonionotus</td>
<td>Java barb</td>
</tr>
<tr>
<td>Pristolepis fasciatus</td>
<td>Striped tiger leaffish</td>
</tr>
<tr>
<td>Probarbus jullieni</td>
<td>Seven-striped barb</td>
</tr>
<tr>
<td>Cirrhinus microlepis</td>
<td>Small Scale Mud Carp</td>
</tr>
<tr>
<td>Oxyeleotris marmoratus</td>
<td>Sand goby</td>
</tr>
<tr>
<td>Channa stiata</td>
<td>Striped snake-head fish</td>
</tr>
<tr>
<td>Clarias batrachus</td>
<td>Walking catfish</td>
</tr>
<tr>
<td>Monopterus albus</td>
<td>swamp eel</td>
</tr>
<tr>
<td>Cyprinus carpio</td>
<td>Carp</td>
</tr>
<tr>
<td>Trichogaster trichopterus</td>
<td>Three-Spot gourami</td>
</tr>
<tr>
<td>Anabas testudineus</td>
<td>Common Climbing Perch</td>
</tr>
<tr>
<td>Channa micropeltes</td>
<td>Great Snakehead</td>
</tr>
<tr>
<td>Henicorhynchus siamensis</td>
<td>Siames mud carp</td>
</tr>
<tr>
<td>Hampala dispar</td>
<td>Eye-spot barb</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

This study the traditional fishing gears and fish types in the Nong Bo Reservoir, Borabu, Maha Sarakham Province. It records and identifies, that include their types of fishing gears and species of fish.

Local fishing gear in the reservoir there were 16 gears types. were the most common gears used and found in the entire study area such as; Cast net (34.78%), Gill net (22.83%), Drop door trap (15.22%) and Trap (11.96%).

Facundo et al.(2014) who reported that the traditional fishing gears and fish methods of ilocos norie philippines. The fishing gears and fishing methods documented in the survey are classified under four categories as follows: hand instruments, traps, lines, and nets.

Further, a variety of freshwater fish species comprising the catch of the fishing gears are identified and recorded as to their local names and English or common names. These include 21 species of freshwater fish,
Some gear was used for selective specific type, size, flooding cycle, fish cycle and fish migrations. (Chantabut et al., 2015) such as eel trap suitable for eel fish, drop door trap for snake head fish and net can catch all type and size of fish throughout the year.

The findings from this research were; changing the structure of fishing gear made from iron to use for the long period. Net made from polyester, the size of the mesh depends on the type and size of fish, that making it possible to catch every type and size of fish. As a result, now a day fishing gear able to catch fish throughout the year.

Acknowledgements

The authors are highly grateful Research and Development Institute Rajabhat Maha Sarakham University Maha Sarakham, Thailand to carry out the research. Thanks to the participating fisherman.

References


### Table 3: Species of fish catching by fishing gears of fisherman

<table>
<thead>
<tr>
<th>Species of fish</th>
<th>Gill net</th>
<th>Cast Net</th>
<th>Single Hook</th>
<th>Round scoop basket</th>
<th>Trap</th>
<th>Drop door trap</th>
<th>Dragged Gears</th>
<th>Small Lift Nets</th>
<th>Attracting Devices, Brush Parks</th>
<th>Plunge basket</th>
<th>Scoop net</th>
<th>Plunge</th>
<th>Scoop</th>
<th>Eel Trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oreochromis niloticus</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbounymus gonionotus</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pristolepis fasciatus</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probarbus jullieni</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cirrhinus microlepis</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxyeleotris marmoratus</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channa stiata</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarias batrachus</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monopterus albus</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyprinus carpio</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichogaster trichopterus</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anabas testudineus</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channa micropeltes</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Henicorhynchus siamensis</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hampala dispar</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effects of Fat Sources on Feed Intake and Feed Cost of Total Mixed Ration in Crossbred Thai Native X Brahman Bulls

Wantanee Polviset¹,*, N. Prakobsaeng¹, and C. Yuangklang²

¹Program in Animal Science, Faculty of Agricultural Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
²Rajamangala University of Technology-Isan, Nakhon Ratchasima Campus, Muang, Nakhon Ratchasima, Thailand
(*author for correspondence, E-mail: polviset@hotmail.com; Fax: +6643725439)

Abstract

This research was to study feed intake, body weight change and feed cost. Four crossbred Thai native x brahman bulls were injected anthelmintic and vitamin AD₃E before the trial. The cattle were random assigned according to a 2x2 factorial in 4x4 latin square design. Each period of feeding lasted for 21 days. The arrangement of treatments: (1) Total mixed ration with 3% fat level from palm oil, (2) Total mixed ration with 6% fat level from palm oil, (3) Total mixed ration with 3% fat level from sunflower oil and (4) Total mixed ration with 6% fat level from sunflower oil. All crossbred Thai native x brahman bulls were allotted to receive total mixed ration (Ad libitum).

The results revealed that diet had no effect on feed intake, growth rate and feed cost (P>0.05), but trend of the highest % body weight intake (% BW) was 2.26% from animal feeding total mixed ration with 3 % fat level from palm oil according to the lowest cost (kg/baht) was in TMR with 3% fat level from palm oil.

Based on this study, supplementing TMR with 3% fat level from palm oil in TMR diets was suitable in beef cattle without any effect and the lowest cost for the diet.

Keywords: Fat sources, Palm oil, Sunflower oil, Feed intake, Thai native X brahman bulls

Introduction

In livestock production systems, a major strategy to enhance the livestock production in developing countries could be balanced between protein and energy in feed. Especially energy due to Beef cattle production need a high energy ration to guarantee high productivity (Manso et al, 2006). In addition, using fats in the diet could be suitable for ruminants with high energy requirements such as vegetable oils prevent ruminal acidosis, reduces dust in the diets, palatability and modify fatty acid deposition in meat or milk. Nevertheless, high level of fat in ruminant diets could adversely affect microbial fermentation and may negative effect voluntary feed intake and fiber digestion. Furthermore in general recommendation that total dietary fat should not exceed 6–7% of dietary dry matter (Jenkins, 1993; Wanapat et al., 2011) without negatively affecting the total tract nutrient digestion (Soliva et al., 2003). Therefore, oilseeds and oil such as palm oil and sunflower oil supplementation can also be used for energy sources and have potential to improve energy utilization in ruminants.

Palm oil is the principal vegetable with a rich content of antioxidants and lauric acid, the saturated fatty acid composed of medium-chain fatty acids (Kim et al., 2014). Moreover by produce from palm tree such as oil palm fronds used in beef cattle diets could agree to live body weight gain (Zahari et al., 2003). In addition, sunflower oil is rich polyunsaturated fatty acid exceedingly effective in ammonia nitrogen concentration in rumen (Ivan et al., 2003), which would improve nitrogen utilization thus could be live body weight gain in beef cattle. Therefore, the objective of this study was to compare palm oil and sunflower oil in TMR diets with differing forage:concentrate to determine feed intake and live body weight alter in crossbred Thai Native x Brahman bulls.

Materials and Methods

Animals, experimental design and treatments

Four crossbred Thai native x Brahman bulls, aged about 2 years and 150±27.73 kg of BW were used. The bulls were treated for intestinal worms and were injected with a mixture of vitamins A, D₃ and E. The bulls were fed four rations according to a 2x2 factorial in 4x4 Latin-square design with 21 days per period. The bulls were housed individually. During each period, animal received of total mixed ration (TMR) ad libitum. The
dietary treatments were two fat source diets; palm oil and sunflower oil with two levels of fat; 3% and 6% (Table 1).

**Sample collection and analysis**

Feed intake was recorded everyday in experimental period in all animals. The cattle were weighed before and after feeding experiment. During experiment period, the cattle were weighted each period before feeding in the morning. The body weight changes were calculated from the average value of the weight in each period. The experiment period was totally 84 days.

**Table 1 Ingredients and chemical composition of total mixed ration (TMR)**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Palm oil</th>
<th>Sunflower oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>Rice straw</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Ground corn</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Cassava chip</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>Urea</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>DCP</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Premix</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Salt</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Palm oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

**Chemical composition by calculation (%)**

<table>
<thead>
<tr>
<th></th>
<th>Palm oil</th>
<th>Sunflower oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>92.81</td>
<td>92.81</td>
</tr>
<tr>
<td>CP</td>
<td>16.15</td>
<td>16.75</td>
</tr>
<tr>
<td>TDN</td>
<td>72.00</td>
<td>74.22</td>
</tr>
<tr>
<td>NDF</td>
<td>28.22</td>
<td>27.70</td>
</tr>
<tr>
<td>EE</td>
<td>3.28</td>
<td>6.30</td>
</tr>
</tbody>
</table>

Statistical analysis

The means of each measured parameter were analyzed by the analysis of variance (ANOVA) using the General Linear Model (GLM) procedures (Statistical Analysis System Institute, 2001). Differences among dietary treatments were statistically compared using the Duncan’s New Multiple Rang Test (DMRT) (Steel and Torrie, 1980).

**Results**

**Total dry matter intake**

Total dry matter intake (kgDM/d) was not affected by fat supplementation from different oil sources and different percentage of oils (P>0.05). The results of %BW intake are shown in Table 2. There was no statistically significant difference oil sources, percentage of oils and interaction between in percentage of oil x oil sources in the evaluated period (P > 0.05). A tendency of %BW intake was found in animals fed with 3% palm oil. Statistically, the addition the lowest cost was found in 3% palm oil (8.9 baht/KgDM).
Table 2 Feed intake (kg/d), body weight change (kg) and feed cost in crossbred Thai native x brahman bulls used different fat oil

<table>
<thead>
<tr>
<th>Item</th>
<th>Palm oil</th>
<th>Sunflower oil</th>
<th>SEM</th>
<th>% of oils</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Intake(kg DM/d)</td>
<td>3.93</td>
<td>3.17</td>
<td>3.60</td>
<td>0.262</td>
<td>0.5081</td>
</tr>
<tr>
<td>% BW</td>
<td>2.26</td>
<td>1.75</td>
<td>2.21</td>
<td>0.114</td>
<td>0.3370</td>
</tr>
<tr>
<td>Initial Body weight (kg)</td>
<td>178</td>
<td>112</td>
<td>154</td>
<td>158</td>
<td>-</td>
</tr>
<tr>
<td>Final Body weight (kg)</td>
<td>235</td>
<td>154</td>
<td>-</td>
<td>218</td>
<td>-</td>
</tr>
<tr>
<td>Body weight change (kg)</td>
<td>57</td>
<td>42</td>
<td>-</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>Feed Cost (baht/kg)</td>
<td>8.9</td>
<td>9.5</td>
<td>9.8</td>
<td>11.1</td>
<td>-</td>
</tr>
</tbody>
</table>

SEM = standard error of the mean
ns = not significant (P>0.05)
Conclusions and Discussion

It could be concluded that supplementation of fat sources from 3% palm oil trends to improve %BW intake compared with 6% palm oil, 3% sunflower oil or 6% sunflower oil. However 3% palm oil was suitable for used as fat sources in ruminant diets due to lower prices.

Using different percentage oils and oil sources supplementation did not affect (P>0.05) on feed intake and %BW intake even compared feeding with saturated fatty acid (palm oil) and unsaturated fatty acid (sunflower oil) not agree with Sutton et al. (1983) who suggested that polyunsaturated fatty acids can decrease fiber digestibility and decrease in dry matter intake that might be total dietary fat does not exceed 6–7% of dietary dry matter (Wanapat et al., 2011).

Budgeting for feed cost was used to animal production to calculate net incomes. In ruminants, total mixed ration (TMR) is practical for using. Feeding animal with 3% palm oil in TMR was lowest price (8.9 baht/KgDM) and trends to be highest %BW intake that more profitable compare with the other treatments.

Acknowledgements

The authors would like to express their most sincere gratitude and appreciation to the Commission on Higher Education, Research and Development institute, Rajabhat Maha Sarakham University, Thailand, for their financial support.

References

Gene Cloning And Expression of F3H Gene In Phenylpropanoid Pathway From Bitter Melon (Momordica charantia L.)

Nguyen Thi Thanh Mai1, Tien Huynh2 and Sang Un Park3

1Faculty of Agriculture, Forestry and Fishery, Vinh University, Vietnam.
2School of Applied Sciences, RMIT Melbourne, Australia
3College of Agriculture & Life science, Chung Nam National University, Korea.
E-mail: thanhmainln@gmail.com

Abstract

In plant, F3H gene encodes a key enzyme of the flavonoid biosynthesis through phenylpropanoid pathway. In this research, full length sequence of F3H gene encoding the biosynthesis of flavone-3-hydroxylase enzyme from bitter melon (Momordica charantia L.) was cloned by reverse transcription-PCR. McF3H comprises 1335 bp with open reading frame (orf) encoding 370 amino-acid protein. The deduced McF3H protein showed high identities to other plant F3Hs. Phylogenetic tree analysis revealed that McF3H shared the same ancestor in evolution with other F3Hs and had a further relationship with other angiosperms species. Quantitative real time PCR of the transcription of F3H gene copies amongst different plant organs and fruit maturing stages. Among the organs, the highest level of F3H was found in male-flower, while its expression was very low in root, stem and old leaf. Interestingly, during the ripening period of fruit (six divided stages), the expression of F3H decreased gradually from first to ripening stage. The isolation and characterization of McF3H gene will be helpful to further study the role of McF3H gene in the biosynthesis of flavonoids in M. charantia.

Key Words: flavone-3-hydroxylase (F3H), gene cloning and expression, bitter melon (Momordica charantia L).

Introduction

Bitter melon (M. charantia L.) is a tropical and subtropical vine of the Cucurbitaceae family and it is widely grown in Asia, Africa and Caribbean for both vegetable and medicine. It has been found to have strong medical activities such as against antidiabetic, antitumor, anticancer, anti-inflammatory and antiviral effects [1,2 &3]. These properties are considered to mainly derive from flavonoids, which is biosynthesized by phenylpropanoid pathway. Phenylpropanoid-derived natural products play an important role in plant growth, development and environmental stresses such as defense against pests and predators as well as signal molecules for communication with other organisms [4]. Recently, these compounds have been found to have benefit for human health like antioxidant, antiobesity, antibacteria antihyperglycaemia and acyl-CoA-cholesterol inhibition. [5,6,7,8 &9]. Therefore, metabolic engineering has been more and more developed to improve quantities and qualities of each specifically flavonoids from various species in order to further commercial utilization. Catechin is a majority group of flavonoid families has been isolated from bitter melon [10]. Flavone 3-hydroxylase (F3H) activity is necessary for the production of flavonoids as well as anthocyanins. Several records have indicated that F3H gene plays a key role in biosynthesis of numerous chemical compounds such as catechin [11], anthocyanin ([12] However, the cloning and expression of F3H gene from M. charantia had not yet recorded. In this paper, thus, this gene has been cloned, sequence analysed and expressed from different plant organs and fruit maturing stages.

Materials and Methods

Plant material

Seeds of M. charantia (Sub-continent phenotype variety) were bought from Asiaseed Company (Korea). It was grown in experimental farm in Chungnam National University (Deajeon, Korea, 2009). The different plant organs were selected at lately stage on vegetable phase of plant development and samples of fruit were harvested from early establishing fruit to full-ripped fruit and keep in -80°C and full-ripe seeds were harvested and kept in 4°C until used.

Isolation of cDNA encoding catechin biosynthetic genes

Total RNA was extract from 1 month plant and used for synthesis of single strain cDNA by using GeneRacerTM Kits (Invitrogen), according to the manufacturers recommended protocols.
Primers for amplification of full length of gene and gene expression were designed by online-primer3 program http://frodo.wi.mit.edu/primer3/ Amplification of cDNA full length by Rapid Amplification cDNA End (RACE) technology. 3′-RACE PCR was performed using the GeneRacer 3′ primer and the reverse primer of each gene.

PCR for amplification of 3′ end and 5′ end of cDNA was amplified by hot start method using the RACE cDNA template. The first reactions of RACE-PCR were performed in a final volume of 25 µl. After denaturation at 94°C for 5 min, the amplification consisted of 30 cycles of 1 min at 94°C, 1 min at annealing temperature (www.bioneer.co.kr) and 1 min/kb at 72°C, followed be one step of elongation at 72°C for 10 min.

The PCR products were then analyzed by agarose gel electrophoresis and ethium bromide staining. The second RACE PCR reactions were performed in final 50 µl volume. Next steps were conducted similar to fist PCR. The fragments of expected size were purified by using LaboPassTM GEL Kit and then cloned to T-Blunt vector (SolGent, Daejeon, Korea) and sequenced with the aforementioanal protocol.

Sequence Analyses.

Sequence similarities were calculated with the Basic Local Alignment Search Tool (BLAST) (http://www.ncbi.nlm.nih.gov/BLAST).

Multiple sequence alignment was constructed using the MultAlin program (http://bioinfo.genotoul.fr/multalin/multalin.html).

Phylogenetic tree was constructed with TreeTop, Phylogenetic Tree Prediction (http://www.genebee.msu.su/services/phtree_reduced)

Quantitative real time PCR (qPCR)

qPCR was performed for evaluation of Transcriptional level of gene in catechin biosynthesis pathway from M. charantia and GUS gene expression.

CYP gene was cloned from M. charantia which share high homology with CYP gene from other species (data not shown) and used as an internal reference.

Performance: Real-time PCR was carried out by Mini Opticon Real-time PCR system (Bio-Rad Laboratories, Hercules, CA) in a 20µl reaction volume containing 0.4µM of each primer and 19 SYBR Green Real-Time PCR master mixed (Toyobo). Cycling parameter was as follows: one cycle at 95°C for 5 min, follow by 40 cycles of 15 sec at 95°C, 15 sec at 56°C and 20 sec at 72°C. Triplicate quantitative real time PCR experiments were performed for each sample.
Results

Cloning and characterization F3H gene in M. charantia

Flavanone-3ß-hydroxylase (F3H) belongs to a family of 2-oxoglutarate-dependent dioxygenases (2-ODDs). It is a key enzyme to act as part of the flavonoid biosynthesis pathway which plays important roles in the interactions which occur between plants and their environment (Figure 1).

To obtain the full length sequence of F3H, the total RNA from seedlings of M. charantia was isolated and synthesized cDNA and then it was used to obtain the full length cDNA of genes by Rapid Amplification cDNA End (RACE) technology.

Full length nucleotide sequence of F3H gene has been cloned which comprises 1335 bp with its open reading frame (orf) was 1261 nucleotides long, translated into a putative protein that contains 370 amino acids.

A comparison of the deduced amino acids sequence homology of F3H gene between M. charantia and other species by utilizing BLAST algorithm was shown in Figure 2. The amino acid sequence of McF3H gene from M. charantia share 79 percent identity in Gossypium hirsutum F3H (GhF3H); 80% in Nicotiana tabacum (NtF3H); 84% in Dimocarpus longan (DlF3H) and 84% in Citrus maxima cultivar Feng Wei (CmF3H) respectively.
Figure 2. Alignment of amino acids sequences for F3H from M. charantia (Mc) with other F3H families from Gossypium hirsutum (GhF3H-GU434116), Nicotiana tabacum (NtF3H-AB289450), Dimocarpus longan (DlF3H-EF468104) and Citrus maxima (CmF3H-GU323284).

**Phylogenetic tree of F3H family**

A phylogenetic tree was built by using Tree Top-Phylogenetic Tree prediction program (http://www.genebee.msu.su/services/) in order to compare McF3H to other F3Hs from various plant species at the amino acid level (Figure 6).

From phylogenetic tree which indicates McF3H gene is closely relative to F3H gene which cloned from Fagopyrum esculentum (FeF3H) (accession no. HM149789). It also close to F3H from P. cyrifolia (PcF3H) (accession no. GU390545). However, McF3H is further relative to F3H from various species such as Gossypium hirsutum (GU434116); Nicotiana tabacum NtF3H (AB289450); Zea mays ZmF3H (NP_001105695); Arabidopsis thaliana AtF3H (NP_190692).
Expression of F3H in Bitter melon

McF3H gene expressed with highest level in male-flower and lowest in root and old-leaf (figure 4). This result has shown that F3H gene contributes significantly to flower anther and pollen formation, which had been discussed in earlier research (Deboo et al., 1995). On the other hand, a high expression of F3H gene when fruit is young and green (figure 4) is considered that necessity of F3H in flavonols production, rather than that of anthocyanins.

Figure 3. Phylogenetic tree of McF3H and some of its homologues: \( \text{L.chinensis} \) \( \text{LcF3H} \) (HQ402912); \( \text{F.esculentum} \) \( \text{FeF3H} \) (HM149789); \( \text{C.nitidissima} \) \( \text{CnF3H} \) (HQ290517); \( \text{P.cyrifolia} \) \( \text{PcF3H} \) (GU390545); \( \text{G.hirsutum} \) (GU434116); \( \text{N.tabacum} \) \( \text{NtF3H} \) (AB289450); \( \text{Z.mays} \) \( \text{ZmF3H} \) (NP_001105695); \( \text{A.thaliana} \) \( \text{AtF3H} \) (NP_190692). GenBank accession numbers are indicated in parentheses.

Figure 4. Expression of McF3H gene in the six different plant organs of \( \text{M. charantia} \).
Figure 5. Expression of McF3H gene in six different fruit maturation stages of M. charantia L.

Conclusion

This research has been done to clone and characterize F3H gene from phenypropanoid pathway in bitter melon which is necessary for the biosynthesis of flavonoids, the main ingredients of Bitter melon extract. Its expression was high in young fruit and reproductive organs where biosynthesis of compounds is likely occur frequently.

References

Development of Effective Procedure for Mediated Transformation of Bitter Melon (Momordica Charantia L.) by Agrobacterium Rhizogenes

Nguyen Thi Thanh Mai¹, Tien Huynh² and Sang Un Park³

¹Faculty of Agriculture, Forestry and Fishery, Vinh University, Vietnam.
²School of Applied Sciences, RMIT Melbourne, Australia
³College of Agriculture & Life science, Chung Nam National University, Korea. E-mail: thanhmainln@gmail.com

Abstract

Through this research, an efficient protocol for Agrobacterium rhizogenes-mediated transformation of bitter melon (Momordica Charantia L.) has been set up. Fine strains of soil bacteria A. rhizogenes (R1000, R1200, 13333, R1601 and R15834) were used to test the ability to transfer the T-DNA and link them into the plant genome through possibilities ability to penetrate and form "hairy roots". The results showed that strain R1000 has the ability to infect and stimulate the highest hairy root rates, the results corresponded to the cotyledon (85.0%), hypocotyls (91.6%) and the first leaf (93.3%) of bitter melon seedlings 4 weeks old respectively. For selection after gene transferring, geneticin at a concentration of 30 g L⁻¹ was determined for the most effective selection. GUS analysis results from bitter melon genome has identified the success of the T-DNA translocation into the plant's genome. GUS gene expression in hair roots of transgenic lines with strain R1000 were higher than the control.

Keyword: Agrobacterium(A.) rhizogenes, mediated Transformation, Bitter melon (Momordica charantia), Hairy roots.

Introduction

Momordica(M..) charantia is a tropical and subtropical vine of the family Cucurbitaceae and widely grown in Asia, Africa and Caribean. M. charantia contains rich of biologically active compounds such as glycosides, saponin, alkaloid, triterpenes [3,8]. These compounds have shown to have various and highly effective medicinal functions like anti-human immunodeficiency (HIV), antidiabetic, antitumor, antibaterial, antioxidant, and to function as febrifuge medicine for jaundice, hepatitis, leprosy [5; 8].

Hairy root culture is used to produce high productive and stable root contains valuable secondary metabolites that are valuable sources for variety of pharmaceuticals, cosmetics and functional foods [3]. Hairy root is obtained by infection with soil negative gram Agrobacterium(A.)rhizogenes. Its genes are turned on leading to transfer its T-DNA for its root induction plasmid (Ri plasmid) into plant through the wounding sites. The T-DNA containing the transgene of interest in a disarmed binary vector contains the root locus (rolA, rolB, rolC and rolD, as well as the auxin biosynthesis-encoding genes aux1 and aux2) genes (responsible for root proliferation) [5]. After integration and expression, the hairy root is observed in rapidly growth. This technique has led to commercial production of metabolic compounds that are difficult to cultivate in sufficient quantities by other means [7].

Establishment of hairy root from many species by infection with A. rhizogenes has been reported such as Platycodon grandiflorum [6], Lotus corniculatus [1], Scrophularia buergeriana [7], Scrophularia ningpoensis [4]. However, with our limited knowledge, no any study on transformation with A. rhizogenes from M. charantia has been reported. Therefore, the objective of the present study was the establishment an efficient protocol for transformation of M. charantia hairy root culture by A. rhizogenes to understand the molecular biological mechanism that regulates the synthesis of secondary metabolites. This protocol will be useful for studying and applying for the production of valuable metabolites such as phenolic compounds from M. charantia hairy root cultures.

Materials and Methods

Plant materials

Seeds of M. charantia were harvested in experiment green house of Chungnam National University (Deajeon, Korea) and kept in 4°C until used. For this experiment, the unhulled seeds were surface-sterilized with 70% ethanol for 30s and 10% bleach for 10 min with shaking and then rinsed three times in sterilized water. Sterilized seeds after blotting with autoclaved paper were placed in plastic box with medium consisting of 30 g L⁻¹ sucrose, half-strength inorganic salts, and vitamins of MS medium [10], solidified with 0.26% (W/v) phytagel. The medium was adjusted pH 5.8 before adding phytagel and then sterilized by autoclaving at 1.1kg cm⁻² (121°C) for 20 min. The seed were germinated in the grow chamber at 22–25°C temperature under...
standard cool white fluorescent tubes with flux rate of 35 mM s⁻¹ m⁻² and 16-h photoperiod. Cotyledons, hypocotyls and first leave from 5- to 6-d-old seedlings were used as explant sources for transformation.

**Time and place**
This research was carried from October 2010 to March 2011 in plant molecular physiology Lab, Agriculture and Life science College, Chungnam National University, Korea.

**Optimization of hairy root culture conditions**
For the selection of optimal *A. rhizogenes* strain, five different strains 13333, R1000, R1200, R15834 and R1601 were used on the induction of hairy roots from cotyledon, hypocotyl and first leaf of *M. charantia* seedlings. The strains contain pBI121 plasmid as transformed vector. The pBI121 vector contains a cauliflower mosaic virus (CaMV) 35S promoter::GUS fusion sequence and the neomycin phosphotransferase gene (NPTII) as a selectable marker. This binary vector was electrophoresed into *A. rhizogene* strains. *A. rhizogenes* cultures were inoculated from glycerol stock and grown overnight at 28 °C shaking (180 rpm) in liquid Luria–Bertani medium (1% tryptone, 0.5% yeast extract, and 1% NaCl, pH 7.0) containing kanamycin (50 mg L⁻¹) in darkness. The bacteria were cultured 24h to mid-log phase OD A600 0.5. Cells were then collected by centrifugation for 10 min at 3000 rpm and resuspended in liquid inoculation medium half MS. (1/2MS salts and vitamins containing 30 g L⁻¹ sucrose). Cell density was adjusted to an OD A600 of 1.0 for inoculation. The various concentration of kanamycin (0, 50, 75, 100, 200 and 300 mg L⁻¹) and geneticin (0, 5, 10, 20, 25, 30, and 50 mg L⁻¹) were tested to get the best condition for plant selection.

### Materials and Methods

**Establishment of hairy root transformation**
The different kind of seedling explants were wounded randomly by using a scalpel, immersed in an *A. rhizogenes* culture suspended in liquid inoculation medium for 10-15 min, blotted dry on sterilized filter paper and incubated in the dark on ½ MS medium. After 2d of co-cultivation, the explants were transferred to hormone – free selection within 4-5 weeks, numerous genetin resistant roots had emerged from the wounded sites. The hairy roots were separated form explant tissue and sub-culture in the dark at 25°C on hormone-free selection medium. After repeated transfer to fresh selection medium, rapidly growing hairy roots culture were obtained.

2.5. PCR analysis for GUS and rolB gene
Plant genomic DNA for polymerase chain reaction (PCR) analysis was extracted as described by Edwards [2]. After that, they were subjected to PCR analysis specific to the rol genes with the primers (table 1). The amplification cycle consisted of denaturation at 95°C for 1 min, primer annealing at 55°C for 30 s and primer extension at 72°C for 1 min. After 30 repeats of the thermal cycle and final extension 72°C for 10 min. Products electrophoresed on a 1% agarose gel. Gels were stained with ethidium bromide and visualized under UV light.

2.6. Total RNA isolation, cDNA synthesis and quantitative real-time PCR
Total RNA was extracted from 100 mg *M. charantia* hairy roots by manufacturing recommended protocol (Invitrogen, Carlsbad, CA). Reverse transcription of 1 µg total RNA was performed through the manufacturer’s procedure (ReverTra Ace-a-; Toyobo, Osaka, Japan) using an oligo(dT)20 primer. The resulting cDNAs were used as templates for real-time PCR.

Transcriptional level analysis of GUS expression in *M. charantia* hairy roots was performed by qPCR using a Mini Opticon Real-time PCR system (Bio-Rad Laboratories, Hercules, CA). Primers designed from full-length GUS cDNA sequences were highly specific for a gene confirmed by the online program (http://frodo.wi.mit.edu/primer3). Real-time PCR was carried out in a 20 µl reaction volume containing 0.4 µM of each primer and 19 SYBR Green Real-Time PCR master mix (Toyobo). Amplification was conducted as recommended by the manufacturer cycling parameters. Triplicate experiments were performed for each sample.

### Table 1. List of PCR primers used in this experiment

<table>
<thead>
<tr>
<th>Name of primer</th>
<th>Sequences (5′ – 3′)</th>
<th>For use</th>
</tr>
</thead>
<tbody>
<tr>
<td>RolB_F</td>
<td>TCAAAATGGATCCAAATTTG</td>
<td>Genomic DNA PCR</td>
</tr>
<tr>
<td>RolB_R</td>
<td>TTCAAGTCGGCTTTAGGCTT</td>
<td></td>
</tr>
<tr>
<td>GUS_F</td>
<td>ATCGGTGCACATGTTAGCTCTGTAGAAAC</td>
<td></td>
</tr>
<tr>
<td>GUS_R</td>
<td>CGATCCATGGTCATTGGCTCCTCCCTGCT</td>
<td></td>
</tr>
<tr>
<td>GUS_qRT-F</td>
<td>TTACCCTTACGCTGAGAGATGC</td>
<td>Real-time PCR</td>
</tr>
<tr>
<td>GUS_qRT-R</td>
<td>GCTGTACAGTTCTCTCGGCTTGT</td>
<td></td>
</tr>
</tbody>
</table>
Results and Discussion

Establishment of *M. charantia* hairy root cultures

Five different *A. rhizogenes* strains (R1200, R1000, 13333, R1601 and R15834) were used to check their ability to induce the formation of hairy roots on three explant types of *M. charantia* (cotyledon, hypocotyl and first leaf). All strains of *A. rhizogenes* induced hairy roots at infected sites (figure 1).

![Figure 1](image)

*Figure 1*. Development of hairy root from a hypocotyl explant of *M. charantia* after inoculation with *A. rhizogenes* strain R1000 (a), rapidly hairy root culture in phytalgel-solidified medium (b) and liquid culture (c).

Among these strains, R1000 strain infected with the highest frequency on all three different explants examined, being 85.00, 91.67 and 93.33 % for cotyledon, hypocotyl and first leaf explants, respectively. By the contract, R1601 and R15834 strains induced hairy roots in low frequency and some explants were damaged and dead after 2-d co-cultivation. It was suggested that these strains are highly virulent to infect *M. charantia* explants. On the basis of these results, we decided to use R1000 strain for our further study.

Table 1. Effect of different strains of *A. rhizogenes* on hairy root induction of *M. charantia* explant after 4 weeks in culture.

<table>
<thead>
<tr>
<th><em>A. rhizogenes</em> strains</th>
<th>Cotyledon</th>
<th>Hypocotyl</th>
<th>First leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1200</td>
<td>82.66 ± 5.0</td>
<td>89.33 ± 4.1</td>
<td>89.00 ± 3.5</td>
</tr>
<tr>
<td>R1000</td>
<td>85.00 ± 3.1</td>
<td>91.67 ± 3.4</td>
<td>93.33 ± 2.5</td>
</tr>
<tr>
<td>13333</td>
<td>81.65 ± 4.1</td>
<td>89.00 ± 4.9</td>
<td>84.33 ± 5.5</td>
</tr>
<tr>
<td>R1601</td>
<td>41.60 ± 4.1</td>
<td>49.67 ± 3.7</td>
<td>49.00 ± 5.0</td>
</tr>
<tr>
<td>R15834</td>
<td>41.00 ± 4.0</td>
<td>45.67 ± 5.3</td>
<td>57.67 ± 4.1</td>
</tr>
</tbody>
</table>

Roots induced by *A. rhizogenes* fast growing, and sometimes having branches which varied in their morphological nature (figure 1). They are considered as genetically stable. These hairy roots can be used as an interesting material for the production of secondary metabolites of pharmaceutical value.

To determine the appropriate antibiotics and concentration to use for plant selection, kanamycin and geneticin were used to test. On the medium with extremely high concentration of kanamycin (up to 300 mg L\(^{-1}\)) as well, frequency of hairy root formation was very high too (more than 70% explants induced hairy roots). However, geneticin supplemented in media inhibited the formation and development of hairy roots induced by wild-type *A. rhizogenes* R1000. Hairy roots infection frequency was approximately 70% on medium with 5 mg L\(^{-1}\) geneticin. These infection frequency reduced drastically while increase geneticin concentration and in both 30 mg L\(^{-1}\) and 50 mg L\(^{-1}\) geneticin - media completely inhibited the development of hairy root from explants (Table 2). Therefore, for the remainder of the study, we used 30 mg L\(^{-1}\) geneticin media to select for transformed hairy roots.
Table 2. Effect of various genetin concentrations on hairy root induction and growth in *M. Charantia*

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Concentration of Antibiotics (mg L(^{-1}))</th>
<th>Hairy roots induction frequency (%)</th>
<th>No. of hair roots / explant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>100</td>
<td>8.0 ± 0.4</td>
</tr>
<tr>
<td>Kanamycin</td>
<td>50</td>
<td>100</td>
<td>7.5 ± 0.3</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>100</td>
<td>7.3 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>6.5 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>82.5 ± 5.3</td>
<td>5.0 ± 0.7</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>65.0 ± 3.5</td>
<td>3.5 ± 0.4</td>
</tr>
<tr>
<td>Genetin</td>
<td>5</td>
<td>73.3 ± 4.73</td>
<td>5.1 ± 0.7</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>45.0 ± 3.53</td>
<td>3.0 ± 0.4</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>29.15 ± 2.93</td>
<td>2.0 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

After 2 days of co-cultivation with *A. rhizogenes*, explant were transferred to 1/2 MS medium containing 250 mg L\(^{-1}\) cefotaxime to eliminate the *Agrobacterium* and 30 mg L\(^{-1}\) genetin for selection.

Figure 2. Evaluation of the growth capacity of *M. charantia* hairy root in half MS medium for 27 days. Values represent the mean of 3 independent measurements ± SD.

Hairy roots emerged from wound sites of cotyledon, hypocotyl and first leaf explants within 20 days of inoculation. Approximately 4–6 weeks after co-cultivation with *A. rhizogenes*, hairy roots were subcultured on fresh medium containing appropriate antibiotics for growing more. After repeatedly transferring to fresh medium, rapidly growing hairy roots were transferred to liquid medium for 27 days. The growth of hairy roots of *M. charantia* was investigated by harvesting 6 flasks at 3-day intervals. As the culturing time increased (27 days), the fresh weight of the hairy root cultures increased from the original inoculum level of 2.1 mg L\(^{-1}\) to 34 mg L\(^{-1}\). The maximum growth (34 mg L\(^{-1}\)) after 27 days of culture (Figure 2).
3.2. Molecular analysis of transgenic bitter melon hairy roots

![Image of gel electrophoresis showing bands for rolB and GUS genes]

**Figure 3.** PCR amplification of the rolB and GUS gene from transformed genomic DNA isolated from wild type hairy root (Lanes W1 and W2) and hairy root from first leaf explant of M. charantia transformed with R1000 (Lanes G1-G5). Lane M: molecular size markers, lane W1, W2: wild type roots and lanes G1-G5: various hairy root lines.

To determine whether pBI121 had transformed successfully, we assayed for integration of the GUS gene into the plant genome. In five transformed hairy root lines (G1-G5) induced from R1000 which contain transgenic vector pBI121 and 2 wild type hairy root lines (W1 and W2) were used as a negative control. Hairy roots were selected randomly for DNA analysis. PCR specific primes for rolB and GUS gene were used to amplified these genes in plant genome. (table 4).

The rolB gene of the Ri-plasmid which responsible for the induction of hairy roots by A. rhizogenes. Cumulatively, these results revealed that wild-type (W1 and W2) and transgenic hairy roots contained rolB gene of the Ri-plasmid in A. rhizogenes (G1-G5) showed amplified band whereas amplified band of GUS gene have just expressed in transgenic hairy roots. The presence of GUS gene and GUS expression were further confirmed by qRT-PCR (figure 3)

3.3. Quantitative RT-PCR

![Image of bar graph showing GUS expression levels]

**Figure 4.** Quantitative RNA analysis of GUS gene expression in wild type roots (WT1 and WT2) and hairy roots transformed with A. rhizogenes R1000 (pBI121) (I-V). The value for each line is the mean of 3 replication ± SD.

After confirming the integration of GUS gene into plant genome by standard PCR, the transcription of the all these hairy roots were detected for GUS transcription level by quantitative RT-PCR. Quantitative RT-PCR RNA analysis revealed the higher levels of GUS transcripts in all of the transgenic hairy root cultures (I-V) than those in wild type hairy roots (W1-2) of M. charantia (Figure 4).
Conclusion

This research has been done to establish an efficient protocol for \textit{Agrobacterium rhizogenes}-mediated transformation of bitter melon. Among five \textit{A. rhizogenes} used (R1000, R1200, R1601, 13333 and 15834), R1000 strain was the best for infecting and inducing hairy roots from bitter melon.

Hairy roots induced by \textit{A. rhizogenes} fast growing in either phytagel-solidified or liquid medium and sometimes having branches which varied in their morphological nature. They are considered as genetically stable.

This approach is the rapidly and technical simplicity of \textit{A. rhizogenes}. It becomes a valuable tool for basic plant research, as well as a used full technique for metabolic engineering in the biosynthesis of secondary metabolites.

References


Pathogenicity and Antimicrobial Activity of *Streptococcus* sp. Isolated from Siamese Fighting Fish (Betta Splendens Regans)

Chutharat Kanchan¹*, Puttachat Imjai¹, Aonanong Chaiyara² and Nukoon Kanchan³

¹Aquaculture Technology Program, Faculty of Agricultural Technology, Rajabhat Maha Sarakham University, Maha Sarakham 44000, Thailand
²Fisheries Program, Faculty of Agriculture Technology, Sakon Nakhon Rajabhat University, Sakon Nakhon 47000, Thailand
³Animal Production Technology Program, Faculty of Agro-Industrial Technology, Rajamangala University of Technology Isan Kalasin Campus

(¹author for correspondence, E-mail: cmunchan@yahoo.com)

**Abstract**

*Streptococcus* sp. was isolated from diseased Siamese fighting fish *Betta splendens* Regans. The virulence of *Streptococcus* sp. to Siamese fighting fish was conducted by intraperitoneal injection of two doses of bacterial suspensions with 7.5x10⁷ and 7.5x10⁵ CFU per 0.05 ml. The cumulative mortality was observed in high and low dose groups which showed 95 and 40 percent, respectively. Moreover, the antimicrobial activities of six drugs viz. amoxycilin, ciprofloxacin, enrofloxacin, oxytetracycline, sulphamethoxazole-trimethoprim and trimethoprim were determined. *Streptococcus* sp. was sensitive to ciprofloxacin, enrofloxacin, sulphamethoxazole-trimethoprim, oxytetracycline and trimethoprim whereas its resistance to amoxycilin. Two medicinal plants extracts namely *Terminalia catappa* and *Centella asiatica* were tested. Crude extracts were performed for antimicrobial activities by broth dilution method. The results showed that the Indian almond extract had the higher antimicrobial effect than Asiatic pennywort extract. The MIC values were 6.25 and 12.5 mg/ml and the MBC values were 12.5 and > 200 mg/ml, respectively.

**Keywords:** Antimicrobial activity, Pathogenicity, Siamese fighting fish, *Streptococcus* sp.

**Introduction**

Siamese fighting fish is an economically major species of ornamental fish in Thailand. As an ornamental fish, the males have more attractive colors and fins [2]. Bacterial diseases is the most common infectious problem of ornamental fish. In this study, we could be isolated *Streptococcus* sp. in the diseased siames fighting fish. The diseased fish showed some clinical signs namely fin rot, abdomen enlargement; kidney distention with white nodules. *Streptococcus* sp. is a septicemic diseases that affects whether freshwater and marine tropical fish and food fish such as zebra danios *Brachydanio rerio* and pearl danios *Brachydanio albolineatus* [4], Nile tilapia *Oreochromis niloticus* [11]. Moreover, *Streptococcus* sp. is a gram-positive bacteria with caused a disease in ornamental fish [6]. Diagnosis of bacterial disease of fish required observation of common clinical signs associated with the disease, isolation and identification of the causative bacterial organisms and confirmation with animal inoculation is important to fish culturist and fisheries managers [1]. The degree of virulence of its bacterium therefore is importantly studied in the aquaculture field. Moreover, the most common approach to eliminate bacterial disease is used of antibiotics [13] and [11]. Therefore, misuse of any antibiotics can lead to the establishment of resistant bacteria and accumulation of antibiotic residues in the environment. The alternative treatment by using some medicinal plants have been investigated for pathogenic bacteria [3],[5] and [8]. The aims of the present studies are to study the pathogenesis of *Streptococcus* sp. against Siamese fighting fish and to study the antibacterial activity of some medicinal plants.

**Materials and Methods**

**Fish**

Ninety-healthy Siamese fighting fish (average 3.67 g in body weight and 9.72 cm in body length) were used in this study. The experiments were carried out at the Faculty of Agricultural Technology, Rajabhat Maha Sarakham University.

**Preparation of the inocula**

*Streptococcus* sp. isolated from diseased Siamese fighting fish was used in challenges. Concentrations of bacterial suspension were adjusted to 7.5x10⁷ and 7.5x10⁵ CFU per 0.05 ml by using 0.5 McFarland standard.
Experimental infection
The virulence of *Streptococcus* sp. to Siamese fighting fish was conducted by intraperitoneal injection of two doses of bacterial suspensions. The experimental infection was divided to three groups; 30 fish per group (total 90 fish). Group 1, 2 were challenged with high and low bacterial concentration, respectively. Group 3 was a negative control inoculated with sterile normal saline. A 0.05 ml of inoculum was intraperitoneally injected in each group according to [12] with few modifications. All experiment groups were maintained in 1 L of individual aquarium. Mortalities were recorded daily for 2 weeks post injection with bacterial suspension. Both dead and survived fishes were re-isolated from the kidney for evaluated the etiologic evidence of fishes.

Antibacterial drugs susceptibility test
The antimicrobial activities of six drugs viz. amoxycilin, ciprofloxacin, enrofloxacin, oxytetracycline, sulphamethoxazole-trimethoprim and trimethoprim were determined [7]. Briefly, Muller Hinton agar were prepared and the bacterial suspension with $6.0 \times 10^8$ CFU/ml were inoculated by spread plate method using sterile cotton swab. Then, antibiotic discs were placed on the media and incubated at 30 °C for 18-24 hours. The experiments were performed in triplicate in each drug. After incubation, the diameter of the zone of bacterial growth inhibition were measured.

Preparation of herbal extracts
Two herbal extracts including *Terminalia catappa* and *Centella asiatica* were carried out according to [8] with slight modifications. Briefly, 50 g of each plant powder and 200 mL of 95% ethanol were mixed for 48 h at a room temperature. Then, the aqueous extracts were filtered and concentrated in vacuum at 40 °C using rotary evaporator. These extracts were dissolved in dimethyl sulphoxide to make the final concentrations.

Antimicrobial activity of leave extracts against *Streptococcus* sp.

**Determination of minimum inhibitory concentration**
In order to determining minimum inhibitory concentration (MIC), a serial two-fold dilution of each plant extract with Muller Hinton Broth were prepared in sterile 96-well microtiter plate as follow: 200, 100, 50, 25, 12.5, 6.25, 3.125 and 1.563 mg/mL. Then, the bacterial suspensions were added in each well and incubated at 30 °C for 18-24 hours according to [9] with few modifications. The experiments were conducted in triplicate. The MIC was observed in the minimum concentration of each plant extract that could be inhibited the growth of bacteria.

**Determination of minimum bactericidal concentration**
Fifty microliter of each clear well were inoculated into Muller Hinton Agar and incubated at 30 °C for 18-24 hours. The experiments were done in triplicate. The MBC was observed in the minimum concentration of each plant extract that could be killed the growth of bacteria.
Results

*Streptococcus* sp. was isolated from diseased Siamese fighting fish *Betta splendens* Regans. The present studies aims to study the pathogenesis of *Streptococcus* sp. against Siamese fighting fish and to study the antibacterial activity of some antimicrobial drugs and medicinal plants. The results are described as follows:

Mortality

The cumulative mortality was observed in high and low dose groups which showed 95 and 40 percent, respectively. The mortality data was corresponded with re-isolation from the kidney of dead fishes. Thus it seems that *Streptococcus* sp. was a pathogenic bacteria base on the results of mortality and re-isolation.

Antibacterial drugs susceptiblility test

*Streptococcus* sp. was sensitive to ciprofloxacin, enrofloxacin, sulphamethoxazole-trimethroprim, oxytetracycline and trimethroprim whereas its resistance to amoxycilin.

Antimicrobial activity of leave extracts against *Streptococcus* sp.

**Determination of minimum inhibitory concentration and determination of minimum bactericidal concentration**

Two medicinal plants extracts namely *Terminalia catappa* and *Centella asiatica* were tested. Crude extracts were performed for antimicrobial activities by broth dilution method. The results showed that the Indian almond extract had the best antimicrobial effect than Asiatic pennywort extract. The MIC values were 6.25 and 12.5 mg/ml and the MBC values were 12.5 and > 200 mg/ml, respectively.

**Table 1** Antimicrobial activity of six drugs against *Streptococcus* sp.

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Inhibition zone size (mm)*a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AML</td>
</tr>
<tr>
<td><em>Streptococcus</em> sp. resistant</td>
<td>35.23±1.30</td>
</tr>
</tbody>
</table>

*a Each result is the mean±S.D. of three replicates. AML = Amoxycillin, CIP = ciprofloxacin, ENR = Enrofloxacin, OT = Oxytetracyclin, W = Trimethoprim and SXT = Sulphamethoxazole-Trimethoprim

**Table 2** Antimicrobial activity of leave extracts against *Streptococcus* sp.

<table>
<thead>
<tr>
<th>Herb</th>
<th>MIC (mg/ml)</th>
<th>MBC (mg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Terminalia catappa</em></td>
<td>6.25</td>
<td>12.5</td>
</tr>
<tr>
<td><em>Centella asiatica</em></td>
<td>12.5</td>
<td>200</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

*Streptococcus* sp. is a septicemic diseases that affects whether freshwater and marine fish [4] and [13]. Moreover, *Streptococcus* sp. is a gram-positive bacteria with caused a disease in ornamental fish [6]. The diseased fish showed some clinical signs namely fin rot, abdomen enlargement; kidney distention with white nodules. The pathogenicity results showed that *Streptococcus* sp. was a pathogenic pathogen to the Siamese fighting fish according to the mortality rate of 95% which corresponded with [13] reported that *Streptococcus* infections could be caused high mortality rates (>50%) within one week. For antimicrobial suspetibility testing of antibiotic drugs against *Streptococcus* sp. showed ciprofloxacin, enrofloxacin, sulphamethoxazole-trimethroprim, oxytetracycline and trimethroprim were highly effective drugs whereas there was no effect from amoxycilin. In addition, the antimicrobial activity of two medicinal plants extracts showed that the Indian almond extract had the best antimicrobial effect than Asiatic pennywort extract. It was similar to [10] revealed the potential of Indian Almond extract to control bacteria in Siamese fighting fish namely *Streptococcus* sp. From these results could be suggested that ciprofloxacin and Indian almond extract were the best antibacterial activity for curing the bacterial disease causing by *Streptococcus* sp.
The authors are grateful thanks to research grant of Rajabhat Maha Sarakham University for the research support.

References


Sustainable Development of Agriculture, Rural Areas and Farmers in Vietnam: Achievements and Challenges

Tran Tu Khanh, Nguyen Thi Minh Phuong* and MA. Cao Thi Thanh Van

Economics Department – Vinh University
182 Le Duan, Vinh city, Nghe An province
Vietnam

(* author for correspondence, E-mail: minhphuongn78@yahoo.com)

Abstract

In Vietnam, the population living in rural areas accounts for nearly 70% and nearly 60% employees working in the agricultural sector. Thus, the policy directions and solving problems of developing agriculture, farmers, rural areas play an important part and is the task of the political - social system. This article assesses the achievement of policies on developing agriculture, farmers and rural areas in Vietnam in recent years, and give the challenges and propose solutions to help the sustainable development of Vietnamese agriculture, farmers and rural areas in the coming years in the context of international integration.

Keywords: Sustainable development, Agriculture, Rural areas, Farmers

Introduction

1. Approach

Agriculture, farmers and rural areas are hot and persistent issues. Vietnam is proud of being the country of wet rice civilization. Also it is proud to be a leading exporter of rice, coffee, cashew, rubber, catfish, shrimp - products of farmers’ hard working.

According to many experts, although the contribution of agriculture to national GDP is only about 20% and only 23% in export, judging from the look of the agricultural labor force, Vietnamese farmers’ ability is prominent. Back in the early years of industrialization and modernization period when the country’s economy in general and agricultural economy in particular faced many challenges, agricultural workforce was classified as fragmented production style, arbitrary labor discipline, shallow economic thinking, etc... Now we can see how great the contribution of this manufacturing sector has been in recent period.

One fact that is happening is that income and consumption per capita of rural economic area is two times lower than urban area and the difference is likely to increase. According to the calculations of experts, in the next two decades, there will be one quarter of the rural population moving to urban areas to find employment opportunities. If it happens, that the rural areas are left behind in the development process is unavoidable. So far the issue of agriculture, farmers and rural areas has received many concerns. Vietnam’s agriculture and rural areas have faced many challenges to move forward to industrialization and modernization. However, to reduce inequality, wealth gap between urban and rural areas, the program of agriculture, farmers and rural areas should be deployed on all aspects: training, improving the quality of human resources, building new rural areas and creating legal institutions and fostering responsibilities of communities in rural areas.

2. Research Methodology

Information presented in this article are mainly collected through published document and documents on the Internet. The basic method for analyzing in this article is the systematic approach to Vietnam agriculture, manipulating the viewpoint of economic development theories of development economists to assess and analyze the theoretical and practical issues for economic development in general and the development of agriculture and farmers in Vietnam in particular.

3. Achievements and challenges of agriculture, rural areas and farmers in Vietnam in the period of international integration

3.1. Achievements

According to the report of the Standing Committee of the National Assembly at the 3rd Session of the National Assembly XIII, in the period 2006-2011, the total investment for agriculture, farmers and rural areas from the state budget and government bond was 432788 billion VND. In particular, investment in agriculture, forestry and fishery was 153548 billion VND (35.48%); social infrastructure development to reduce poverty in rural areas was 279 240 billion (64.52%). After the issuance of 7th Resolution 7th (X plenum), in the period 2009-2011, investment in agriculture, rural areas and farmers gained more attraction and increased significantly.
Total investment capital in 3 years was 286212 billion, accounting for 52.3% of the total investment capital for development from the state budget and government bond, was 1.95 times higher than the period before the issuance of Resolution (2006-2008). [2]

Thanks to the investment in agriculture, rural areas and farmers, we could witness the gradual innovation and development in rural areas. The living conditions of the rural population continued to improve; agricultural infrastructure continued to be upgraded and gradually modernized. The average growth rate of agricultural sector in the period 2006-2010 was 3.36% per year. Production value of the industry increased by 4.69% in 2010; the average increase in 5 years was 4.93% per year (planned target was 4.5% per year). The total value of agricultural exports in 2010 hit record levels, reaching 19.15 billion US dollars. The increase was nearly 22.6% compared to 2009, exceeding the 77.3% target set up at the Tenth Party Congress. The total area of rice cultivation in 2010 was 7,444 million hectares, increased by 23 thousand hectares compared to 2009. But production increased more than 900 thousand tons, insured domestic food security and exported 6.7 million tons of rice. The total value of livestock production grew 7% in 2010. Forest coverage increased from 37.1% in 2005 to 39.5% in 2010. In the period 2006-2010, 1,091 hectares of forest was planted, exceeded 9% compared to the plan. The total fishery in 2010 was nearly 5.2 million tons, increased by 7.2% compared to 2009, exceeding 30% compared to 5-year plan target. [1]

In addition, irrigation system with many important projects was invested. So far the total irrigation capacity of the irrigation system has raised to about 3.45 million hectares of arable land; rural transportation infrastructure was rationally allocated; health care system in rural areas was invested to expand and upgrade the quality. In 2011, 40% village met national standard for social community health care; 94.2% village had their own community health workers (89.2% in 2006).

After more than a year of implementation, the new rural construction program has received many positive results. All 63 provinces and cities have completed the preliminary assessment of the new rural area situation by 19 criteria. At the end of the year 2011, about 52% of the village was drawing up plan of new rural construction. Agricultural insurance program after more than a year of implementation was deployed in all 20 provinces and cities with 98294 households signing insurance contracts (in which 88% was poor household) with 959.4 billion VND insurance value of crops and livestock and 48.7 billion VND premium.

Besides, the central budget has given assistance to overcome the consequences of natural disasters and epidemics. The support amount in 3 years alone (2008-2010) was up to 11217 billion VND, not counting hundred thousand tons of rice to help poor households from hunger and effect of disaster. The state budget spent on agriculture, rural areas have increased rapidly over the years. Specifically, cost estimates for this sector in 2009 increased 34.7% compared to 2008 and in 2010 increased by 29.7% compared to 2009. In 2011 cost estimates increased 26.5% compared to 2010, raising the proportion of expenditure on agriculture, farmers and rural areas in total spending from the state budget from 39.3% in 2010 to 39.8% in 2011.

Owing to policies and legislation for investment in agriculture, farmers and rural areas, rural infrastructure was strengthened. Farmers' life is guaranteed, contributing to political security and strengthening national capabilities. In the last 5 years, food has been firmly secured with the average of 509 kg per capita. Fishery production reached 2.9 million tons, poverty rate fell from 21.45% (2006) to 9.5% (2011). Vietnam became the leading rice exporter in the world (in 2011, exported 7.2 million tons of rice).

However, despite trying to increase public investment in agriculture, farmers and rural areas to over 52% of total development investment from the State budget and Government bonds, only about 55-60% met the actual demand.

3.2. Challenges

* Obstacle to land consolidation

In recent years, Vietnam has actively implemented land consolidation to create favorable conditions for agricultural production. However, in many places, the implementation still faces many difficulties and problems. The reason why land consolidation progress has been slow is that it is impossible in the midland and mountainous districts, where most of productive land is terraced fields. In the terraces, because the distance between steps from 1 to 2m, land consolidation cannot be applied. But if land consolidation is not implemented, it is impossible to bring mechanization to land preparation and harvesting. In addition, land consolidation in most localities relied heavily on part-time officers, specialized staff who were too thin and weak. In some place there were no officers. Thus, implementing this program was very difficult. On the other hand, the government, organizations are not aggressive enough because many people said it is the responsibility of the agriculture sector, of members of the Steering Committee, district to village. Leaders of some districts and cities also said that terraces occupied most of the area and there is the cause of low funding support from the State. Based on research in many localities, the progress of land measurement, correction of documents the change of land and renewal of certificates of land use rights after consolidation was too slow. Critical stage is also on fund allocation.
difficulties in irrigation

A series of arable land must be abandoned because there is no water reservoirs, dams, canal systems. Meanwhile, many irrigation works with the investment of billions VND could not prove efficiency and were rapidly degraded or damaged.

Not long ago, Vietnam agriculture was invested to build permanent dam system for irrigation. However, when the construction was completed, there was not a single drop of water because of the errors in design and survey. Due to weak geological foundation in this area, long heavy rain would lead to erosion, causing bad damage to the concrete channel and cemented roof. Moreover, soil and waste came with water into box-channel system, leading to pressure difference, causing burst and breakages at many points.

Lack of capital, information and labor

In the past time, many people accessed to preferential loans for economic development purpose, especially in the agriculture, forestry and fisheries fields. But now it is very difficult for them to achieve the expected loans. In fact, most of household’s garden size in some places is small and fragmented. In particular, land potential is untapped adequately. Nowadays in the province thousands of hectares of land are hilly gardens, forest gardens. The gardens are abandoned or unproductive. The main reasons are due to farmer’s lack of capital, meanwhile the access to state’s preference credits asks for many criteria and procedures. The farmers cannot borrow commercial loans from the banks because of no collateral. Besides trusted borrowing style only gives them about few tens of million as banks “fear” that farmers are not able to pay total principal and interest amounts when epidemics occur continuously.

Due to lack of market-oriented information, farmers continually face the risks associated with the consumption of key agricultural commodities. In recent years, a series of famous specialty crops such as cinnamon, sugar cane, cotton, pineapples, cassava has not brought economic efficiency. Thousands of farmers have to cut down and turn cinnamon into firewood. Also they suffer from “the devaluation season” and vice versa.

In practice in many localities, young workers working far away is also a concern because they do not find the healthy young to do farm work in the season. In many places, the labor force in agriculture is a serious shortage. Now farmers are mostly the elderly, women and children. They do not earn much from rice and legumes. Many young and middle-aged workers left field. Many people calculated, in favorable conditions, 1 acres of land can produce 300 kg dry rice. With the price of 5 thousand dong per kg, the total value of sales is 1.5 million. Meanwhile, the cost of fertilizers and plant protection products and plowing and infield irrigation fees has soaked up 2/3 of this amount. Nurturing for more than 3 months, only for achieves 500 thousand net incomes, that is too low. Many farmers said that this time, they could earn this amount by only 3 days if working in a city as a mason.

Mechanization of production is an important part in the agricultural – rural industrialization and modernization strategy. However, in the future, if the inadequacies of the State’s credit policy for farmers are not solved, the mechanization of agricultural production of farmers in Vietnam will be limp.

Join WTO

As a global trade regime, the WTO activities complying with the principle of non-discrimination, to create stable platform for development, ensure free trade through negotiation, competitive environment for the equality and preferential terms to developing countries. From the perspective of the opportunities and challenges for agriculture, rural areas and farmers, when implementing WTO commitments, Vietnam has a chance for agricultural products to penetrate deep into the world market, promote best advantages of tropical agriculture in global trade, increasing foreign investment to develop agriculture and rural areas. Joining the WTO is the highest rung in the process of opening up the economy and global economic integration. It is a great opportunity for our country to exploit the advantages that the integration process brings. However, joining the WTO is also a big challenge for the agricultural economy like Vietnam.

According to experts, the implementation of WTO commitments brings many problems to agriculture, rural areas and farmers such as how to retain the market share of farm produce in its “homeland”. There are questions on how to start, what and how they should do to reduce the disadvantages when facing difficulties due to competition from foreign agricultural products. Farmers receive compensation but do not know how to use effectively. They find business opportunities; accept to be the employees but cannot find work due to low skill levels.

Vietnam’s rural economy is largely a spontaneous development, lacks planning and it is passive in the sale of products. Looking at the list of 94 calling - FDI key national projects in 2006-2010 period (nearly 26 billion U.S. dollars) shows evidently imbalance between industrial sectors - construction to agriculture - rural. In this list there is only one project for agriculture and animal husbandry, forestry and 4 for fisheries projects. We do not produce standard agricultural products because we have no major and focus production base, standard technology process; and connection between production and consumption. So far, 90% of raw agricultural products are still sold and 60% juice products are sold at low prices. Production is very fragmented and small.
On average, each household has only 2.5 workers (mostly female workers), and only about 0.7 ha of cultivated land. According to a survey of the Ministry of Agriculture and Rural Development, only 25% of farmers have access to market information. Agricultural restructuring, the restructuring of the rural economy has been uneven as well as slow. So far there have been 77% of the purely agricultural households, only 1.6% decrease compared to 10 years ago.[1]

4. Solutions to develop Vietnamese stable agriculture, rural areas and farmers

* Focus on irrigation, field refurbishment

Because the number of invested and constructed irrigation is too little, the damaged irrigation canal systems during the flood period are not fixed. In the future, Vietnam has to invest and build as well as coordinates with other departments to utilize the legal funds in possible conditions. In particular, the province focused on building dams system, permanent canals in the area where there are frequent droughts, and support the pipes for a number of high mountain hamlets to bring water from the stream to fields, and also assign the people involved in monitoring the construction of irrigation works at the same time. To accelerate this task, the province has to attract local citizens’ consensus. If the area of land consolidation implementation of a village is 10 hectares at least, the state budget will support the hamlet’s Steering Committee 3 million and the people committee from 7 to 10 million. To the districts or cities’ Steering Committee, based on the implementation area in local places, provincial budget will support 30 thousand dongs per ha. Besides, to timely measure the land, adjust vary cadastral resumes and grant renewal certificates of land use rights for farmers after land consolidation as last time, from now on provincial budget will support 400 thousand dong per ha for related industry which rapid implement this stage. In particular, in order to help farmers more in the production process, the province will raise more funds to support the local authorities such as 50% of funds for construction of the main field’s shaft lines and the sewers cross streets. Provincial budget also supports 2 million per ha for field refurbishment.[3]

However, many people believe that to effectively implement this stage, there should be drastic involvement in of the whole political system, but do not put it on the agriculture industry’s shoulder and it’s more important that it should gain people's consensus. The farmers could see real benefits from this work. In particular, it has to quickly enhance and improve the professional of specialized staffs mainly in land measuring, cadastral testing, the change, and renewal certificates land use for farmers after land consolidation.

* Crop and livestock insurance

According to statistics, in recent seven years, blue ear disease, H5N1 flu, foot and mouth disease, cholera, paratyphoid, pasteurellosis have infected, causing death of a lot of cattle and poultry in Vietnam. The main reason is lumbering in inoculation stage, and the rate of herd vaccination was only 15% - 65% per year. Prevention of epidemics, crop insurance, livestock, seed improvement and change production practices are considered as fundamental solution to create incentives for livestock development in the direction of merchandise, stable and sustainable in the coming years.[2]

According to experts as well as the researchers if we wanted the breeding industry to become the main production sectors in agriculture, Vietnam should focus to develop as central direction. Accordingly, we have to rapidly improve seed quality, enhance mechanisms to support the investment in breeding development, procurement of new equipment and specially training local veterinarians strong enough to raise early cattle with hybridized blood in the next time.

* Improve production custom

Statistics show that, at present fragmented livestock are counted up to over 87% of herds and 85% of the product volume. The main breeding form is on extensive way utilize agricultural sub-products as feed for livestock. This fragmented farming method is the main reason to burn many kinds of dangerous disease. In order to limit the damage caused by the disease, the agriculture sector and local authorities have to plan large scale raising areas, phase small animal practice. When livestock insurance services thrive, it’s sure that the herd which is injected the vaccination will increase rapidly.

We need to create favorable conditions for farmers and business investment model as livestock farms, and to “pull” the business in this area. Now the province should have policies to attract suitable, especially expedite administrative procedures in the implementation process for compensation, site clearance and land allocation, land lease, land use rights secured. At the same time, the province encourages investors and land owners as households and individuals to apply for the land use right to contribute in the breeding farm - business agreement. The State guarantees the right to use the land in the case of investment allocation and land lease.

In particular, it is necessary to apply the highest level of incentives to investors in accordance with the current legislation to build farms, as well as the slaughter house and concentrating livestock and poultry process. Accordingly, we need to supply capital investment budget to support the development of essential infrastructure outside the fence, including environmental treatment systems, electricity, water, transportation and other ancillary works.
If we can solve the basic problems mentioned above the construction of new rural areas as well as Vietnam’s "Tam nong" will be implemented deeply and sustainably.

References

To Promote Some Measuring the Combinational and Training Researches on Applied Scientific Technology of Social Science in Universities and Institutes in Vietnam

Nguyen Thi Dung¹ and Nguyen Hong Phuc²

¹Deputy, Department of Inspect, University of Labour and Social, 43 - Tran Duy Hung street, Trung Hoa ward, Cau Giay district, Hanoi city, Vietnam. E-mail: dungcamg@yahoo.com; Tel: 0904578405
²Military Medical Chamber, National Defense Academy, 93 - Hoang Quoc Viet, Nghia Do ward, Cau Giay district, Hanoi city, Vietnam. E-mail: dungcamg@yahoo.com; Tel: 0913321455

Abstract

To promote the combination of research, train and scientific technology application is the main policy of the Vietnam Communist Party and State of their management to their meeting of the needs toward their radical and comprehensive renovation with educational and training processes. The combination is currently conducted in formative manner and ineffective, particularly in social science sector. Meanwhile, demand for integrating research and training in social science block has been very urgent. To overcome on this situation, the measures are able to take, promote, and strengthen on the combination of research and scientific technology application was included, such as; to develop a national project on combination of research and scientific technology application in social science in Vietnam was administered, to develop a set of criteria to ensure effectiveness of combination of research and training which will be based on the needs of society was assessed, to increase self-control of research institutes and universities of social science sector in combination of research and scientific technology application was examined, to be continued of the renovate management mechanism was managed, the cost norm and means of providing finance research and scientific technology application in social science were found. The comprehending legal framework and criteria of combination of research and scientific technology application as a basic for evaluating activities of research and scientific technology application in social science were used. Suggestions that this study was to apply scientific technology in transferring National University and investigate of the key Universities into Universities’ researches are provided.

Keywords: Measures, Research, Scientific, Train, Institute, University, Social science

Introduction

1. Regional and International Background – requests for co-operating the researching and training the combination of research and scientific technology application between institutes and universities whereas to cover of the social science in Vietnam:

The International background of the first 21st century is the development of revolution of the information science, enhancing the knowledge based-economy’s development. This background is influenced strongly to content and method of education for both normal university and post-university. However, many opportunities and challenges for education and development of the social science were introduced. The educating social science ought to change in the globalization of the whole persons and throughout in the nation were interested.

Nowaday, the labors’ skills in the regional economies ought to be needed to develop their higher quality on their work, consequently. Many researches in Asian Nations reported on the the labors’ skills in the regional economies in each country had been changed and showed on their high quality of their skills for developing economical sectors with affecting situation in their region from the specialized of local traditional products, such as; rice, cereal, oil, and etc, were provided. Focusing on a specialized region which it has been improved the labors’ skills to support the industrial products, namely; in the electronic products that there are a lot of developing the labors’ skills to their profitions and improvements continuing. Suggestions that the sectors of labor also transformed strongly and promptly. Labors also transformed from agricultural works to industrial works (both in producing and service themselves); the producing technology that it has based on the natural source ought to have working skills for the producing technology to promote on the whole labors were used. Morever, the regional economics must be improved to labors’ skills in the transformation of their happenning knowledge menanagements similary as in Japan, Korea, or Singapore whereas the religious labors’
skills are too higher developing quality than in South East Asian countries, such as; Vietnam, Thailand, Philippine and Indonesia [1].

The combination of research, train and scientific technology application of the Vietnam is currently conducted in formative manner and ineffective, particularly in social science sector. Meanwhile, demand for integrating research and training in social science block has been very urgent. To overcome on this situation, the measures are able to take, promote, and strengthen on the combination of research and scientific technology application was included.

Subject to contribute to provide the scientific foundation for the implementation of the policy and guidelines of the Vietnam Communist Party and State for social science education. Subject to assess the whole picture on the status of the combinational and training researches on applied scientific technology of social science in universities and institutes; and propose yet the lessons of practical experience of some developing countries, and regional transformation.

Materials and Methods

We have applied interdisciplinary approach (pedagogy, economics, sociology ...) an effective manner; help the reader to have a multifaceted look on the situation and to promote some measuring the combinational and training researches on applied scientific technology of social science in universities and institutes in Vietnam.

We have applied the methods such as: Statistical methods, survey methods, methods of analysis - synthesis, quantitative methods, qualitative methods, information processing method, research methods text document, expert methods etc. The modern research methods have been used thoroughly and matching themes should have achieved the target set of topic.

Paper using methods analysis and synthesis to handle the information relating to the subject. Research methods mainly to reflect the current status of scientific research capacity and technology in the field of science social in universities and institutes in Vietnam is methods of analysis – synthesis, quantitative research methods, qualitative methods.

Results

As this a result, the need of educating labors is increasing their development of their training skills on day by day was practiced. For example, in the simple industry, the religion labors should be understood and trained of their industrial producing skills for acting and controlling machines that it has been gone complex skills on the program composition and designing technologies, perfectly. The need ought to be increased for supplying of their skills of the whole labors who has never satisfied of their previous timely, it caused on the inadequate labors’ skills indicated that they were lower quality skills in Asia over the past decade.

The inadequate labors’ skills have revealed that an effect on this research result for absorbing investment of the foreigning capital resources to be influencing the result of growth and development of each national economy. The combinations of this study between the practicing through an association of learning knowledge and the needs of labors' skills of their works were found, relationshiply.

In terms of the changing business environment is too fast that it has based on the developing previous technology to the information technology was included. Exactly, the advance technology is applied into the business and production of highly appreciated by the enterprises. The standardized daily life for people should be improved of their living styles in satisfaction and developing sustainable all times with the enterprising innovations to reduce the expense, and apply science and technology to produce and sale of the consumers demands to their products, fortunately.

The enterprising needs ought to be trained labors by trainer labors and labors who are able to well done on work, efficiently and may not be retrained of their high quality skills, immediately. These labors will save the enterprises to expense of training and re-training, the reducing the cost-price and increasing the products to competition in the market. Generally, the balancing competition of the demand and supply of labor skills, the training of human resource has to be updated for all times to satisfy the real life the of their advances on science and technology. This asking balance of the training units have to lead to connection with enterprising and researching sectors, deeply.

Especially, the relationships between training and reality programs for trending reform on with the narrow distance of the universities with to compare of the researches and users for applying the results of this research study.

In Vietnam, the combinations between researching and training were investigated of the formality by well done on reaches and effects in the branch of social science, especially. The structural organization of
institutes and universities of the branch of social science was dissatisfied with three missions, namely; training skills, research on science and applied sciences of the results and products.

Basically, the specialized departments belong to the universities (faculty, researching center) of the implementations to the target in each field of research have never gone on searching needs to management and checked status of the independent subject in implementing the science researching topic, consulting the policies, and criterial science. The patterns of combining and financial mechanism had never searched and trained for previous research study to develop currently status in the institutes and universities for sustaiable. There were not any pattern of combining and financial mechanism which is suitable with the researching and training at the institutes and universities under the social science branch. The administrative and financial procedures for this combination are still bureaucratic, obstructed for the researching of interdisciplinary branches and multi-branches of the social science, and the social science and natural science. Moreover, the reality showed that the result of university education in Vietnam is only teaching not researching and applying to the reality [2].

2. Associations between the urgent solutions for promoting the combination of the researching and training scientific technology and application to promote on the branch of social science in institutes and universities in Vietnam:

2.1. Selected a national project on the researching and training combinations of the social science in Vietnam at this present

The educational reformation of the university and research in science to require with the innovation are componental in thinking, evaluating, ignoring the conservativeness, complacency of the leaders and memberships of universities and institutes belong to the social science. The strategy and scheme to develop social science for Vietnamese whose they have never been successfully if they ought to be inadequate on human resource for supplying social science of their researching and training combinations. The national project is able to develop the social science for Vietnamese meanwhile as it might be self-controlled their unities with the researching and training the creative activities, correctly [3], [4], [5].

2.2. Building the criteria to ensure the effectiveness of uniting the researching and training scientific technology application based on the specification of social needs:

To ensure the effectiveness of uniting the researching and training scientific technology application are appreciated to be followed as:
- The research on science system of training targets as the uniting are going on management, successfully based on the real demand all of the campuses throughout the universities in Vietnam, respectively.
- Making regularly a survey method for evaluating the real needs and reacting capability of the training facilities were administered with the combinational research to manage educational training program of Vietnamese teachers for improving their teaching quality to indicate that their satisfaction of their training requirements, actually.
- Changing programs of contents and methods were trained for decreasing or increasing general theory of students’ handling mindsets of passive way by the case study approach to their practical lessons. Teachers’ presentations of their teaching style for enhancing students’ discussions and their abilities to their self-studies were reduced onto organizing scientific research contests toward their major subjects were associated. Combinations between students’ assessments and their improving teamwork for presenting abilities were differentiated by enhancement of students’ actual forms [6].
- Focusing on the practicing facility assessments are fastened on cooperation of universities and the social science institutes to arrange and develop students’ acquainting scientific methods with this scientific research program for equipping and supporting their skills, sustainability.
- Teamwork with students’ partners and participants for encouraging the training units are taken advantage of cooperation and scientific researches with institutional and enterprising researches with the collective practicing guides were used.
- Strengthening international cooperation in training and scientific research of students to exchange programs on their scholars and international experiences in foreign contents are trained and practiced to their teachers who are instructing in the religion universities to exchange teaching styles on international techniques with the oversea or foreigners. This situation is revealed that the cooperative training as scientific research to support Vietnam teachers who should be going on the international teaching management styles with the foreign methods and programs.
- Strengthening the infrastructure and creating favorable conditions for scholars in collaboration with teachers and students are participated to seek in these research topics while as combinational practicing theory.

2.3 Strengthening autonomy right for the research institutes and universities belong to Social Science in combining research and training:
- Research institutes and universities belong to Social Science should be searched and created conditions for developing relationships with local authorities or centers (which) that they are required on training and scientific research.
The autonomy of the institute shows the objectives that it is identified research topics ought to have actually needs from the awareness of the social problem. The researcher teams were improved and developed of their academia to attract to young talent with their passions. The institutional activities should have the fund for supporting independent management of the state to arrangement for encouraging state researchers.

- In terms of the social science in universities show of their autonomy to their development of students’ and teachers’ skills, such as; the innovative programs are to allow and encourage as well as methods, the scholarship program to encourage the spirit of students’ learning is stepped up of seeking research. Students’ talent is discovered activities and initiatives of their developing rudimentary thoughts into science by arrangement of their universities.

- The scientific and technological developing strategy to search on sectors is suitable with the capacity, advantage and practical requirements of the region.

- The autonomy of the institute shows the objectives that it is identified research topics ought to have actually needs from the awareness of the social problem. The researcher teams were improved and developed of their academia to attract to young talent with their passions. The institutional activities should have the fund for supporting independent management of the state to arrangement for encouraging state researchers.

- In terms of the social science in universities show of their autonomy to their development of students’ and teachers’ skills, such as; the innovative programs are to allow and encourage as well as methods, the scholarship program to encourage the spirit of students’ learning is stepped up of seeking research. Students’ talent is discovered activities and initiatives of their developing rudimentary thoughts into science by arrangement of their universities.

2.4. Continuing reformation of the management mechanism, norms and modes of financial allocations in research activities and training Social Science Sector:

To improve the constantly quality of scientific and training research in institutions and universities should be arranged for personnel participants to fix activities up with the national quality and inspectional system for graduating involvement and testing international quality system. The government’ policy needs ought to support the funding priorities for building research activities in universities and institutes with regional and international qualification, increasingly. This status has been established on necessary competitive methods of allocations and funds from the State’s institutes and universities, in order to manage the practicing combinational research for applying and conducting the social science research, increasing investment efficiency for scientific activities are completed.

2.5. Completing the legal framework and using standardization to combine of research and training social science to become fundamental system for evaluating research and training social science sector:

2.6. To apply the transforming national and key universities must be promoted the methods of universities' and institutes' researches in Vietnam, interestingly.

Conclusions and Discussion

Nowaday, the global trend of globalization and international integration are going on development and promotion throughout in memberships of educators and researchers to their daily working, strongly. In terms of the Higher education systems in the developing countries, including Vietnam, deeply affected by the (new) modern educational philosophy - the philosophy of "learning society" and the knowledge economy is promoted.

To integrate into educational activities, national universities, key universities should have a suitable roadmap for transition to improve study in (studying) universities with three main functions, such as; training social science research, scientific method research, and satisfying social demands.

Requirements of coordinational social science researches in (between research) institutes and universities for building research and training methods. Vietnam Social Science should achieve a level sufficient to meet the requirements and co-operation of the international social science. Only the total force and integration of scientific strengths and experiences of these subjects could take for developing social science in Vietnam.

Moreover, institutes and universities also have many same functions/tasks such as training, research and international cooperation. This is also the basis for combination institutes and universities in training and research. This integration is an objective, scientific and real product to develop general social science in particular. The effective combinations between universities and institutes are necessary for building research in institutes and universities of their own autonomy in both cognitive and targets are provided.

Acknowledgements

Thank you so much for your invitation to attend The ICSSS 2015. I would like thank so much to the Reviewer for his valuable comments and for his correction of English error on our paper.

References


Applying Experiences of Thai People Through Behaviors with Water into Protecting the Ecological Environment in Vietnam

Dang Thi Oanh¹, Nguyen Thi Nhung² and Nguyen Van Thuy³

¹College of Pedagogy in Lao Cai, Vietnam
²CT University, Vietnam
³College of Pedagogy in Lao Cai, Vietnam

Abstract

In the research of international science association at Maha Sarakham Royal University – Thailand (July 18th – 19th, 2013), we had an article which was about the diversity, uniqueness and value in traditional water’s culture of Thai people in the northwest of Vietnam. In this research, we look for, choose and propose solutions to apply, and promote the experiences of Thai people from through behaviors with water into protecting ecological environment in the local at the present. It is such as:

- Apply the experiences of Thai people in Dien Bien through behaviors with water into protecting the water resource;
- Apply the experiences of Thai people in Dien Bien through behaviors with water into protecting the forest;
- Apply the experiences of Thai people in Dien Bien through behaviors with water into protecting the land;
- Apply the experiences of Thai people in Dien Bien through behaviors with water into coping with changes of environment, climate and forecasting to prevent disaster in the local.

Keywords: Experiences, Thai people, Vietnam, Behaviors, Water, Protecting, Environment

Introduction

Nowadays, protecting water resource has been a popular issue that most countries and people always want to find methods for solution. They are modern methods of technology and science as well as traditional ones.

As we know, there are many different, unique and humane experiences in behaviors with water in traditional culture of Thai people in southwest Vietnam. It is said that these experiences help Thai people effectively and stably exploit water resource and contribute to protect ecological environment.

Missions and Method of Research

Mission of research: This research is aimed at proposing solutions to apply the experiences of Thai people in Dien Bien through behaviors with water into protecting the water resource and ecological environment in the local at the present.

Method of research: interdisciplinary research method, method of observation and attendance, method of comparison, analyzing and summarizing.

Research Result and Discussion

4.1. Apply the experiences of Thai people in Dien Bien through behaviors with water into protecting the water resource in the local

Besides modern technology methods, we need to restore the system of standard in people’s behaviors and common knowledge about water which is from ethnic minorities. Popularizing the technologies, and new regulations and implementing fresh water projects, and residential zoning, etc need to be based on people’s psychological characteristics, residential customs, behaviors with water resource to propose reasonable methods. Especially, it is necessary to have methods aimed at applying common knowledge of ethnic minorities about water in protecting water resource and building economy, culture and society in the local toward stable development.
4.1.1 Apply traditional methods used to protect forest in reserving water resource

Protecting the forest is to defend the stockpile and place regulating the underground water, as well as to reserve water resource, and then to establish common knowledge about water. Protecting and forming the forest is an optimal solution to reserve water resource, especially in mountainous areas which is at the beginning of rivers, and streams. Forest’s function is the protection and the improvement of water resource. In the complicated relation of soil – forest – water which we are easy to realize, when forest is formed and developed in the best conditions (with big cover of trees, and bushes covering the ground); the whole or most rainfall will be absorbed into the soil, the rainfall is on the ground will be very little or not. If the forest is not protected, exploited exhaustedly, and the cover on the ground does not exist anymore; most rainfall will be kept on the ground, making soil eroded, creating floods at lower areas as well as making water resource’s quality decreased. When the forest is formed and protected in the good condition, water absorbed into the soil will be kept by soil, and tree root which uses some parts of them; the redundant water will be absorbed into underground water and flow to slits of rivers, streams with the high regulating. So, covers of plants in the forest have an important impact in regulating rivers’ flow system in the forest at river’s valleys, limiting the attack of water to the ground, decreasing floods, increasing the flow in the dry season (to raise restored underground water for supplying in the dry season).

Therefore, keeping and protecting the forest at the beginning of rivers and streams to reserve animals and plants in the water at river’s valleys in the area. Especially, the forest at the beginning of rivers in the districts as Muong Nhe, Muong Ang and Dien Bien district,ect.

4.1.2 Applying method of biological diversity, intercropping of Thai people to contribute to the protection of water resource

Biological diversity is to help create various natures, especially many kinds of plants on the ground to make the equality in ecosystem, regulate the climate, protect the resource of soil and water. The research of scientists defines that the layer of plants has positive impact, and takes part in the circulation of water on the surface of the earth. Dien Bien is an area which is hot, humid, much rainy, so the plant cover is different. Thai people in Dien Bien often cultivate many different kinds of trees in the same area. They are plants with fasciculate root, tap-root, straight-growing trees, trees spreading on the ground, trees with big or small leaves,ect. Therefore, biological diversity will create a system that helps keep rainfall, smoke (leaves, tree-trunk) and a protect system that is against soil’s erosion.

(All kind of tree roots raise though topsoil to be used as barriers to maintain soil and to prevent rainwater eroding soil).

4.1.3. Reasonable population distribution and prohibition of free immigration

Free immigration not subject to any plan leads to suddenly rapid population increase. People have to deforest or burn off land for cultivation willy-nilly and they even burn and destroy the riverhead forests, water storage forests to ensure their lives, which cause exhaustion of resources of forest and water. Thence they influence existing environment of Vietnamese folk knowledge of ethnic groups.

Consequently, immigration is avoided spontaneous but a plan and a reasonable distribution to guarantee of cultivated land sufficiently for livelihood as well as it need to avoid deforestation in a large area especially, riverhead forests and protecting living environment.

On the other hand, population distribution significantly effects on water resource which is the existing environment of Vietnamese folk knowledge of ethnic groups, especially places of high population density. Water resources form rivers or streams is effected directly or indirectly by life activities (Wastewater of residential areas through sewerage systems comes into streams, then from streams into rivers and pollutes the water resource). In sum up, the reasonable population distribution reduces the negative effects on water resource - which is the environment of Vietnamese folk knowledge of ethnic groups arising and existing.

4.1.4. Applying the folk treatments to clean water resource

Cleaning water for people’s life activities is not only applied scientific measures of sterilization and cleanse but also is combined with folk treatments as follows:
- To lessen troubled water, putting a handful of crumpled leaves of basella alba (Mong Toi) or hibiscus (Dam But) into a pail of water (about 20 litters). After that, tiring many times to deposit sediment and decanting to have the clear water.
- Pouring water into a clean piece of cloth tightened in many times until having the clear water.
- Keeping water in vessels, jars in a long time to deposit sediment to the bottom then scooping the upper water for use.
- Keeping water in vessels, jars and drying under the sunlight to deposit sediment;
- Boiling water and letting it cold to deposit dirty substances to the bottom then decanting the upper water;

In addition, to take stream water for cooking (places having scarce water resource), ethnic minorities often dig a short ditch from 3 – 5 m to lead water to a small hole next to the stream. It is left a full of gravel in
the bottom of hole to purify water. When taking water from these holes, people have to scoop smoothly to avoid ripples of troubled water. According to the troubled degree of water, people get into the holes and ditches to roll water and bail water out for washing the holes and ditches after 1 – 3 months.

4.15. Applying customary laws on protecting water resource of Thai people to build and improve the legal regulations on exploiting and protecting water source.
Besides of solutions of organizing, managing and protecting the current water sources (as mentioned above), it needs to prove the customary laws of ethnic minorities on water source protection. Typically, there are the customary laws of Thai people on water source protection, and rules of Ha Nhi people, Dao people on protecting forests and water source.

We can utilize these customary laws to build and completing legal frame on protection, exploitation, and effective economization of water resource in local policies of using and protecting water as well as to deploy policies of balancing and protecting water resource and endemic aquatic species; use policies of inventory to evaluate water resource or regulations of fishery and aquaculture in nature with a harmonious direction; use regulations of forbiddance of leaving litter to streams and rivers; develop a system of collecting and treating waste to avoid waste overflowing into streams, rivers and lakes; regulations of places for washing herbicide sprayers or tanks; regulations of minimum period of keeping water in fields after spraying herbicides.

4.1.6. Applying habits and customs, belief of water of Thai people to propagandize and educate people protecting ecological environment

The experts affirm that the recession of natural resources is not only due to development of economy and commerce or the pressure of population and pollution but also due to complex issues regarding to the change in lifestyles, habits and customs, in other words, traditional culture of native community. Therefore, we need an appropriate policy to enhance awareness of preserving and proving traditional culture in general and Vietnamese fold knowledge of ethnic minorities in protection of biological environment and development of economy, culture and society in particular.

In this aspect, it need to restore some typical beliefs, habits and customs, which are still suitable for water from some ethnic minorities, in order to create an invisible belief barrier effecting people’s mentality strongly to constrain and prevent harm of water resource.

Creating some places of water sources sacredly is by building and restoring natural water mines; recovering water festivals in these places to strike on people’s mentality and belief to improve their attitudes of defying water resources and to prevent behaviors of harming water resources uncontrollably.

In educational propaganda, we should pay attention to mentality, habits, customs, and belief of water for each ethnic group to have effective solutions. Besides of regular propaganda of water role, we need more information of the facts of water pollution in province, more warning and forecast of quality or pollution of water; the degree of impact of polluted water environment on humanity and society; solution for repairing consequence and evaluation of fluctuation and changes of water ecology.

Building some scientific films reflecting the facts and role of water in our earth, the facts of water resources inland and Dien Bien Province in particular to educate and propagandize people as well as to warn in advance consequences that people have to bear if they now do not protect water resources and biological environment.

4.2. Applying behavior with water from Thai People in Tay Bac, Vietnam to protect forest resources in local place.

Forest resources and water resources have an interactive relationship, which mean this element is the basic and condition for other one’s sustainable sexist. Therefore, to restore and to protect and to develop a new forest area, we need to pay attention to water element (Water resource and folk knowledge of water). We need to research on local place to carry out derivation of uncultivated places and treeless hills. When having water, trees will become verdant. Thence combining with solutions of forest protection is to have verdant forest areas.

Besides, we need to enhance reclaiming to farm rice on terraced fields. The farming will encourage and strengthen more awareness of riverhead forest protection of ethnic groups. Because, the riverhead forests or forests on mountain tops are the storage areas for supplying water to these terraced fields.

4.3 Applying Thai people’s behaviors in the northwest about water in terms of protecting land resource in the local.

4.3.1 Applying knowledge of cultivating rice terraces in order to restrict the soil erosion on the surface of the milpa.

As mentioned, rice terraces not only help to cultivate rice on the milpa, to create environmental landscapes but also to be effective against erosion on the surface of the milpa.
The rice terraces demolish cracks on the soil surface; simultaneously they keep water on the surface of the milpa, reduce the flow rate of water from the forest rain and the slope of mountainside; rice terraces make water flow widely on the surface, not focus on the one part of the surface.

On the other hand, the system of rice terraces on the hillsides also create the surfaces in order to break, prevent and reduce the slope of the water currents on the surface of the hillsides when it rains heavily. This helps to restrict certain erosion from the rate of the water currents on the surface of the hillsides. However, at the areas of rice terraces, local people have to design the drainage system to prevent large currents from the top of the hill, or for drainage if necessary. Therefore, the surface of rice terraces (especially when rice plant is growing and developing) is protected, restricted erosion and washout of water.

**4.3.2 Applying folk knowledge of the ethnic minorities about water to improve soil and restrict phenomenon of desertification.**

We can apply the ethnic minorities’ knowledge of digging ditches, creating water pipelines from the ravines to hillsides in cultivating to solve the problem of soil desertification. For example, we can transfer water from the small rivulet on the top of mountain to the uncultivated hills. Only reeds may help to improve these uncultivated areas. It is because that they may grow and develop, if it is enough moisture. The tree leaves fall to the ground when they are old will differentiate into the humus layer on the ground. Gradually they provide nutrients, improve soil layer on the surface. This makes land more fertile and be restored as before.

**4.4 Applying behavior experience with water from Thai people in Dien Bien to adapt to environmental change, climate, and forecast disaster prevention in local.**

**4.4.1. Folk knowledge of water of the ethnic minorities with adaptation of current climate and environmental changes.**

The current climate and environmental changes (climate warming, erratic flooding phenomenon, heavy rain, and long-lasting rain in the dry season) derive from many different causes, including environmental changes related to water environment. Therefore, in order to cope with the negative changes in terms of environment and climate, besides modern scientific and technological solutions, we can apply some folk knowledge of water of the ethnic minorities. For example, we can reduce air warming and air pollution by bringing water to bare land areas so that trees can grow rapidly that in turn will form regenerating forests that surround residential areas, researching to build artificial reservoirs in the valley that in turn will create natural air-conditioners to reduce the air temperature in the regions.

**4.4.2 Folk knowledge of water of the ethnic minorities with climate issues and disaster prevention the province of Dien Bien.**

In forecasting about natural disasters, flood, flood prevention; besides the modern technical scientific methods need to apply traditional knowledge in forecasting natural disasters such as flood, hail, rain, hoarfrost, etc. (as mentioned above) Therefore preventing methods are proposed to reduce their damage to local people’s lives.

Not only is Vietnamese folk knowledge of water applied to preventing but also opposing well and even people can enjoy their peaceful lives with changeable weather phenomena at local. Vietnamese folk knowledge of water of ethnic minorities has significantly impacts such as local people’s actions when crossing rivers in flooding season or while having flooding, flash flooding, it is necessary for them to be awareness of skills to protect their family and themselves as well as properties. For instance, skill of swimming in the torrent is hanging a string from this bank to another for sticking when people are crossing the rivers. The water level suddenly rises after heavy rain so it needs to move to another place when it has not rained yet or the beginning of rain in short time; or the ways to recognize that land becomes soft leading to landslides, flooding, and so on. It is very important to know how to prevent promptly.

In the other hand, setting, upgrading lakes and dams for reducing flooding in the rivers; embankment for preventing landslide, protecting people; helping the flowing conveniently to restrain flooding in some parts of rivers in this area; we can apply experience of choosing some places to prevent flooding of ethnic minorities, “Avoiding building houses in shallow streams, strong wind, some places with strong wind and so on” to prevent natural disasters in raining and flooding season.

**Conclusion**

Vietnamese folk knowledge of water of ethnic minorities in Dien Bien province primarily is made and existed in traditional society with natural and social characteristics. Nowadays, when we want to improve Vietnamese folk knowledge of water into property and resource to develop economics and culture, we must pay attention whether their characteristics are suitable to natural and social conditions at present which can promote the potential and benefit to satisfy social development in current.
Furthermore, human culture in whole, Vietnamese folk knowledge of water of ethnic minorities in specific is not absolute and perfect value. Vietnamese folk knowledge also has some disadvantages, if using without consideration, we will have problems. We need to test to give their effects and sustainability and then use and deploy widely Vietnamese folk knowledge. If possible, it should be tried to improve Vietnamese folk knowledge. During using Vietnamese folk knowledge, we should combine Vietnamese folk knowledge and modern science technology.

Therefore, local authorities need to identify culture in whole, Vietnamese folk knowledge in specific is a resource in economics, culture and society development. However, how the exploitation of culture resource (especially Vietnamese folk culture) is suitable to the real situation in local which needs to research carefully.

References

Biodiversity of Medicinal Plants in Pu Mat National Park

Dao Thi Minh Chau*,1, Tran Thi Ngoc Linh1 and Tran Minh Hoi2.
1Biology Department, Vinh University, 192 Le Duan, Vinh city, Nghe An, Vietnam
2Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology
18 Hoang Quoc Viet, Ha Noi, Vietnam
E-mail: dao.chau27@gmail.com

Abstract

Pu Mat National Park is currently keeping a very large forest area with high biological diversity. The Core zone accounts for 94,804.4 hectares, and the buffer zone accounts for 86,000 hectares, in which 94% of this area is still covered by forest and about 22% is considered as primary forests. Pu Mat is the biggest Special Use Forest in Northern Vietnam. The remaining tropical rainforest in this National Park is a very precious heritage, especially in light of the tough economic environment in which most local livelihoods depend on forest resources. Forests not only give people food, shelter, clothes, but also valuable medicinal plants. According to the survey results, about 1115 species of medicinal plants within 176 families in six higher plant sectors of the core and buffer zone in Pu Mat National Park. Of these, approximate 108 species have been put into the markets and 58 species in the wild are being overexploited. Many species previously had large reserves but are scarce. The most remarkable up to 35 rare species named in the Vietnam Red Book are being exploited.

Keywords: National Park, Nature Reserve, Medicinal Plants

Introduction

From past to present, forest resources have always held a very important role in the physical life and spirit of mountain people. They especially ethnic minorities exploit the trees for building houses, eating, breeding, making clothes, playing, beauty, and medical treatment. Over many generations, the knowledge and experience that they gained in exploitation and using forest products is increasingly rich, distinctive and valuable, particularly in the field of harvesting and using medicinal plants. Unlike other forest products which are often exploited by many people, medicinal plants are exploited only by “ong lang” or “ba me”, so they are still sustainable over many generations. However, in recent years, medicinal plants have begun being purchased in bulk and sold to China. Many valuable species are currently being depleted, and many rare and precious species are now extinct.

Currently, there are several research projects on medicinal plants and how ethnic minority people use these plants as medicines. However, these research projects were on small scales in specific localities—not overall assessment of the Pu Mat National Park area. Therefore, we started research on medicinal tree species in the entire Pu Mat National Park. We did research on species that are being exploited and commonly used, as well as valuable species that are being sold out of the area unregulated, in order to propose solutions for the sustainable use of medicinal trees in Pu Mat National Park.

Location and Research Methods

a, Location and research subjects.
Pu Mat National Park has a large core zone, bordered by Laos, and its buffer zone stretches over forest stands of three mountainous districts (Con Cuong, Anh Son and Tuong Duong). In the entire research area, plant samples in 5 following areas including:
+ At Cao Veu;
+ At Lu Da - Mon Son;
+ At Khe Bu;
+ At Khe Thoi;
+ At Tam Hop.

The population of Pu Mat National Park is over 93,500 people living in 111 villages, and its population growth is about 2.6% per year. Most of the population works in the agricultural sector, while the area of arable land is increasingly limited due to the rapid impoverishment of sloping land areas, climate change, water shortages and drought. On average, people who live in buffer zones can be self-sufficient for only about 2/3 of the cost of living, while the remaining 1/3 relies on the exploitation of forest resources, including medicinal plants. These people are the direct exploiters, users and traders of medicinal plants. In order to collect data on
the current state of exploitation, use and trade of medicinal plants, we interviewed and surveyed 240 households in 8 villages representing 8 communes of 3 districts.

b / Research Methods.
- Collecting previous research results on medicinal plants in the research area.
- Collecting plants from main areas, based on the document of Nguyen Nghia Thin 1997 [8].
- Identifying plants based on the document of Nguyen Tien Ban in 1997 [4], Pham Hoang Ho [6], Vo Van Chi [5], the scientific name’s revision according to Vietnam plants catalog [2].
- Identifying rare, precious and endangered species according to the Vietnam Red Book [1].
- Interviewing households about exploiting medicinal plants in 3 districts of Pu Mat National Park by survey forms and then tracking statistics on Excel.
- Interviewing traders in the locality about purchased medicinal plants.

3. Research results

3.1. The diversity in taxa of plants.
To complete the list of medicinal plant species in Pu Mat National Park, we based our list on data from previously announced research results on plants, medicinal plants and non-timber products in the research area. Then we identified the areas that need additional survey sampling and we organized 5 surveys in the 5 areas mentioned in the previous section. The results showed that there were 1115 species used by local people in Western Nghe An as medicines. There were 545 genuses, 176 families, and 5 orders of higher plants in Pu Mat National Park. The distribution of quantity and proportion of families, genuses and species are shown in Table 1.

<table>
<thead>
<tr>
<th>Orders</th>
<th>Families</th>
<th>Genuses</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Psilotophyta</td>
<td>1</td>
<td>0.57</td>
<td>1</td>
</tr>
<tr>
<td>Lycopodioiphyta</td>
<td>2</td>
<td>1.14</td>
<td>4</td>
</tr>
<tr>
<td>Equisetophyta</td>
<td>1</td>
<td>0.57</td>
<td>1</td>
</tr>
<tr>
<td>Polypodiophyta</td>
<td>21</td>
<td>11.93</td>
<td>32</td>
</tr>
<tr>
<td>Pinophyta</td>
<td>6</td>
<td>3.41</td>
<td>5</td>
</tr>
<tr>
<td>Magnoliophyta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnoliopsida</td>
<td>122</td>
<td>69.32</td>
<td>444</td>
</tr>
<tr>
<td>Liliopsida</td>
<td>23</td>
<td>13.07</td>
<td>71</td>
</tr>
<tr>
<td>total</td>
<td>145</td>
<td>82.39</td>
<td>502</td>
</tr>
</tbody>
</table>

Table 1. Distribution of the number and proportion of families, genuses and species of medicinal plants in Pu Mat National Park.

Most of these species are concentrated in Magnoliophyta, accounting for 94.43% of total species. Magnoliophyta is dominant compared to others in terms of species and taxa such as genuses or families because of the characteristic tropical forest ecosystems of Pu Mat Nation Park. On the other hand, the majority of commonly-used medicinal plants are species whose habitats are relatively favorable for harvesting: forest edges, roadsides, along streams, low hills and secondary forests. These areas are favorable living environments for Magnoliophyta.
The habitats of medicinal plants in Pu Mat are divided into 5 types, and the distribution of the species’ habitats is shown in Chart 1. The most common habitats are forest (49%) and mountain (23%), with only about 10% of all species living in the remaining habitats.

Of the total 1115 harvested medicinal plants, woody plants accounted for only 27%, but the harvested parts are mainly flowers, fruits, leaves, bark and roots. Herbaceous plants accounted for 34% of all exploited medicinal plants, followed by shrubs and vines (Chart 2).

3.2. Exploitation, use and management of medicinal plants
The results reported in this article were based on surveys of 240 households in 8 communes of 3 districts located in the Biosphere Reserve.

It can be said that mountainous ethnic people’s health care has depended heavily on traditional methods. Traditional harvesting of medicinal plants has been handed down for generations and forest resources have been exploited sustainably.
In the last 10 years, medicinal plants have become commodities, and they have been exploited and trafficked more often and more commonly. According to our research, 108 medicinal plant species have been sold from Pu Mat National Park to Vinh market, other provinces and China. Up to 58 species are being exploited in nature and overexploited for exporting to China. This phenomenon causes many species to become scarce and that can lead to depletion.

With the shortage of arable land, lack of employment, and forest-dependent lifestyle, the traders at Pu Mat area just submit purchase price matching workdays have slit to bring the people in the villages, young and old, girls and boys are pulled together into the forest, they find, picking, digging, .... health, then go away, for many, poor health, then go close, earn less, everyone will gather medicinal plants for sale to the purchasing agent, who can carry out much higher priced districts, who harvest will be less able to sell for at the point of purchase, at the commune.

When local people can gather medicinal plants for sale, their income increases, but this income is not sustainable because medicinal plants are depleted after each harvest. In fact, the income of the local population is calculated only on the day of forest harvesting, and "only the value of medicinal plants = 0". Local traders often set prices for people buying their daily work; the purchase price is not dependent on the value of the goods and the market price.

According to the statistical results from 240 questionnaires, the collection of medicinal plants from the forest to sell and to use contributed an average of 32-38% of the total income of households.

In the past ten years, the conservation management policies have often targeted timber and wildlife, but people are still allowed to exploit the majority of medicinal plants from protected forests and production forests. Even the policy of "closed forest" on the SUF area has changed.

In 2012, the Prime Minister approved Decision No. 126 / QD-TTg on the implementation of benefit-sharing mechanisms in the management, protection and sustainable development SUF [3]. This means that the local people living around the protected areas and national parks can still harvest medicinal plants from SUF. Since medicinal plant resources in Pu Mat national park area are continuously being exhausted, there is a risk of losing many species of endangered and valuable plants.

3.3. Diversity of rare genes

The above analysis finds that medicinal plants are continuing to be exploited freely with little attention to management and conservation. This is because people living in Pu Mat National Park are enormously dependent on forest resources and their knowledge about value of medicinal plants is very limited, as the majority of medicinal plants are still considered to be "minor forest products". Meanwhile, demand for medicinal plants in China’s markets is massive. These factors together cause many medicinal plants in Pu Mat to be in the state of exhaustion and scarcity. Table 2 lists the 35 medicinal plant species that are being exploited in Pu Mat national park area which are included in the Vietnam Red Book. There are 58 medicinal plant species are being overexploited in nature, with 25 species listed in the Red Book of Vietnam. 33 remaining species are also endangered. If no conservation and management measures are taken soon enough, these species will fall into the state of depletion and risk disappearing from the Pu Mat National Park.
### Table 2. The medicinal plant species in Pu Mat National Park in the Vietnam Red Book, 2007

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Vietnamese name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Drynaria bonii H. Christ.</td>
<td>Tắc kè đá</td>
<td>VU</td>
</tr>
<tr>
<td>2 Drynaria fortunei (Kuntze ex Mett.) J.Sm.</td>
<td>Cốt toàn bộ</td>
<td>EN</td>
</tr>
<tr>
<td>3 Fokienia hodginsii (Dunn) A. Henry &amp; H. H. Thomas</td>
<td>Po mu, (Mây), Vác</td>
<td>EN</td>
</tr>
<tr>
<td>4 Cycas pectinata Buch.-Ham.</td>
<td>Tuê lốc</td>
<td>VU</td>
</tr>
<tr>
<td>5 Enicosanthellum plagioneura (Diels.) Ban</td>
<td>Nhọc trái khóp lá thúơn</td>
<td>VU</td>
</tr>
<tr>
<td>6 Mitrephora thorelii Pierre</td>
<td>Mạo dại thorel</td>
<td>VU</td>
</tr>
<tr>
<td>7 Xylopia pierrei Hance</td>
<td>Giên trồng</td>
<td>VU</td>
</tr>
<tr>
<td>8 Kibatalia laurifolia (Ridl.) Woods.</td>
<td>Thân linh lá nguyệt quế</td>
<td>VU</td>
</tr>
<tr>
<td>9 Rauvolfia cambodiana Pierre ex Pit.</td>
<td>Ba gạ cam-pu-chia</td>
<td>VU</td>
</tr>
<tr>
<td>10 Rauvolfia verticillata (Lour.) Baill.</td>
<td>Ba gạ lá vòng</td>
<td>VU</td>
</tr>
<tr>
<td>11 Winchia calophylla A. DC</td>
<td>Mớp lá dep/ Sừa lá nhỏ</td>
<td>VU</td>
</tr>
<tr>
<td>12 Acanthopanax trifoliatus (L.) Voss.</td>
<td>Nụg gia hương</td>
<td>EN</td>
</tr>
<tr>
<td>13 Panax bipinnatifidus Seem.</td>
<td>Tam thất lòng chim</td>
<td>VU</td>
</tr>
<tr>
<td>14 Panax vietnamensis Ha et Grushv.</td>
<td>Sâm Việt Nam</td>
<td>EN</td>
</tr>
<tr>
<td>15 Balanophora laxiflora</td>
<td>Đỗ đát hoa thưa</td>
<td>EN</td>
</tr>
<tr>
<td>16 Markhamia stipulata (Wall.) Soem. ex Schum.</td>
<td>Đinh/ Thục dinh</td>
<td>VU</td>
</tr>
<tr>
<td>17 Euonymus chinensis Benth.</td>
<td>Đỗ trong nam</td>
<td>EN</td>
</tr>
<tr>
<td>18 Gymnastemma pentaphylla (Thunb. ex Murr.) Makino</td>
<td>Giảo có lam</td>
<td>EN</td>
</tr>
<tr>
<td>19 Callerya speciosa (Champ.) Schot</td>
<td>Cát sâm</td>
<td>VU</td>
</tr>
<tr>
<td>20 Sophora tonkinensis Gagnep.</td>
<td>Hoa hoé bac bộ</td>
<td>VU</td>
</tr>
<tr>
<td>21 Casianopsis hystrix DC.</td>
<td>Cà ổi là đọ</td>
<td>VU</td>
</tr>
<tr>
<td>22 Cinnamomum balansae Lecomte</td>
<td>Vụ hương</td>
<td>VU</td>
</tr>
<tr>
<td>23 Cinnamomum parthenoxylon Meissn.</td>
<td>Re hương</td>
<td>CR</td>
</tr>
<tr>
<td>24 Strychnos cf. ignatii Bergius</td>
<td>Cử chỉ/ Má tiên lòng</td>
<td>VU</td>
</tr>
<tr>
<td>25 Strychnos nitida G. Don</td>
<td>Má tiên là bóng</td>
<td>EN</td>
</tr>
<tr>
<td>26 Ardisia silvestris Pit.</td>
<td>Lá khôm tía</td>
<td>VU</td>
</tr>
<tr>
<td>27 Canthium dicoccum (Gaertn.) Teysm. &amp; Binn.</td>
<td>Xương cá</td>
<td>VU</td>
</tr>
<tr>
<td>28 Myrmecodia tuberosa Jack.</td>
<td>Lại ỏ kiến, ỏ kiếơn</td>
<td>VU</td>
</tr>
<tr>
<td>29 Aquilaria crassa Pierre ex Lecomte</td>
<td>Gió bâu, trim hương</td>
<td>EN</td>
</tr>
<tr>
<td>30 Disporopsis longifolia Craib</td>
<td>Hoàng tinh cách</td>
<td>VU</td>
</tr>
<tr>
<td>31 Peliosanthes teta Andr.</td>
<td>Câu tử thảo/ Sâm câu</td>
<td>VU</td>
</tr>
<tr>
<td>32 Polygonatum kingianum Coll. ex Hemsl.</td>
<td>Hoàng tinh vàng</td>
<td>EN</td>
</tr>
<tr>
<td>33 Curculigo orchoides Gaertn.</td>
<td>Sâm câu tự lan</td>
<td>EN</td>
</tr>
<tr>
<td>34 Anoectochilus setaceus Blume.</td>
<td>Lan gắm trung bộ</td>
<td>EN</td>
</tr>
<tr>
<td>35 Smilax elegantissima Gagnep.</td>
<td>Kim cang nhiều tán</td>
<td>VU</td>
</tr>
</tbody>
</table>
Conclusions and Recommendations

1. Medicinal Plants in Pu Mat National Park are not only valuable with high biodiversity (1115 species in 545 genera, 176 families), but also closely linked with local community life from past to present, including their significant income in recent years (accounting for 32-38% of the average income of the household).

2. Current exploitation status is unmitigated by the lack of conservation measures and sustainable management. Most of the products are sold in raw materials, unprocessed. Medicinal plant resources are being depleted rapidly; 58 species have been exhausted and 35 of the species are listed in the Vietnam Red Book.

3. The prices of medicinal materials "only counted = 0", so the local people's income from collection of medicinal plants is very low; community life has not improved. It is becoming even harder to earn income when medicinal plants are gradually becoming scarcer. Forest protection and biodiversity conservation will become more difficult.

Recommendations for immediate action: Prohibit the exploitation of medicinal plants which are rare, valuable, or listed in the Vietnam Red Book; Assess the current state to take measures for sustainable exploitation of species which are considered goods; Implement specific plans for the conservation and development of valuable species.

References

[3] The Decision No. 126/ QD-TTg dated 02 May 02 2012 on the implementation of benefit-sharing mechanisms in the management, protection and sustainable development of the SUF.
The Relationship Between Population Distribution and Agroforestry Production Development in Dien Bien Province

Nguyen Thi Thu Huong
Dien Bien Teacher Training College
E-mail: nguyenhuongspdb@gmail.com

Abstract

The population distribution associates with the workforce distribution by sector and territory. Therefore, the population distribution directly impacts on the territory’s socio-economic development. Dien Bien is a mountainous province located in Northwestern Vietnam. It is landlocked and isolated from economic development centers in the northern mountainous area and the whole country. Over 80% of its population resides in rural areas and the agroforestry has long been the major sector of the local economy. Analyzing the relationship between population distribution and agroforestry development is the basis to take Dien Bien’s maximum advantages to develop agriculture as well as help plan to rearrange its population and workforce to be more suitable with their living and production conditions, from which to boost the economy to grow stably and sustainably.

Keywords: Population distribution, Agroforestry, Northern mountainous area, Local economy

Content

II.1. Population distribution in Dien Bien province

For such a mountainous province as Dien Bien, the population distribution is profoundly influenced by the level of socio-economic development, production conditions and natural environment. The population will live crowdedly in the areas where favorable natural incentives and good socio-economic development converge and vice versa, the population is scattered where the natural conditions are harsh and the economic development is low. The population distribution in Dien Bien province is following that principle.

II.1.1. Population density

Dien Bien has the lowest population density in the country. In 2010, the province’s average population density was 53 people/km², lower than that of the northern midland and mountainous region (118 people/km²) and much lower than the whole country’s (263 people/km²).

Dien Bien population density fluctuation over the years

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (thousand people)</th>
<th>Area (km²)</th>
<th>Density (people/km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>449.9</td>
<td>9562.9</td>
<td>47</td>
</tr>
<tr>
<td>2006</td>
<td>459</td>
<td>9562.9</td>
<td>48</td>
</tr>
<tr>
<td>2007</td>
<td>467.8</td>
<td>9562.9</td>
<td>49</td>
</tr>
<tr>
<td>2009</td>
<td>493.01</td>
<td>9562.3</td>
<td>51.6</td>
</tr>
</tbody>
</table>

Source: General Statistics Office of Vietnam, 2010

II.1.2. Population distribution characteristics

The noticeable characteristic of Dien Bien is the uneven population distribution among the lowlands and the highlands. The population is extremely dense in some places but in some other places, there are few people living.
Dien Bien population density by district and town in 2009

<table>
<thead>
<tr>
<th>District/town</th>
<th>Average population (people)</th>
<th>Area (km²)</th>
<th>Density (people/km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dien Bien Phu City</td>
<td>48,836</td>
<td>64,27</td>
<td>759.9</td>
</tr>
<tr>
<td>Muong Lay Town</td>
<td>11,666</td>
<td>112,56</td>
<td>103.6</td>
</tr>
<tr>
<td>Muong Nhe District</td>
<td>54,770</td>
<td>2,499,50</td>
<td>21.9</td>
</tr>
<tr>
<td>Muong Cha District</td>
<td>52,655</td>
<td>1,771,78</td>
<td>29.7</td>
</tr>
<tr>
<td>Tua Chua District</td>
<td>47,445</td>
<td>685,26</td>
<td>69.2</td>
</tr>
<tr>
<td>Tuan Giao District</td>
<td>74,287</td>
<td>1,137,77</td>
<td>65.3</td>
</tr>
<tr>
<td>Dien Bien District</td>
<td>106,398</td>
<td>1,639,26</td>
<td>64.9</td>
</tr>
<tr>
<td>Dien Bien Dong District</td>
<td>56,709</td>
<td>1,208,98</td>
<td>46.9</td>
</tr>
<tr>
<td>Muong Ang District</td>
<td>40,241</td>
<td>443,52</td>
<td>90.7</td>
</tr>
</tbody>
</table>

Source: General Statistics Office of Vietnam, 2010

It can be seen that the most populated area in the province is Dien Bien District, accounting for 21.6% of the province’s population, followed by Tuan Giao (15.7%) and Dien Bien Dong (11.5%). Muong Nhe District has a relatively small population, accounting for 11.1% of the province’s population, followed by Muong Cha, Tua Chua, Muong Ang and Muong Lay town with 10.7%, 9.6%, 8.2% and 2.4% respectively. Dien Bien Phu City’s area is equal to 6.7% of the whole province but 9.9% of the province’s population is living there.

The concentration of the provincial population is precisely reflected by the population density in specific territories. Dien Bien’s population distribution picture is clearly divided into 2 parts.

1.2.1. The population distribution in the lowlands

The lowlands include basins between mountains and the valleys along the rivers’ and streams’ banks at the mountains’ foots. The majority of the delta belongs to Dien Bien Phu City and Dien Bien District; the rest is in other districts and towns. The population density of this area is quite high but unevenly distributed among the lowlands of districts. In 2009, Dien Bien Phu City’s population density was 759.9 people/km² while that in Dien Bien District was 64.9 people/km².

The most densely populated area in Dien Bien is the valley basin. It is the plain with fertile soil, favorable conditions for agricultural production, and it is the residential and production area of most Kinh and Thai people in the province. Notably, just Dien Bien Phu City and Dien Bien District account for nearly 32% of the province’s population.

The reasons include: Firstly, it gathers all headquarters and is the province’s economic and political center; most of people there are working in non-agricultural sectors; therefore, the population density is high. Secondly, the suburban areas have had a long history of agricultural development, especially rice cultivation and livestock, etc., which require many laborers.

During its development, this area has been identified to take the key role in promoting the provincial economic growth and gradually shifting to the national progress.

1.2.2. The population distribution in the highlands

* In areas of low hills

This is the transition zone between the plains and the high mountains of the province and also, between the province’s most naturally favorable, populated and economically developed area with the most sparsely populated area with the most difficult socio-economic conditions. In this region, the most populated areas are Muong Ang District (90.7 people/km²), followed by Tua Chua (62.2 people/km²), Tuan Giao (65.3 people/km²), and Dien Bien Dong District (45.9 people/km²). However, within the region, the residents are more crowded in the places adjacent to the lowlands than in the places adjacent to the highlands. The higher the places are, the lower the population density is and the ratios are different among districts, which proves the uneven population distribution of some ethnic groups including Dao, Giay, etc. on the mountainside.
Currently, this is the area concentrating most large-scale farms which cultivate fruits, tea, coffee, rubber, etc. for the provincial market.

* In areas of high mountains

These areas are the highest region of 9 districts and towns, accounting for more than 70% of the province’s but the population is extremely sparse. In 2009, Muong Nhe District’s population density was 21.9 people/km² on average and that of Muong Cha District was 29.7 people/km². However, such a density is different among communes.

The high mountainous and dissected terrain causes the biggest obstacle to the province’s population distribution. Furthermore, these areas include many border communes, the population distribution thus play an important role in protecting national security.

The natural and socio-economic conditions of these areas are extremely difficult. Most of people there belong to H’mong and some other ethnic minorities that have a habit of living and farming on steep slopes of high mountains. The agricultural production is very limited in these areas; the form of self-sufficiency is popular among residents.

II.2. The agro-forestry and fisheries development in Dien Bien province

Dien Bien is a mountainous province and most of its population live in the rural areas. Therefore, agro-forestry and fisheries production is always considered the main production sector which has an important role in stabilizing the society as well as strongly influences on the province’s economic growth.

Since its establishment in 2004, the province’s economic structure has had positive changes. However, the agro-forestry, fisheries and service sectors still play the key role while the industry and construction sectors have been keeping modest role and not had any big progress.

<table>
<thead>
<tr>
<th>Sector</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agroforestry fisheries</td>
<td>745.9</td>
<td>906.9</td>
<td>1145.5</td>
<td>1450</td>
</tr>
<tr>
<td>Industry and construction</td>
<td>504</td>
<td>602.6</td>
<td>611.8</td>
<td>670</td>
</tr>
<tr>
<td>Service</td>
<td>758.2</td>
<td>954.7</td>
<td>1093.6</td>
<td>1215</td>
</tr>
</tbody>
</table>

Source: Statistics Yearbook 2010

The GDP-contributing proportions of sectors have changed over the years. Accordingly, the proportions of the agro-forestry and fisheries have been increasing, from 37.1% in 2005 to 40.2% in 2007 and 43% in 2009. Meanwhile, the proportions of the industry and construction sectors have been remaining the lowest and tended to decrease from 25.1% in 2005 to 21.4% in 2007 and 2.06% in 2009. The share of service sector has increased but still unstable, reaching 38.4% in 2007 and down to 36.4% in 2009. Given the current economic situations, the agriculture is the sector that influence most on the whole province’s economy as well as the social life of local people. This also demonstrates that Dien Bien’s industrialization and modernization are facing with many difficulties.

II.2.1. Agriculture production

In the long term, the agro-forestry is still the main sector playing significant role in Dien Bien’s socio-economic development, especially in addressing the demand for food; keeping the political and social stability, especially in the border areas; protecting the watershed of the national hydropower projects as well as providing materials for developing the processing industry in order to promote the economic growth.

The agriculture in Dien Bien has been developing quite fast and stably. In 2007, its agricultural production values reached 1155.4 billion dong, and average growth rate of 8.05% per year.

In the province’s agriculture restructure, crop production still remains the dominant part while the livestock has become the key sector to exploit the province’s advantage of natural grasslands and the agricultural services are being formed and growing well.
Dien Bien’s agricultural production value structure (Unit: %)

<table>
<thead>
<tr>
<th>Sector</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop production</td>
<td>77.8</td>
<td>77.5</td>
<td>74.4</td>
<td>71.4</td>
</tr>
<tr>
<td>Livestock</td>
<td>21.5</td>
<td>21.6</td>
<td>23.4</td>
<td>26.9</td>
</tr>
<tr>
<td>Service</td>
<td>0.7</td>
<td>0.9</td>
<td>2.2</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Source: General Statistics Office of Vietnam, 2010

Crop production

For recent years, the crop production of Dien Bien has been developing strongly both in terms of quantity and quality. The area, productivity and yield of main crops have been increasing; the arable land has been expanding, contributing to increase the production value. In 2007, the province’s agriculture land reached 120,100 hectares.

In crop production, the province has been promoting the intensification, increasing number of crops and changing crops structure, etc. These works have ininitially brought in good results which help add more values generated on one area unit and gradually build the momentum for agricultural and rural economic development. At present, the food production is prioritized to develop in the places having good irrigation conditions and able to deliver high productivity in order to ensure the province’s food security. Other areas with worse conditions will be transferred to plant other crops such as vegetables and short-term industrial crops such as soybean, peanut, etc.

*In terms of food production, rice is the main crop that is cultivated in all areas of the province. The biggest rice fields include Muong Thanh in Dien Bien District (area: 12,932 hectares, yield: 60,686 tons) and Tuan Giao (area: 5,623 hectares, yield: 16,515 tons). These are the well-known rice-cultivating areas of the province and also of the Northwest. In particular, Muong Thanh’s rice is well known for its high quality for long. In 2009, the province’s rice cultivating area was 44,914,000 hectares and the output was 146,563,000 tons. The key areas like Dien Bien basin and Tuan Giao have provided their rice products to other markets outside the province thanks to its large cultivation areas and high quality.

*Corn is also an important crop for Northern mountainous provinces. It is thus planted in all districts with the increasing area and yield. In 2009, corn cultivation area reached 29,534 hectares and the yield was 66,793 tons. The key areas for corn cultivation include: Pu Nhung – Phinh Sang – Ta Ma (Tuan Giao District), Tua Chua, Dien Bien Dong and Dien Bien.

*Other crops

+Soybean: Dien Bien province has made big investment in developing soybean. The soybean-growing areas have been established in the regions with favorable conditions such as Pu Nhung – Phinh Sang – Ta Ma (Tuan Giao); Sa Dung – Pu Nhi – Keo Lom – Phinh Giang (Dien Bien Dong); Si Pa Phin, Na Hy, Cha Cang, etc., which helps deliver a big and stable goods source. In 2009, the soybean yield reached 117,556 tons and the cultivation area was 9,209 hectares in which, Tuan Giao District had 4,393 tons in yield and 3,495 hectares in area.

+ Tea: Tea tree is very suitable with the soil and climate in Dien Bien, especially on the mountain over 1,000 meter high. The key areas for tea development include:
  - The highland Ta Phinh (Tua Chua): with the area of 329 hectares in 2009
  - The highland Dien Bien Dong
  - Muong Nhe – Muong Toong – Na Hy (linked to the economic-defense zone Muong Cha)
+ Coffee: Coffee is the kind of plant that has high economic value and is quite suitable with the natural conditions of Dien Bien. However, it has not been developed stably for the past years. In 2009, the province had 1,546 hectares coffee with the yield of 1,261 tons in which, Muong Ang District accounted for 1,405 hectares in area and 1,172 tons in yield.
+ Rubber tree: Rubber trees have been planting in Dien Bien since 2008. Currently, rubber is grown mostly in Dien Bien, Muong Nhe, Muong Cha and the area is increasing. In 2009, the total area of rubber in the province was 2,475 hectares in which, Dien Bien accounted for 1,149 hectares.
+ Cotton: The province plans to boost its cotton cultivation area through implementing the pilot project of planting high quality cotton trees, evaluating the effectiveness of cotton to expand to other districts such as Dien Bien Dong, Muong Cha, Tuan Giao, etc. In 2009, the provinces had 11,979 hectares of cotton and gained 1,116 tons in yield.
II.2.2. Forestry production

For the recent years, the forestry sector has achieved positive results, particularly in protecting, recovering and developing forest. Therefore, the forest area of the province has been increasing continuously. In 2007, the province’s total forestry area was 378,600 hectares and it is now continuing to be expanded. However, in terms of production structure, territory structure, technical level and production organization, there remain many shortcomings. The forestry production is now mainly in extensive form which is the typical production method of our mountainous residents. Dien Bien’s technical level in forestry production is still very low compared to other regions, including seed, wood processing (typically Dien Bien paper mill), producing skills and farm workers’ level.

II.2.3. Fisheries

As a mountainous province with many rivers and streams, the exploitation and aquaculture play an important role in providing fish, shrimp and other aquatic products in order to meet the people’s needs. However, the natural aquatic resources are getting exhausted and the catch is on the decline because the exploitation has not been managed well and no breed has been supplemented. The total catches in 2007 were 68 tons.

The aquaculture, mainly fish breeding, has been developing strongly for recent years. In 2007, the province’s aquaculture area reached 1,700 hectares and the production was 926 tons, meeting the people’s critical demands. The province’s aquatic centre has been established and put some new aquatic species into production such as green crayfish, carp, white pomfret, tilapia, etc. These activities have brought in good results, opening up the growth prospect for Dien Bien in the future.

In general, agro-forestry and fisheries sectors are the province’s strength. Due to the differences in natural conditions and farming skills of the people, the productivity and yield of crops, especially food crops, are different among locations. In the lowlands, the productivity and yield are high thanks to their high farming level and large wet-rice area. Typically, in Dien Bien, the rice productivity in 2009 was 46,930 kg/hectare, 1.44 times higher than the province’s average, and the district’s yield was 60,686 tons, accounting for 41.4% of the whole province’s rice yield. This is also the region having the highest population density in the province. The higher the places are, the more difficult production conditions are and the less productivity and yield get. In the highlands, the production activities are very sparse, mostly maintaining the burning off land and tilling the fields or planting short-term industry crops.

II.3. The relationship between population distribution and agroforestry production development in Dien Bien Province

II.3.1. The agricultural economic development and population distribution are profoundly influenced by the natural and socio-economic conditions

+ To the agriculture: The most developed areas are places with low and flat terrain, fertile soil, modern farming techniques, etc.
+ To the population distribution: The population are crowded in the plains and valleys but sparse in the high mountains. People are living densely in the places with good socio-economic development.

II.3.2. The agricultural development has the direct impact to the province’s population workforce distribution
The population tends to concentrate in the places with developed agriculture such as Dien Bien District whose population accounts for up to 21.6% of the province’s and in 2009, its yield of grain crops topped the provinces and 4.6 times higher than Muong Nhe District, reaching 79,783 tons.

The higher the regions are, the narrower production activities are. The main production is in the nomadic farming form which is typical for mountainous residents. The production specialization is lower and instead, the extensive cultivation as well as burn off land and till the field methods are popular.

II.3.3. The proper population distribution creates the main momentum for the province’s rapid agriculture development

The province’s key agricultural economic zones have been established by exploiting the natural and socio-economic conditions and human factors. In the plain areas, the rice production is not only to serve for people in the province but also to make rice become the commodity and local specialty. In the low hills, the concentration of crops and the building of coffee and rubber zones have mobilized a big local labor force. Such agricultural production activities have helped people settle and stabilize their life.

Conclusion

In conclusion, the mutual reliance between agricultural production and population distribution is clearly manifested in the province’s socio-economic development picture. Given the characteristics of a border province with large separated mountainous areas, Dien Bien needs, in its stable development strategy, to have policies to develop production in the difficult regions to attract the workforce, stabilize the economic life and ensure the defense security in the province.

References

[1] Patrick Gubry, Nguyen Huu Dung, Pham Thuy Huong (2003), _Vietnam’s population and development_, The World Publisher
Expression of Soybean Antioxidant System After Cowpea Aphid Infestation

Mai Van Chung1,*, Hoang Thi Quynh Trang2 and Nguyen Dinh Hung2

1Faculty of Biology, Vinh University
2Class 53B Biology, Vinh University
Le Duan str. 182, Vinh city, Nghe An province, Viet Nam
(* author for correspondence, E-mail: chungmv@vinhuni.edu.vn; Fax: (+84) 38 3855269)

Abstract

This study was designed to investigate whether extent oxidative stress and expression of antioxidant system are induced in leaves of soybean [Glycine max (L.) Merr.] cultivar DT84 that was cultured on Hoagland medium to stage V3 (fully developed leaf at second trifoliate node, third trifoliate leaf unrolled) and then was infested by cowpea aphid (Aphis craccivora Korch) for 48 hours. Two variants were used as: variant treated by 10 aphids per seeding and control (without aphid treatment). Infestation of cowpea aphid caused oxidative damage in leaves of soybean DT84, and accumulated different expression of several non-enzymatic as well as enzymatic antioxidants. Level of ascorbic acid was strongly increased while amount of total phenols minor altered. Activity of superoxide dismutase-SOD, catalase-CAT, peroxidases-POX and polyphenol oxidase-PPO was remarkably enhanced, whereas activity of ascorbate peroxidase-APX, ascorbate oxidase-AO was significantly reduced after aphid infestation. It was suggested that, ascorbic acid and enzymes such as SOD, CAT, POX, and PPO may play protective role in the defense mechanism of soybean against oxidative damage from infestation of cowpea aphid.

Keywords: Cowpea Aphid-Aphis craccivora, Soybean-Glycine max, DT84, Antioxidant, Enzyme, Infestation

Introduction

The plant–aphid interaction is a dynamic system subjected to continual variation and change (Mello and Silva-Filho, 2002). In this system, aphids evolve and develop many strategies to overcome plant defense barriers which allow them to feed, grow and reproduce on their host plants. Plants have developed different mechanisms to reduce aphid attack (Morkunas et al., 2011), in which the change in property of several non-enzymatic and enzymatic components of the antioxidant system has been suggested to be among first responses. Non-enzymatic antioxidants include compounds such as ascorbate, glutathione, phenolics as well as carotenoids. They interact with numerous cellular components via the crucial roles in defense (De Pinto and De Gara, 2004). The enzymatic components comprise of antioxidant enzymes such as superoxide dismutase (SOD, EC 1.15.1.1), catalase (CAT, EC 1.11.1.6), peroxidase (POX, EC 1.11.1.7), ascorbate peroxidase (APX, EC1.11.1.1) and ascorbate oxidase (APO, EC 1.10.3.3), and polyphenol oxidase (PPO, EC 1.10.3.1). These enzymes operate in different subcellular compartments and respond in concert when cells are exposed to oxidative stress (Sharma et al., 2012).

DT84, a cultivar of soybean [Glycine max (L.) Merr.], is extensively cultured in Vietnam. However, in the available literature, the information regarding the expression of defense mechanisms in this cultivar response to aphid infestation is still missing. The aim of the present work was to examine the expression of the antioxidant system in cultivar DT84 of G. max after cowpea aphid (Aphis craccivora Korch) infestation since they play an important role as anti-herbivores.

Materials and Methods

Materials

Soybean plant

The cultivar of soybean [Glycine max (L.) Merr.] used in experiments is ‘DT84’, which is provided by Nghe An Seed Centre (Vietnam).

Cowpea aphid

The aphid species is cowpea aphid (Aphis craccivora Korch), which is cultured and supported by Department of Applied Entomology (Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology). Virus free individuals were reared on host, G. max, in the phytotron with controlled environmental factors.
Experiments

Being culture in Hoagland medium to stage V3 (fully developed leaf at second trifoliate node, third trifoliate leaf unrolled), each soybean plants was treated by 10 wingless adults of *A. craccivora*. Aphid individuals were carefully transferred to soybean leaves with a fine paintbrush. Larvae and winged adults were monitored through all experiments; therefore number of *A. craccivora* wingless adults was constant. The control was soybean without aphid treatment. All control and aphid-infested variants were separately put in glass boxes (50cm × 50cm × 50cm) covered by nylon gauze and placed in the phytotron with temperature of 23-25°C, humidity related 70-75%, light period 14 light /10 dark hours with light intensity of 110-130 μM photons.m⁻².s⁻¹.

Leaves in control and the infested plants were carefully collected at 0, 24 and 48 hours post-infestation (hpi). Aphids all were removed. Leaves were weighed, frozen in liquid nitrogen and kept at -20°C for subsequent analyses of lipid peroxidation, antioxidative compounds and enzymes. Measurement of electrolyte leakage was performed in fresh materials at particular time points for all variants.

The analytical methods

Assessment of cellular damage

Electrolyte leakage was conductrometrically measured to assess the injury percentage of cell membrane according to the method of Sullivan (1971).

Lipid peroxidation was determined by the thiobarbituric acid reactive substances (TBARS) assay following the minor modification from method of Heath and Packer (1968).

Quantification of antioxidant compounds

Ascorbic acid and total phenols were analyzed by the methods of Kampfenkel et al. (1995) and Mechikova et al. (2007), respectively.

Enzymatic assays

Antioxidant enzymes were extracted from frozen leaves by homogenizing with an identified volume of phosphate buffer (pH 7.0). After that, the homogenate was centrifuged at 12,000×g for 20 minutes at 4°C. The supernatant was selected for enzyme assays.

Activity of superoxide dismutase (SOD) was measured according to modification from method of Giannopolitis and Ries (1977). Catalase (CAT) activity was assayed following the method of Chen et al. (2000) with minor modification. Peroxidase (POX) activity was followed the procedure of McAdam et al. (1992). Ascorbate peroxidase (APX) and ascorbate oxidase (APO) activities were assessed following the method of Cao et al. (2004). Polyphenol oxidase (PPO) activity was measured by the method of González et al. (1999).

Protein concentration was quantified by Bradford’s method with bovine albumin as the standard.

Statistics

All analyses were performed in three independent experiments. Analysis of variance (ANOVA) was applied to verify whether means from independent experiments within a given experimental variant were significant with the level of significance α=0.05.

Results

Cell membrane damage

Cell membrane injury leading to leakage of cellular content and lipid peroxidation can be caused after aphid infestation. The degree of *G. max* cell membrane injury was estimated through measurements of electrolyte leakage and lipid peroxidation.
Table 1. Effects of A. craccivora on lipid peroxidation and injury percentage in soybean leaves
FW: fresh weight of leaves. Data are expressed by mean ± SE of the three different replicates. In each row, (*) is considered statistically significant between the infested variant and control in specific time at the P < 0.05 level.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Time of infestation</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 hpi</td>
<td>24 hpi</td>
<td>48 hpi</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control leaves</td>
<td>Infested leaves</td>
<td>Control leaves</td>
<td>Infested leaves</td>
<td></td>
</tr>
<tr>
<td>Injury</td>
<td>%</td>
<td>1.21 ± 0.115</td>
<td>1.43 ± 0.122</td>
<td>8.55 * ± 0.451</td>
<td>2.19 ± 0.138</td>
<td>10.26 * ± 0.759</td>
</tr>
<tr>
<td>TBARS</td>
<td>µM.g⁻¹ FW</td>
<td>1.08 ± 0.046</td>
<td>1.39 ± 0.091</td>
<td>2.18 * ± 0.152</td>
<td>1.04 ± 0.085</td>
<td>2.32 * ± 0.063</td>
</tr>
</tbody>
</table>

The percentage of injury (based on electrolyte leakage) in G. max leaves caused by A. craccivora compared with control plants is shown in table 1. Infestation of cowpea aphid caused an increase of injury in soybean leaves from 1.21% at the beginning to 8.55% at 24 hpi and 10.26% at 48 hpi; whereas, the damage degree in control was much lower (1.43-2.19%).

Lipid peroxidation is a mechanism of cellular injury in plants, and is used as an indicator of oxidative stress in cells and tissues. Measurement of the end-product of lipid peroxidation by the thiobarbituric acid reactive substances (TBARS) assay has been used to indicate this process. After A. craccivora infestation 48 hours, content of TBARS in aphid-infested leaves (2.32 µM.g⁻¹ FW) was by 2.23-fold higher than in control (1.04 µM.g⁻¹ FW) and 2.15-fold higher than at the beginning (1.08 µM.g⁻¹ FW). It was indicated that cowpea aphid infestation caused oxidative stress in soybean leaves.

Antioxidant compounds

Aphid infestation accumulated to significantly increase in level of ascorbic acid (AA, vitamin C) in the infested leaves. The highest level of AA obtained at 48 hpi (3.54 mg.g⁻¹ FW), having by 93.44% greater than that recorded in control (1.51 mg.g⁻¹ FW).

In contrast to AA biosynthesis, amount of total phenols were reduced in the infested leaves with the rate of 2.24% recorded at 48 hpi in comparison with control (table 2). The decrease in the total phenols content in the infested leaves was concomitant with the high activity of both peroxidases-POX and polyphenol oxidases-PPO (table 3) because total phenols act as substrates of these antioxidant enzymes.

Table 2. Effects of A. craccivora on antioxidant compounds in soybean leaves
FW: fresh weight of leaves. Data are expressed by mean ± SE of the three different replicates. In each row, (*) is considered statistically significant between the infested variant and control in specific time at the P < 0.05 level.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Time of infestation</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 hpi</td>
<td>24 hpi</td>
<td>48 hpi</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control leaves</td>
<td>Infested leaves</td>
<td>Control leaves</td>
<td>Infested leaves</td>
<td></td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>mg.g⁻¹ FW</td>
<td>1.51 ± 0.078</td>
<td>1.47 ± 0.115</td>
<td>1.93 * ± 0.241</td>
<td>1.83 ± 0.106</td>
<td>3.54 * ± 0.097</td>
</tr>
<tr>
<td>Total phenols</td>
<td>mg.g⁻¹ FW</td>
<td>7.06 ± 0.822</td>
<td>7.47 ± 1.056</td>
<td>7.23 ± 0.928</td>
<td>7.15 ± 0.586</td>
<td>6.99 ± 0.314</td>
</tr>
</tbody>
</table>

Antioxidant enzymes

In the infested leaves were the remarkable increases in the activities of superoxide dismutase-SOD, catalase-CAT, peroxidases-POX and polyphenol oxidase-PPO. Of which CAT, POX and PPO were strongly enhanced to increase following time of infestation; activity of these enzymes was significantly higher than in control since 24 hpi, whereas this sign of SOD activity was only recorded at 48 hpi (table 3). On the contrary, activities of ascorbate peroxidase-APX and ascorbate oxidase-AO in the infested variants changed little and the difference was not recorded in comparison to control plants.
Furthermore, AA can also influence the efficacy of concentration is maintained by an efficient recycling system that makes AA a convenient antioxidant. High damage caused by oxidative process through synergic action with other antioxidants (Racchi, 2013). High regenerate oxidized carotenoids or α in a number of enzymatic and non-enzymatic components of the antioxidant system has been suggested to be enzymatic reactions. It can also directly scavenge O and hydroxyl radical OH (Chirkova et al., 1991). Our results recorded, the injury percentage in soybean leaves increased depending on duration of experiment. Increased electrolyte leakage is established mechanism of cellular injury in plants, and is used as an indicator of oxidative stress in cells and tissues. The TBARS assays has been used to indicate this process in soybean leaves. The electrolyte leakage was positively correlated with the TBARS content. The increase in percentage injury of leaf cell membrane and activation of lipid peroxidation detected in G. max after A. craccivora infestation were symptoms of cellular damage resulted from oxidative stress. Infestation of cowpea aphid stimulated ROS generation which causes subsequently membrane damage leading to lipid peroxidation in the plant cells. It indicated that enhancement of lipid peroxidation was accompanied by exosmosis of electrolytes, an increase in membrane relative permeability, and the cell membrane integrity was injured finally.

Table 3. Effects of A. craccivora on antioxidant enzymes in soybean leaves

Data are expressed by mean ± SE of the three different replicates. In each row, (*) is considered statistically significant between the infested variant and control in specific time at the P < 0.05 level.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Time of infestation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 hpi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control leaves</td>
</tr>
<tr>
<td>SOD</td>
<td>nkat.mg⁻¹ protein</td>
<td>8.20 ± 0.38</td>
</tr>
<tr>
<td>CAT</td>
<td>nkat.mg⁻¹ protein</td>
<td>18.33 ± 1.02</td>
</tr>
<tr>
<td>POX</td>
<td>nkat.mg⁻¹ protein</td>
<td>6.21 ± 0.38</td>
</tr>
<tr>
<td>APX</td>
<td>nkat.mg⁻¹ protein</td>
<td>13.77 ± 1.02</td>
</tr>
<tr>
<td>AO</td>
<td>nkat.mg⁻¹ protein</td>
<td>8.97 ± 0.81</td>
</tr>
<tr>
<td>PPO</td>
<td>nkat.mg⁻¹ protein</td>
<td>6.77 ± 0.35</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

Oxidative damage

Infestation of cowpea aphid caused oxidative damage in soybean leaves with an increase in injury percentage and levels of TBARS, the end-production of lipid peroxidation.

The change in membrane permeability as measured by electrolyte leakage was detected like a symptom of injury caused by increased formation of reactive oxygen species-ROS such as hydrogen peroxide-H₂O₂, superoxide anion radical- O₂⁻ and hydroxyl radical-OH⁺ (Chirkova et al., 1991). Our results recorded, the injury percentage in soybean leaves increased depending on duration of experiment. Increased electrolyte leakage is used to monitor loss of membrane integrity, and hence, indicates damage in soybean cells caused by aphid infestation activities.

Lipid peroxidation is a well-established mechanism of cellular injury in plants, and is used as an indicator of oxidative stress in cells and tissues. The TBARS assays has been used to indicate this process in soybean leaves as a small but progress increase of TBARS content was recorded in G. max leaves in the duration of A. craccivora infestation. TBARS content was enhanced to slightly increase and always higher that in control plants.

The electrolyte leakage was positively correlated with the TBARS content. The increase in percentage injury of leaf cell membrane and activation of lipid peroxidation detected in G. max after A. craccivora infestation were symptoms of cellular damage resulted from oxidative stress. Infestation of cowpea aphid stimulated ROS generation which causes subsequently membrane damage leading to lipid peroxidation in the plant cells. It indicated that enhancement of lipid peroxidation was accompanied by exosmosis of electrolytes, an increase in membrane relative permeability, and the cell membrane integrity was injured finally.

Expression of antioxidants in soybean defense mechanism

Plants protect themselves to stresses through different defense mechanisms, in which, the change in property of non-enzymatic and enzymatic components of the antioxidant system has been suggested to be among first responses (Ahmad et al., 2008). Damage resulted from the oxidative stress was diminished by the enhanced generation of non-enzymatic antioxidant such as AA as well as activity of enzymatic components e.g. SOD, CAT, PPO and POX in aphid-infested leaves. That alteration may serve to induce the defense response of soybean DT 84 to A. craccivora infestation.

AA is considered as the most powerful antioxidant in plant cell because of its ability to donate electrons in a number of enzymatic and non-enzymatic reactions. It can also directly scavenge O₂⁻ and OH⁺ and regenerate oxidized carotenoids or α-tocopherol, thus providing membrane protection and minimizing the damage caused by oxidative process through synergic action with other antioxidants (Racchi, 2013). High concentration is maintained by an efficient recycling system that makes AA a convenient antioxidant. Furthermore, AA can also influence the efficacy of plant defenses such as myrosinases and tannins, and alter...
insects’ susceptibility to natural enemies. Conversely, herbivores appear to influence both de novo synthesis and redox cycling of AA in their host plants, thereby potentially altering plant susceptibility to pests (Goggin et al., 2010). Therefore, the increase in level of AA in soybean leaves after aphid infestation may play as anti-herbivory agent.

Potential roles of enzymatic antioxidants such as SOD, CAT, POX and PPO in plant signaling have been implicated in plant resistance to insect herbivores, including aphids (Mai et al., 2013). The high efficiency of those enzymes observed in G. max is one of the most important elements of the defense responses to damages caused by cowpea aphid infestation.

Analyses of spectrophotometric assays showed that infestation of A. craccivora enhanced SOD activity in G. max. Activity of this enzyme in the infested leaves increased after aphid infestation, and was much higher than in control. Within the photosynthetic tissues, SODs constitute the first line of defense against ROS. SOD plays a key role in defense mechanisms against active oxygen build-up, because this enzyme can counteract oxidative damage caused by over accumulation of O$_2^•^-$, it catalyzes the disproportionation of O$_2^•^-$ to H$_2$O$_2$ and O$_2$ (Abassi et al., 1998). Being accompanied by an early oxidative burst, a higher induction of SOD activity elicited in some crops after aphid feeding compared to the control plants suggests the involvement of this enzymes in plants resistance responses (Moloi and van der Westhuizen, 2008; Mai et al., 2013).

Similar to SOD, the CAT activity in soybean seedlings was also enhanced by A. craccivora infestation. We supported that CAT may contribute in the defense mechanism of G. max against cowpea aphid attack by regulating levels of H$_2$O$_2$. The detection of an increase in CAT activity in aphid-infested leaves is one of the most important observations in the soybean-aphid interaction. The strong enhancement of CAT protects the soybean cells against an excess of H$_2$O$_2$ and thus against considerable membrane degradation. Role of SOD and CAT in soybean was similar to results recorded in expression of pea defense mechanism (Mai et al., 2013).

A number of processes are regulated by POXs that have direct and/or indirect role in plant defense, including lignification, suberization, somatic embryo-genesis, auxin metabolism, and wound healing. Production of phenoxo and other oxidative radicals by the POXs in association with phenols directly deter the feeding by insects and/or produces toxins that reduce the plant digestibility, which in turn leads to nutrient deficiency in insects with drastic effects on their growth and development. In addition, POXs have been reported to have direct toxicity in guts of herbivores (War et al., 2012). Interestingly, the change of POX activity in soybean is similar to results recorded in other plant species such as barley and cereal (Constabel, 1999) with conclusion that the increase in activity of POX might have contributed in plant defense responses to stress.

The PPOs are important enzymes in plants that regulate feeding, growth, and development of insect, and play a leading role in plant defense against the biotic and abiotic stresses. Many studies of enzyme induction by herbivores attest to the general belief that PPOs play a key role in defense against herbivores. At least three mechanisms have been proposed by which PPO might affect insect herbivores: (1) PPO-generated quinones could alkylate essential amino acids, decreasing plant nutritional quality, (2) redox cycling of quinones may produce oxidative stress in the gut lumen, and (3) phenolic oxidation products, such as quinones and hydrogen peroxide, could be absorbed and have toxic effects on herbivores (War et al., 2012). Correlation between induction of PPO activity and insect fitness has been reported in many plants, and PPOs confer plant resistance to a board range of insect herbivory (Bhonwong et al., 2009).

In conclusion, we emphasized that antioxidant system is one of the most important mechanisms, by which plants can protect themselves from insect and other stresses. Expression of the antioxidant components in soybean DT84 defense against cowpea aphid was similar with the study results of Malenčić et al. (2010) and Fortunato et al. (2015) on responses of some soybean cultivars to the fungal pathogens. They all emphasized the importance of a more efficient antioxidative system in the removal of ROS generated in soybean leaves during infection of fungi. Enzymes SOD and CAT are known to control ROS generation, therefore, reduce the cellular oxidative damage; whereas, POX and PPO oxidize their substrates to form other metabolized compounds that lead to the disruption of insect’s nutrition. Those aspects have been clarified in numerous plant-insect interactions. Therefore, from results obtained, we suggested that antioxidant compound ascorbic acid and antioxidant enzymes as SOD, CAT, POX, and PPO may play protective role in the defense mechanism of cultivar DT84 of G. max against oxidative damage caused by A. craccivora infestation. This study contributing to a better understanding of defense response of G. max cv. DT84 to cowpea aphid, thus providing both an impetus and a tool set for further studies on the role of antioxidant system in plant-insect interactions.

References


Greenhouse Gas Emissions in Electricity Generation from Bagasse in Nghe An Province, Vietnam

Dau Thi Khoa and Ho Thi Phuong*

Biology Faculty, Vinh University
182 Le Duan, Vinh city, Nghe An province
Vietnam
(*author for correspondence, E-mail: phuongmt.dhv@gmail.com)

Abstract

Bagasse, the waste from the sugar processes, is used for power plants cogeneration. These produce steam and electricity for using in the sugar mills. Currently, Vietnam has There are nearly 40 bagasse-based biomass power plants with a total designed capacity of 150 MW in Vietnam. In this study, we estimated the greenhouse gases emission of bagasse-fired power plant at sugar mill in Nghe An province of Vietnam. According to our calculations, 817.5 g of carbon dioxide equivalent were released to the atmosphere per kWh of electricity produced. The major part of the total emission (66%) resulted from transportation; about 20% resulted from cane burning, and about 14% from cane cultivation and harvest. The results of this study suggested that the considerable reduction in greenhouse gas emissions could be achieved by switching to a domestic consumption market of sugar production to reduce transport distances as well as improving bagasse-based power generation capacity.

Keywords: Greenhouse gas emissions, bagasse, Sugarcane, Electricity generation

Introduction

As an agricultural country, Vietnam has huge and diversified biomass resources from firewood, rice, coffee husk, straw, and bagasse. Agricultural wastes are most abundant in the Mekong Delta region with approximately 50% and in the Red River Delta with 15% of the amount of the whole country. Annually, there is approximately 60 million tons of biomass available in agriculture residues and waste, of which 40% has been utilized for household energy needs and electricity generation. Vietnam has set target of having a combined capacity of 500 MW of biomass power by 2020, which raised to 2,000 MW in 2030. In which, rice husk and bagasse are the biomass resources with the greatest economic potentials.

According to statistics in 2010, each year there were about 24 million tons of sugarcane in Vietnam and produce 7.8 million tons of bagasse. About 80% of bagasse in the sugar factory was used for power plants cogeneration (steam and electricity). Currently, there is 40 bagasse-based biomass power plants have been developing with a total designed capacity of 150 MW. Electricity generation from bagasse is used in the sugar mills and also sold the excess power to the grid.

Generating electricity from biomass such as bagasse is one strategy for reducing greenhouse gas (GHG) emissions because it is a carbon-neutral: the carbon will be produced as much carbon as the plants suck out of the atmosphere. However, the environmental impacts of power production from bagasse have been quantified to evaluate whether it is really advantageous for the environment. According to research in the UK, electricity from solid biomass is proven to generate electricity with a GHG emission intensity under 200 kg CO₂e/MWh. This intensity is lower than of electricity generated from fossil fuels in the UK (e.g. ~ 437 kg CO₂e/MWh for electricity from natural gas, ~ 1018 kg CO₂e/MWh for electricity from coal) [1]. However, based on the life cycle assessment for electricity production plants in Brazil, Diogo et al. (2014) showed that the production of electricity from bagasse will impact on environmental aspects such as photochemical ozone, toxic to humans through soil and air due to activities such as afterburner cane and the use of chemicals in cultivation process [2]. According to research by Toolseeram R. (2008) electricity produced from bagasse will impact on environmental issues such as greenhouse gas emissions, acidification and non-renewable energy inputs [3]. In addition, the research of Daranee J. and Shabbir H.G. (2006) showed that NOₓ and SOₓ emissions from bagasse power lower than electricity from fossil fuels and the environmental problem of the bagasse-fired power plant is the emission of substantial amount of CO and Total Suspended Particulates (TSP or dust) [4].

In this study, the GHG emission sources related to the sugarcane production within its own boundary will be determined. A comparison to other forms of electricity production will be also presented. In addition, different scenarios have been proposed to evaluate the potential in reduction of greenhouse gas emissions. This study considered a bagasse-fired power plant at a Song Con sugar mill in Nghe An province of Vietnam.
Materials And Methods

Functional unit
The functional unit is a set to one KWh electricity exporting.

Study site
The Song Con Sugar Mill is located in Nghe An province, Vietnam. The mill capacity is 5,000 tons of sugarcane per day during the crushing season in February to December. Total sugar processing capacity is 80,000 tons per year. During sugar production, bagasse (waste) is produced which is used for power generation.

The power plant is of cogeneration type with 2 water-tube boilers and 2 steams. The power plant generally operates at approximately 24 kWh per one tone sugarcane. The power plant generally operates at approximately 18.3 MW per year for the sugar factory and power plant itself.

System definition
The steps of the life cycle of electricity generated from the combustion of sugarcane bagasse which is included in the study will be shown in a flow chart (Fig. 1). The boundary of the life cycle encompasses cane production and harvesting, cane burning, transportation and sugar processing and electricity generation. The life cycle excludes fertilizers and herbicides manufacture, consumption of sugar and waste treatment.

![Flow chart showing the process flow diagram for electricity generation from sugarcane bagasse](image)

Figure 1. Process flow diagram for electricity generations from sugarcane bagasse

Method
The net emission is related to the residue burning in the field, methane (CH$_4$) and nitrous oxide (N$_2$O) and CO$_2$ emissions referred to lime application. All values are converted to CO$_2$ equivalent (CO$_2$e) following the individual global warming potential for a period of 100 years for each gas, using 25 to CH$_4$ and 298 to N$_2$O [5]. Emissions from transportation are considered as the emissions due fossil fuel use (total diesel consumption). The net emission excludes direct and indirect emissions of nitrous oxide from managed soils.

Agricultural residues burning
The sugarcane residues burning result is not only CO$_2$ emissions but also other GHG or precursors, including carbon monoxide (CO), methane (CH$_4$), non-methane volatile organic compounds (NMVOC) and nitrogen (N$_2$O, NO$_x$) species. Usually in the cropland and grassland areas only non-CO$_2$ emissions are considered, due to the assumption that those would be counterbalanced by CO$_2$ removals from the subsequent re-growth of the vegetation within in CO$_2$ rapidly once in atmosphere. NO$_x$ emission is not considered as a net GHG because its global warming potential is very uncertain. In this study, emission factors related to sugarcane residues burning are suggested by IPCC, Chapter 2, Generic methodologies applicable to multiple land use categories. [6,7]

\[
L_{fire} = A \times M_b \times C_f \times G_{ef} \times 10^3
\]

Where:
L_{fire} \text{ Amount of greenhouse gas emissions from fire, tons of each GHG eg. CH}_4, \text{ N}_2\text{O}

A \text{ Burnt area, ha}

M_b \text{ Mass of fuel available for combustion}

C_f \text{ Combustion factor (default value to agricultural residues, 0.8)}

G_{ef} \text{ Emission factor, g/kg dry matter burnt (default values 2.7 to CH}_4\text{ and 0.07 to N}_2\text{O)}

**Lime application**

\text{CO}_2\text{ emission due lime application are suggested by IPCC (2006) [7], Chapter 11, N}_2\text{O emissions from managed soils, and CO}_2\text{ emissions from lime and urea application (equation 11.12). Apply an overall emission factor (EF) of 0.12 for limestone and 0.13 for dolomite. These are equivalent to carbonate carbon contents of the materials (12% for CaCO}_3\text{, 13% for CaMg(CO}_3\text{)}_2\text{). The lime used in this study is the limestone.}

L = M x F x 44/12 x A

Where:

L \text{ CO}_2\text{ emissions, tons}

M \text{ Amount of calcic limestone (CaCO}_3\text{), ton/ha}

F \text{ Emission factor, tonne of C (0.12)}

44/12 \text{ Convert CO}_2\text{–C emissions into CO}_2

A \text{ Area, ha}

**Transportation**

For the transportation, it is considered only the consumption of diesel. Emission factor of diesel combustion is 2,645 kg per litter [8].

L = D x Y x Z x 1,000

Where:

L \text{ CO}_2\text{ emissions, tons}

D \text{ Transportation distance, km.}

Y \text{ Emission factor of diesel (2,645 kg/l)}

Z \text{ Average diesel consumption, litters km}^{-1}

**Results**

**Subsystems and main assumptions**

In Table 1 and Table 2 show the summarizing of the main assumptions and GHG emissions sources considered made in the study, respectively.

**Table 1. Subsystems and main assumptions**

<table>
<thead>
<tr>
<th>Subsystems</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cane cultivation and harvest</td>
<td>Cultivation area of 9,873 ha, including: the districts of Tan Ky (5,625 ha), Thanh Chuong (1,957.81 ha), Yen Thanh (1,010 ha), Do Luong (235 ha), Anh Son (1,046.4 ha) 1 ha ~ 80 tons of cane 12 tons of seed, 0.5 tons of lime, 1.5 tons of fertilizer and 8,000 m(^3) of irrigation water applied per ha</td>
</tr>
<tr>
<td>Cane burning</td>
<td>20.5 tons of sugarcane residues per ha (~ 4.1 tons per ha - dry weight)</td>
</tr>
<tr>
<td>Sugar processing and electricity generation</td>
<td>The sugar mill productivity is 5,000 tons of sugarcane per day, generating 510 tons of sugar, 1,479.6 tons of bagasse, 173.47 tons of molasses and 198.98 tons of sludge. 97% of bagasse is used as fuel for the boiler to produce electricity, with power output of 24 kWh respectively for 1 ton of sugar cane. 12,448 m(^3) of water used per day for cane processing</td>
</tr>
<tr>
<td>Transportation</td>
<td>Material transportation to field, including: seed, fertilizers, herbicides and lime transport  Cane transportation from field to sugar mill Other materials transportation to sugar mill Environmental treatment chemicals transportation to sugar mill Sugar transportation over an average distance of 330 km. from factory to Phu Tho by truck and then 3,041 km. from Phu Tho to China by</td>
</tr>
</tbody>
</table>

221
Table 2. GHG emissions sources consideration

<table>
<thead>
<tr>
<th>Subsystems</th>
<th>Processes</th>
<th>Greenhouse gas emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cane cultivation and harvesting</td>
<td>Lime application</td>
<td>CO₂</td>
</tr>
<tr>
<td>Cane burning</td>
<td>Combustion</td>
<td>CH₄, N₂O, CO, CO₂</td>
</tr>
<tr>
<td>Sugar processing and electricity generation</td>
<td>Energy use</td>
<td>CO₂e</td>
</tr>
<tr>
<td>Transportation</td>
<td>Diesel combustion</td>
<td>CO₂e</td>
</tr>
</tbody>
</table>

*Note: The avoided emissions due to the export of electricity, substituing for fuel oil (If any)*

**Greenhouse gas emissions**

The result in this study showed that the total carbon emissions of electricity generation bagasse was approximately 15,004.32 tons CO₂e per year, corresponding to 817.5 gCO₂e emitted for each kWh of electricity produced, 1.52 tons CO₂e for each cropped hectare, 0.19 tons CO₂e per ton of sugar production and 0.02 tons CO₂e per ton of sugarcane. Figure 2 presents the partition of GHG emission for each emission source considered in this study. The results indicated that GHG emission in transport accounts for 66.45% of the total emissions, about 20% resulted from cane burning, and about 14% from cane cultivation and harvest. The source of sugar processing and electricity generation in the mill released a negligible GHG amount due to electricity generation from bagasse provides almost 100% energy need of the sugar mill. In the emission source of transportation, sugar transport contributed the majority emission (Fig. 3).

![Figure 2. Percentages of GHG emissions for each subsystem](image-url)
Figure 3. GHG emissions from transportation

Comparison with electricity from different sources

Vattenfall [9] published popular account of life cycle studies in Sweden which showed the following CO₂ emissions for different power generation systems (Table 3). The CO₂ emissions for bagasse-derived electricity calculated in the study of Toolseeram R. (2008) in Mauritius [10] and Daranee J. (2006) in Thailand [4] were 35.6 and 89.28 g/kWh, respectively. The result of CO₂ emissions for bagasse-derived electricity in this study was 817.5 g/kWh, higher 9 times than the study in Thailand [4] and 23 times than the study in Mauritius [10]. In our opinions, considerable differences of these studies might be caused from these main reasons:

- Differences in boundary system for each research; for example, in the study in Thailand, emissions from transportation was excluded and in the study in Mauritius, sugar products were consumed domestically due to low emissions of transportation,
- Differences in the power generation capacity from bagasse; for example, in the study in Mauritius, power generation capacity from bagasse was nearly 80 kWh/1 ton of cane, however in this study the capacity was quite low with 24 kWh/1 ton of cane.

According the above reasons, three scenarios were proposed to evaluate the potentials in reduction of greenhouse gas emissions:

- Scenario 1: Increase power generation efficiency to 50 kWh/ton of cane.
- Scenario 2: Sugar consumption in the domestic market: transportation over and average distance of 250 km.
- Scenario 3: Increase power generation efficiency (Scenario 1) and Sugar consumption in the domestic (Scenario 2)

Table 3. CO₂ emissions from different power generation systems

<table>
<thead>
<tr>
<th>Systems</th>
<th>Average emissions (g CO₂e/kWh)</th>
<th>Source references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>980</td>
<td></td>
</tr>
<tr>
<td>Gas thermal</td>
<td>1,170</td>
<td></td>
</tr>
<tr>
<td>Solar photovoltaic</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>5.5</td>
<td>[9]</td>
</tr>
<tr>
<td>Nuclear</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Hydro</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Bagasse</td>
<td>89.28</td>
<td>[4]</td>
</tr>
<tr>
<td>Bagasse (this study)</td>
<td>35.6</td>
<td>[10]</td>
</tr>
<tr>
<td>Bagasse (this study)</td>
<td>817.5</td>
<td></td>
</tr>
</tbody>
</table>

The results for all scenarios are presented in Table 4. It shows that in scenarios 1 and 2, the emissions reduce approximately 52% compared with current emissions; in scenario 3 the emissions reduce approximately...
76% reduction compared to the current. These results is lower than the emissions from coal and gas (fossil fuels), but still higher than emissions from other renewable energy sources (solar, wind and hydrogen).

### Table 4. Comparison of GHG emissions under different scenarios

<table>
<thead>
<tr>
<th>Electricity production (kWh)</th>
<th>Total emissions (tons CO\textsubscript{2e})</th>
<th>Emissions per kWh electricity production (gCO\textsubscript{2e}/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>18,353,280</td>
<td>15,004.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>817.53</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>38,236,000</td>
<td>15,004.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>392.41</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>18,353,280</td>
<td>7,217.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>393.25</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>38,236,000</td>
<td>7,217.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>188.76</td>
</tr>
</tbody>
</table>

### Conclusions and Discussion

The study of GHG emissions related to the electricity generation production at the Sugar Mill in Nghe An province, Vietnam is investigated. The boundary of the life cycle includes 4 subsystems: Cane production and harvesting, cane burning, transportation, and sugar processing and electricity generation.

According to the results, the intensity of electricity generation from bagasse in this study shows that the electricity generation is quite high with 817.5 g CO\textsubscript{2e}/kWh. GHG emission in transport accounts a highest proportion (66.45%) of the total emissions. If there is an improvement of power generation capacity to 50 kWh/ton of cane, GHG emission can reduce to 392.41 g CO\textsubscript{2e}/kWh. If market is in domestic area, the emissions can be reduced to a half of current emission with 393.25 g CO\textsubscript{2e}/kWh. The best scenario is to improve power generation capacity and change sugar consumption market to the domestic area, the emission intensity can drop to 188.76 g CO\textsubscript{2e}/kWh.

### References


Stakeholders’ Assessment on the Relevance of the DMMMSU-SLUC School-On-Air Program

Jesus Rafael B. Jarata
Don Mariano Marcos Memorial State University
Agoo, La Union Philippines
E-mail: jesusrafael.jarata@gmail.com

Abstract

“Edukasyon: GabaysaKaunlaran” (Education: A Guide for Development) is a school-on-air radio broadcasting program of DMMMSU-SLUC which aims to create awareness on matters concerning environment, governance, education, health, literacy, entrepreneurship, and technology, current events and related trends and issues. It also provides a bridge between the university and the community through knowledge and technology sharing. Hence this study assessed the relevance of the said program on the socio-economic conditions of the stakeholders.

The stakeholders referred to in this study are limited to those students, teachers, farmers, fishermen and other members of the community who are directly or indirectly benefitted in the conduct of the program. The researcher selected 45 stakeholders as respondents. On the whole, the respondents “often” believe that the program has an impact in their lives. The program has some degree of influence in terms of improving the social and economic conditions of the stakeholders. In order to further improve the stakeholders’ socio-economic conditions as a whole, a field skills training may also be conducted to complement the knowledge/discussion presented in radio broadcast as in the field of agriculture which requires hands-on training. Moreover, since this study covered only a relatively small number of stakeholders, further research involving a larger number may be done. Impact assessment may also be done to determine how the programs are actually translated in terms of uplifting the socio-economic condition of stakeholders.

Keywords: Community, Entrepreneurship, Environment, Education, School-on-air, Stakeholders

Introduction

According to the Radio Code of the “Kapisananng mga Brodkastersa Pilipinas” (KBP), radio is a medium of communication with the widest reach and thus, has the capability of influencing the most number of audience. Moreover, radio stations contribute to national development and promote the educational, cultural, social, economic uplift of the people. Radio also provides expression of the Filipino identity, encourages patriotism, preserves traditions and development of arts, science and culture.

Every stakeholder of the community should strive hard in order to attain his enterprise’s goals and objectives. To function more effectively, radio stations must permit each member of the organization to render his maximum contribution to continually use Filipino creativity and resourcefulness to deliver matters that relate to development.

In order to be operationalized, the organization’s management should be aware of the radio station’s productivity so as to continue serving the listening public and to provide pertinent information for national development. Moreover, studying the efficiency and effectiveness of one’s organization has long been considered to be important in the management success or failure of any organization.

Precisely, Katz (2001) pointed out that management’s real concern should be what a person can do rather than what he is. He identified three basic skills—technical, human and conceptual—that every successful development communicator must have according to the level of management and communication at which he is operating.

Dela Pena (1999) also pointed out that the effectiveness concept may be described by such as “transforming decisions, establishing awareness, providing solutions and carrying out policies”. Thus, communicators set objectives that may be achieved by integrating its knowledge and skills with ability and experience of the employees. To be successful, communicators must effectively perform the basic functions of planning, controlling, and reporting. This relates with the ideas of Luther Gulick, an American consultant, as
cited by Leveriza (1993), as represented by the acronym POSDCORB—planning, organizing, staffing, directing, coordinating, reporting and budgeting. It should be pointed out that the manager or communicator—for this matter—performs the management functions to carry out its planned goals.

The DMMMSU-SLUC broadcasting program entitled “Edukasyon: GabaysaKaularan” aims (a) to create awareness on matters concerning environment, governance, education, health, literacy, entrepreneurship, and technology and other relevant trends and issues; (b) to provide a bridge between the university and the community and reach clienteles/beneficiaries through knowledge and technology sharing; (c) to provide information and updates on the University’s programs and activities; and (d) to instill the values of patriotism, unity, cooperation, commitment, and concerns of listeners on their environment, community, family, and self and promote the value of excellence, scholarship, service, and professionalism especially in education.

Nowadays, communication is one of the most challenging, stimulating, and satisfying experience that a communicator can have. Furthermore, it is rewarding to tell that one had helped someone within the organization to achieve high level of accomplishment and satisfaction. It is exciting to have a role which requires interacting and communicating with changing, growing, creative and resourceful people.

The communicator in any organization should work together to establish the organization’s long range goals and to plan how to achieve these. It is clear then that the organizations and the people who manage them perform essential functions by coordinating the efforts of different individuals—to enable them to reach goals that would otherwise be much more difficult or even impossible to achieve.

It is increasingly important that for the survival of an organization, there is a need to determine the efficiency and effectiveness of the AM station programs to ensure participation in national or regional development.

The program aired over DZAG involves faculty of the South La Union Campus to disseminate information of socio-economic upliftment so that listeners will have recognition and influence due them. The listeners (especially the local folks) should be given an opportunity to develop their sense of independence and dignity. Moreover, the beneficiaries must be informed, educated, motivated and organized through self-help and discovery. Hence, the changes in the socio-economic life of the stakeholders present a challenging problem for analysis.

The program plays an important role in improving the socio-economic conditions of the DMMMSU-SLUC stakeholders. This socio-economic well-being must be built from a base of increased economic or livelihood productivity of these stakeholders.

The principal goal of the program is to create awareness on matters concerning environment, governance, education, health, literacy, entrepreneurship, and technology and other relevant trends and issues. But, the program is not just about improving life. It is also about providing a bridge between the university and the community and reaching clienteles/beneficiaries through knowledge and technology sharing. The program will lead to economic efficiency by transforming its beneficiaries into prosperous livelihood producers who will become catalysts of growth in the countryside (Garilao, 1994). Moreover, the program provides information and updates on the University’s programs and activities. This means helping to organize stakeholders so they can learn to perform tasks crucial to their status through the programs conducted by the university for the stakeholders. Consequently, the program is expected to bring about social change and to alleviate the economic conditions of the people in the community.

Hence, the “Edukasyon: GabaysaKaularan” will enable the stakeholders enjoy a better quality life through increased knowledge. It is based on the abovementioned theories and principles that this study is conducted.

In this study, the researchers adopted the diagram as a guide in undertaking the study to ensure valuable results by determining the awareness, acceptability and effectiveness of the DZAG program. Hence, the researchers came up with Figure 1 which shows the flow chart in the paradigm.
In this study, the awareness, acceptability and effectiveness of the “Edukasyon: GabaysaKaunlaran” program is determined. The effectiveness is measured by the attainment of the general goals/objectives of the radio program based on the responses from the respondents.

Objectives of the Study
This study assessed the relevance of the DMMMSU-SLUC Broadcasting Program aired over DZAG every Friday at eleven to twelve o’clock high noon.
Specifically, the study sought to determine the stakeholders’ perceived economic and social benefits as influenced by the airing of the “Edukasyon: GabaysaKaunlaran” program. It also determined the degree of attainment of the program objectives.

Materials And Methods

Research Design
Descriptive method was used in the presentation and analysis of data obtained from the stakeholders. Data was gathered through questionnaires given by the researcher to the respondents and given qualitative interpretation.
Descriptive method was used in the qualitative interpretation of data gathered.

Population of the Study
Accidental and convenient selection of respondents was made—identifying those who have been listening to the program of which 45 respondents were chosen. The 45 respondents were distributed as follows: five (5) students, ten (10) teachers, fifteen (15) farmers and fifteen (15) fishermen.

Data Gathering Tools
The questionnaires were translated in Ilokano and Filipino. The administration and collection of questionnaires was made with the assistance of folk leaders in the community.

Treatment of the Data
The data analysis includes the use of percentage and mean. The weighted mean was utilized to measure the responses of the stakeholders on questions pertaining to the socio-economic effects of the broadcasting program.

For purposes of interpreting the mean, the following intervals and their corresponding interpretations were used:
Results

Table 1. Assessment of Stakeholder on the Relevance of the DMMMSU-SLUC Program, “Edukasyon: GabaysaKaunlaran”

<table>
<thead>
<tr>
<th>Items</th>
<th>Weighted Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I listen to the DMMMSU radio program regularly.</td>
<td>4.6947</td>
<td>Always</td>
</tr>
<tr>
<td>2. The time slot of the radio program captures the intended audience.</td>
<td>4.7368</td>
<td>Always</td>
</tr>
<tr>
<td>3. The topics are interesting and discussions are easily understood.</td>
<td>2.7368</td>
<td>Sometimes</td>
</tr>
<tr>
<td>4. The topics in the broadcast are timely and relevant.</td>
<td>3.6632</td>
<td>Often</td>
</tr>
<tr>
<td>5. Topics encourage participation and arouse feedbacks from listeners.</td>
<td>4.5263</td>
<td>Always</td>
</tr>
<tr>
<td>6. Information dissemination is effective and efficient delivered.</td>
<td>4.6947</td>
<td>Always</td>
</tr>
<tr>
<td>7. Discussants, resource persons, and guests are knowledgeable on their topics.</td>
<td>4.6947</td>
<td>Always</td>
</tr>
<tr>
<td>8. The broadcasters are trustworthy and can influence their listeners to act.</td>
<td>4.3895</td>
<td>Always</td>
</tr>
<tr>
<td>9. The radio program is open to comments and suggestions from listeners.</td>
<td>4.6938</td>
<td>Always</td>
</tr>
<tr>
<td>10. The radio program provides healthy interaction through question and answer portion.</td>
<td>2.4378</td>
<td>Seldom</td>
</tr>
<tr>
<td>11. The radio program contributes in community awareness and development.</td>
<td>4.8171</td>
<td>Always</td>
</tr>
<tr>
<td>12. The radio program provides information that are useful in my profession/community/ livelihood.</td>
<td>4.8463</td>
<td>Always</td>
</tr>
<tr>
<td>13. The radio program promotes solidarity among the people.</td>
<td>4.6456</td>
<td>Always</td>
</tr>
<tr>
<td>14. The radio program instills values that are relevant to individuals and the community.</td>
<td>4.8576</td>
<td>Always</td>
</tr>
<tr>
<td>15. The radio program serves as an effective bridge between DMMMSU and the community.</td>
<td>4.7678</td>
<td>Always</td>
</tr>
<tr>
<td>Overall Weighted Mean</td>
<td>4.0333</td>
<td>Often</td>
</tr>
</tbody>
</table>

As presented in the table, item 14 got the highest weighted mean of 4.8576. The respondents believe that the program “always” instills values that are relevant to individuals and the community. This is true because based on the informal interviews conducted to some of the respondents, they said that the programs’ hosts motivate and inspire them to pursue learning through participation to various fora, symposia or trainings that would improve their lives. They are inspired to be more independent, self-reliant, and responsible citizens.
Likewise, a weighted mean of 4.8463 revealed that the radio program “always” provides information that are useful in the stakeholders’ profession/community/livelihood. It is safe to assume, at this point, that the stakeholders are interested in uplifting their standard of living with their contention of the program’s importance and worth.

The program is benefitting the stakeholders “always” in community awareness and development, with a 4.8171 weighted mean. This concurs with the program’s objectives of creating awareness on matters concerning environment, governance, education, health, literacy, entrepreneurship, and technology and other relevant trends and issues. This item on community responsibility is, perhaps, efficiently carried out by the service of the faculty-broadcasters’ orientation, training, knowledge and skills of the culture of the people and the locality. In fact, tapped teachers for the program are selected based on their field of expertise.

Meanwhile, the respondents also “often” perceive that the topics in the broadcast are timely and relevant. The item, with a 3.6632 weighted mean, seemingly indicates the stakeholders’ association to the relevance of news to the present times. As could be gleaned in the radio broadcasting program’s plan of activities (please refer to the appendix), topics change every month—depending on the timely issues on a particular period of time.

Likewise, the respondents deem that the topics are “sometimes” interesting, with a weighted mean of 2.7368. This result implies that some of the topics may not arouse interest from the listeners; thus, topics may also be candy-wrapped to be fun and entertaining—although, the content should always be educational. Logically, listeners turn on their radios to be amused. Entertainments are believed to eliminate tensions, pressures and other negative aspects that could affect their daily activities.

However, the stakeholders “seldom” perceive that the radio program provides healthy interaction through questions and answer portion, with 2.4378 weighted mean. This may be attributed to the fact that the program, although it is aired live, does not have a feature that allows stakeholders to phone in or text the program’s hosts for questions and/or verifications.

As a whole, the respondents assessed the relevance of the broadcasting program with an overall weighted mean of 4.0333—“often”. It can be inferred from the result that the stakeholders can properly and easily assess the relevance of the program. Thus, it can be said that the program provide some benefits among the the socio-economic conditions of the stakeholders.

Conclusions and Discussion

The DMMMSU-SLUC Broadcasting Program, “Edukasyon: GabaysaKaunlaran” aims to attain socio-economic development based on increase productivity through increased of knowledge. It seeks to provide information that are useful in their professions/community/livelihood.

The program is designed with the aim of helping uplift the socio-economic lives of the stakeholders from poverty and stagnation and make them dignified, responsible, self-reliant and determined partners in development.

This study assessed the impact of the DMMMSU-SLUC Broadcasting Program, “Edukasyon: GabaysaKaunlaran” on the socio-economic conditions of the stakeholders.

The stakeholders referred to in this study is limited to those students, teachers, farmers, fishermen and other members of the community who are directly or indirectly involved in the conduct of the program. The researcher selected 45 stakeholders as respondents. The questionnaires were given through purposive and convenient sampling.

Findings

In the light of the investigations and researches conducted, the following are the important findings of the study:

1. The stakeholders “always” believe that the radio program instills values that are relevant to individuals and the community.
2. The stakeholders “always” presume that the radio program provides information that are useful in their profession/community/ livelihood.
3. The stakeholders “sometimes” perceive that the topics in the program are interesting and discussions are easily understood.
4. The stakeholders “often” believe that the topics in the broadcast are timely and relevant.
5. The stakeholders “sometimes” believe that radio program provides healthy interaction through question and answer portion.
6. On a whole, the respondents “often” believe that the broadcasting program has an impact in their lives.
Conclusions

Based on the findings in this study, the following conclusions are drawn:
1. The stakeholders have benefitted from the program through the livelihood/technical/profit skill development training given on air.
2. The objectives of the DMMMSU-SLUC radio broadcasting program of disseminating relevant information were achieved through the findings of the study.
3. The program has some degree of influence in terms of improving the social and economic conditions of the stakeholders.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are set forth:
1. In order to further improve the stakeholders’ socio-economic conditions as a whole, a field training may also be conducted to complement the knowledge presented in radio broadcast—especially skills development requires hands-on training.
2. The program may extend trainings on the use of modern technology to improve learning and livelihood skills.
3. More intensified and interesting topics in education, language proficiency and arts appreciation be conducted to cater to the professional audience of the program.
4. Since this study covered only a relatively small number of stakeholders, further research involving a larger number be done. Impact assessment be also done to determine how the programs are actually translated in terms of the socio-economic condition of stakeholders.

Acknowledgements

This herculean task is a tangible testimony of the adage, “No man is an island”—because this paper is a story of collaboration.

I would like to thank Dr. Emmanuel J. Songcuan, dean of the DMMMSU-SLUC College of Graduate Studies. It was under his watchful eye that I gained so much drive and an ability to tackle research challenges head on. I am also indebted to Prof. Nenita H. Rivera, my research partner, who was always willing to help and give her best suggestions. It would have been a lonely endeavor without her. Many thanks to my academic community, Dr. Raquel B. Quiambao, dean of my home college (College of Arts and Sciences), for her motivation and sincere cooperation; Dr. Loreto B. Waguey, chairperson of the Language Department, for her motherly guidance; and, the faculty members in my department for the cheers and encouragement “when the going gets tough”.

Finally, and most importantly, I would like to thank my parents, Dr. Leonardo M. Jarata and Mrs. Dolores B. Jarata, for their faith in me and allowing me to be as ambitious as I wanted.

To the One who said: “Let there be light; and there was light”, thank You. To God be the highest glory.

References

Electric Lawn Mower Saving Energy and Reducing Pollution

Siriwan Arjhamrung

Department of Engineering Management, Faculty of Engineering, Rajabhat Maha Sarakham University, Maha Sarakham 44000, Thailand
E-mail: siriwan90235@gmail.com

Abstract

It is well known that the price of oil in the country is quite high. Due to the use of oil in large quantities, especially the transportation sector. Industrial sector and agriculture as a result, oil prices rose as well. Pollution emissions due to incomplete combustion of the engine. Including air and noise pollution that is harmful to the health of people as well.

The aim of this project is to develop a gasoline mower. Switching to solar power and batteries. By studying the possibility of changing the energy of gasoline. A solar energy storage battery and test performance compared to gasoline. Sound Test Air Pollution and value to the economy. To test performance of solar mower can cut branches up. The grass can be cut by 150 m. in 20 min20 minutes and cost two baht and estimate = 0.013 baht were cut from a lawn mower engine. Grass areas are equal, but costs 15 baht a square meter and = 0.1 baht, it can be concluded that solar lawn mowers are suitable for use in the value and environmental for safety.

The results of the test mower solar energy can be used practically. By comparing the work with lawn mowers, gasoline was found. Cutting area of 150 square meters for /minutes while a gasoline lawn mower takes 19 minutes and costs were accounted for mower solar cost 0.013 baht per har and a lawn mower gasoline cost 0.1 baht per hrs is also observed. A set of noise and fumes from the engine to work less than solar mower engine.

For testing can conclude that. Mower can use solar energy actually works in practice and have worth for the economic and safety to the worker rather than a lawn mower engine. The cost of mowing 0.087 baht per square meter cheaper than gasoline.

Keywords: Mowerlawn, Moter system, Controller, Battery, Gasoline

Introduction

1.1 Situation Analysis

Thailand is one of countries that very highly consume in Petroleum for transportation Sector, Industrial Sector and also Agriculture Sector. The large amount of petroleum is used in cars, trucks, lorry, motorcycle, light engines and heavy engines for my part of industrials even though Thai government has campaigned for energy saving for a long time. These situations Thai government and Thai people have high cost of living in energy and also cause the pollution in air and sound.

For those situations, the research staff has had the idea to develop a solar energy mower in brush cutter model instead of gasoline mower. The gasoline mower causes the pollution of air and sound and also is not economized in energy, so the solar energy mowers are the selective mowers for Thai people in the future.

1.2 Objectives

1.2.1 To develop the solar energy mower in brush cutter model for practical use and reduce pollution.
1.2.2 To study the competency of solar energy mower in brush cutter model.
1.2.3 To study the suitability of solar energy mower in brush cutter model.

1.3 Timing

1.3.1 Timing is during June –September 2013.

1.4 Framework of the Study

1.4.1 The direct electricity is used in motor.
1.4.2 Dry cell battery is used for power resources, 12 V, 9 amp./h., one battery, 3 kg.
1.4.3 Use Core Shaft to drive mower blades.
1.4.4 Use on-off switch to control electric motor
1.5 Expectation of Benefit

1.5.1 There will have solar energy mower that practical use in mowing and reduce air and sound pollution.

1.5.2 There will have solar energy mower that can mow the grass continuously.

Materials and Methods

3.1 Design to develop the body of mower

Researcher staff had studied and collected data, after that decided to design solar cell mower by consideration of safety, benefit, economized power, beautiful and reduce pollution.

![Figure 17: Structure of the mower](image17)

As shown in figure 17, the components of the mower as follow:

1. Blades
2. Protection of flying debris
3. Shaft of the mower
4. Handle
5. Motor
6. Battery
7. On-off switch No.1
8. Sash
9. Control set
10. On-off switch No.2
11. Pocket of solar cell
12. Solar cell
13. Charger controlled of solar cell

3.2 Design and Steps of Construct

![Figure 18: Attached Motor to Shaft of the Mower](image18)
1. Install motor to the shaft of the mower. This step, we have to unscrew 3 knots, after that attach motor then screw the knot.

Figure 19: Attached the blades

2. Install the blades Before attaching the blades, we have to use 6 angles wrench at the hole beside to fix before unscrew and screw the knot.

Figure 20: Attached the Handle Set to splice of handle

3. Install handle set to the splice of handle. We had to unscrew 4 knots of six angles at splice. Lay handles and make balance of two sides, left and right. After select the level, we have to screw the 4 knots tightly.

Figure 21: Install the base of battery
4. Install the base of battery to the shaft of the mower. This step, we have to let the hole of 4 knots through the hole of the mower, then we use the wrench to screw 4 knots tightly to the base of battery.

Figure 22: Install the set of battery

5. Install the set of the battery. This step, we install battery at the back of the mower to be gravity of the mower.

Figure 23: Create the pocket of Solar Cell

6. Create the pocket of Solar Cell. This step, we have to use electric drill to drill 4 holes of knots to attach cushion to the pocket of solar cell.

Figure 24: Install solar cell into the pocket
7. Install solar cell into the pocket  This step, we have to drill 4 holes of the knots straight to the hole of solar cell and the pocket, then using slotted to screw 4 knots tightly to fit solar cell and the pocket.

![Connecting solar cell to battery](image1)

Figure 25 : Connecting solar cell to battery

8. Connecting solar cell to battery  This step, we have to skewer the plug of solar cell to the plug of battery to charge battery.

**Operation Step**
1. Direct current electricity will flow to motor to drive power to the shaft to the blades and control by switch and safety.

**Testing to mow practically as in picture 26**

![Testing to work practically](image2)

Figure 26 : Testing to work practically

**Results**

Having construction of economized energy mower and reduce pollution, the results of testing is satisfactory. The economized energy mower can operate by using battery as energy resource and the energy is sent to motor by 2 controlled switches. The first switch control battery to turn on and turn off, the second battery will control motor.

For safety in using the economized energy, studying instruction in details is needed as follow;

4.1 **Instruction for solar energy mower.**

1. Put on protected device
2. Put on sash belt
3. Sling the pocket of solar cell (incase of charging during mowing)
4. Press controlled switch on or off as needed
5. Catch the handle tightly for convenience and safety
6. Press switch of motor on the right hand side to start working.

### 4.2 Comparative Tables

#### 4.2.1 Comparative table 1

Table 1: Compare increasing pollution to environment

<table>
<thead>
<tr>
<th>Sequence</th>
<th>List</th>
<th>Solar energy mower</th>
<th>Gasoline engine mower</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Noise pollution</td>
<td>No noisy (65 dB)</td>
<td>Noisy (90 dB)</td>
</tr>
<tr>
<td>2</td>
<td>Air pollution</td>
<td>No increasing air pollution</td>
<td>Increase air pollution</td>
</tr>
<tr>
<td>3</td>
<td>Petrol</td>
<td>No need petrol</td>
<td>Using petrol</td>
</tr>
</tbody>
</table>

To test the level of noise, according to the table, gasoline energy mower make noisy at 90 dB level, higher noisy than normal. That is 80-85 dB level. So if using this mower continuously more than 8 hours, it is dangerous nervous system, increase air pollution and also waste the petrol. On the other hand, solar energy mower makes the noise at only 65 dB level. It is not dangerous to the user. No increase air pollution, no waste petrol and also no increase pollution to environment.

#### 4.2.2 Comparative table 2

Table 2: Compare operation

<table>
<thead>
<tr>
<th>Sequence</th>
<th>List</th>
<th>Time</th>
<th>Area/Sq.M.</th>
<th>Cost (baht)/per Sq.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solar energy mower</td>
<td>20</td>
<td>150</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Gasoline energy mower</td>
<td>19</td>
<td>150</td>
<td>15</td>
</tr>
</tbody>
</table>

According to the table, we can find that in the area of 150 square meter, the solar energy mower takes 20 minutes, the gasoline energy mower takes 19 minutes. When we consider about the cost, the solar energy mower cost only 2 baht or 0.013 baht per square meter, but the gasoline energy mower cost 15 baht or 0.1 baht per square meter. We can conclude that solar energy mower is cheaper than the gasoline energy mower 0.087 baht per square meter.

#### 4.2.3 Comparative table 3

Table 3: Compare suitability of using

<table>
<thead>
<tr>
<th>Sequence</th>
<th>List</th>
<th>Solar energy mower</th>
<th>Gasoline energy mower</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Worthy</td>
<td>No waste petrol</td>
<td>Waste petrol</td>
</tr>
<tr>
<td>2</td>
<td>Safety to health</td>
<td>Safety to health</td>
<td>Danger to health</td>
</tr>
<tr>
<td>3</td>
<td>Safety to environment</td>
<td>Safety to environment</td>
<td>Danger to environment</td>
</tr>
</tbody>
</table>

According to table 3, we can conclude that solar energy mower is more suitable in worthy because it does not consume petrol and also safety to health since there is no burn. There is burn in gasoline energy mower and increasing air pollution. On the other hand, there is not increasing air pollution in solar energy mower.

#### 4.3 Calculation for cost reduction

For one day, gasoline energy mower operated 30 minutes daily, cost 20 baht x 30 days = 600 baht / month x 12 months = 7,200 baht / year.

For one day, solar energy mower operated 30 minutes daily, cost 2 baht x 30 days = 60 baht / month x 12 months = 720 baht / year.

### Conclusion

1. The solar energy mower is the economized energy mower, reduce pollution and using practically.
2. Operation in the area of 150 square meter, solar energy mower takes 20 minutes, cost 2 baht = 0.013 baht per square meter. At the same time, gasoline energy mower takes 19 minutes, cost 15 baht = 0.1 baht per square meter.
3. Solar energy mower, for the cost, is more cheaper than gasoline energy. Mower 0.087 baht per square meter.
4. Loudness and smoke of solar energy mower is less than gasoline energy mower.
Problem and Barriers
1. Rare to find equipments
2. High cost for construction
3. Shortage of device to construct the body of the mower

Recommendation
To future designing of solar energy mower for economizing and reducing pollution, it can be design to more lighter and more speed of motor than before. This is because we can use this mower to mow in varying of grass. Research staff hopes that there will have attendant to keep on developing perfectly and more benefit in the future.

Acknowledgements
The research of Electric mower saving energy and reducing pollution has finished because of the people who helped give some information, suggestions, consultant, ideas and encouragement. Thank you for Mr.PakapolChangyan, who had a review this research. Thank you for the committees who evaluated the research draft. Many thanks for the co-researchers who helped trial and make it be successful.

Finally, I would like to thank the Researching and Developing Institute of RajabhatMahasarakhun University who supported the scholarship and encourage us to do this research so far.

References
[8] The structure of the battery. The articles of the student Nida NIDAITM CONTEST2 year 2555.
[12] Type mowers. Department of Agricultural Engineering. The individual components of Engineering Kasetsart University KamphaengSaen Campus, NakhonPathom. 73140
[16] DC motor. Publisher Technology Promotion Association (Thailand - Japan), TPA
Adsorption of CO$_2$ on B–And Ga–Doped Silicon Carbide Nanosheets: A Theoretical Study

Chanukorn Tabtimsai$^{1,*}$, Preecha Kansawai$^1$, Pattamawan Phoson$^1$, Patsara Pooboontong$^1$ and Banchob Wanno$^2$

$^1$Computational Chemistry Center for Nanotechnology and Department of Chemistry, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, 44000, Thailand.

$^2$Center of Excellence for Innovation in Chemistry and Supramolecular Chemistry Research Unit, Department of Chemistry, Faculty of Science, Maha Sarakham University, Maha Sarakham, 44150, Thailand

($^*$author for correspondence, E-mail: tabtimsai.c@gmail.com)

Abstract

Adsorptions of carbon dioxide (CO$_2$) molecule on pristine, B– and Ga–doped silicon carbide nanosheets (SiCNS) were investigated by using density functional theory calculation at the B3LYP (as 6–31G (d,p)) theoretical level. This work revealed that the structural properties of pristine SiCNT were modified by doping and adsorption. The binding energies indicated that the B atom showed stronger interaction with SiCNS than that of Ga atom in which B atom doping on silicon site showed stronger interaction than that of carbon site. The B– and Ga–doped SiCNSs were more highly sensitive to CO$_2$ than that of pristine SiCNS. In addition, Ga doped silicon site of SiCNS showed the strongest interaction with CO$_2$. The electron transfers from B or Ga atom to SiCNS are responsible for such peculiar adsorption behavior of CO$_2$ on B– and Ga–doped SiCNS. The sensibility of SiCNS–based chemical gas sensors could be dramatically improved by introducing the B and Ga dopants, so B– and Ga–doped SiCNS is more suitable for CO$_2$ detection than with pristine SiCNS.

Keywords: Adsorption, Carbon dioxide, Doped, Silicon carbide, Nanosheet, Theoretical study

Introduction

Silicon carbide nanotubes (SiCNTs), which were first synthesized in 2001, are analogous to carbon nanotubes in many respects and exhibit one-dimensional tubular forms [1,2]. The SiCNTs are promising building blocks for nanotechnology and microelectronics, and have potential applications in the fields of high–power, high voltage, high thermal conductivity, and high frequency applications [3–6]. Theoretical studies have shown that single–walled SiCNTs are semiconductors independent of the helicity, unlike the case for carbon nanotubes [7,8]. It was also found that SiCNTs have a highly reactive exterior surface, which facilitates sidewall decoration and adsorption. For example, the Li atom [9], hydrogen molecule [10] or fluorine atom [11] can be effectively adsorbed to the SiCNTs. The potential use of Cu–functionalized SiCNT as nanodevices for CO$_2$ monitoring has been reported [12]. Recent years have seen significant research attention directed toward the production of exfoliated nanosheets such as graphene, boron nitride and silicon carbide nanosheets. Electronic structures of silicon carbide nanosheets (SiCNSs) have been investigated by spin–polarized first–principle calculation [13]. However, there is no theoretical study about B and Ga interacting with SiCNSs and their adsorption with CO$_2$. Therefore, the adsorptions of CO$_2$ on the B– and Ga–doped SiCNSs, in comparison with its adsorption on pristine SiCNS, have been investigated.

Computational Methods

The SiCNS model composed of 21 silicon, 21 carbon and 18 hydrogen atoms which is nearly the same size of graphene nanosheet model reported in previously published work [14], was chosen for this study. Hydrogen atoms were used to saturate the carbon atoms with dangling bonds at the edge of SiCNSs. The B– and Ga–doped SiCNSs were modeled in the way that one silicon or carbon atom at the center of sheet was replaced with B or Ga atom. Therefore, the structures of B– and Ga–doped SiCNSs (M–SiCNS) were composed of 20 silicon or carbon atoms, 18 hydrogen atoms, and one B or Ga atom. As B or Ga atom in the M–SiCNSs was expected to be adsorption site, the adsorbed gas CO$_2$ was set by placing its molecule over the metal atom. Structural optimizations of the pristine SiCNS, doped SiCNS, and their adsorption structures with CO$_2$ were carried out using the intensive density functional theory method (DFT) at the B3LYP/6–31g(d,p) theoretical level [15–17]. In addition, natural bond orbital (NBO) analysis implemented in GAUSSIAN 09 program [18] was applied through a series of intermolecular interactions under the above system to evaluate the NBO charges. The molecular graphics of all related species were generated with the MOLEKEL 4.3 program [19].
The binding energies \( (E_b) \) of all SiCNSs doping with B and Ga atoms to form B and Ga doping complexes were calculated according to equation:

\[
E_b = E_{M-CNC} - E_{CNC} - E_M
\]  

(1)

where \( E_{TM-CNC}, E_{CNC} \), and \( E_M \) are total energies of B or Ga doping on Si or C sites of SiCNS, pristine SiCNS (Si_{20}C_{21}H_{18} or Si_{21}C_{20}H_{18}), and free B or Ga atom, respectively.

The adsorption energies (\( \Delta E_{ads} \)) of CO\(_2\) adsorbed on pristine and doped SiCNS were obtained from equations (2) and (3), respectively.

\[
E_{ads} = E_{CO2/SiCNT} - E_{SiCNT} - E_{CO2}
\]  

(2)

\[
E_{ads} = E_{CO2/M-SiCNT} - E_{M-SiCNT} - E_{CO2}
\]  

(3)

where \( E_{CO2/SiCNS} \) and \( E_{CO2/M-SiCNT} \) were the total energies of the adsorption of CO\(_2\) on pristine and M–SiCNT, respectively. The \( E_{SiCNT} \) and \( E_{M-SiCNT} \) were the total energies of the pristine and M–SiCNT, respectively, and \( E_{CO2} \) was the total energies of isolated CO\(_2\) molecules. A negative or positive value for \( E_{ads} \) was referred to as exothermic or endothermic processes, respectively.

**Results**

The optimized structure of pristine SiCNS is shown in Figure 1. The calculated bond lengths of pristine SiCNS, denoted by C–Si1, C–Si2, and C–Si3, were estimated to be 1.803, 1.780, and 1.803 Å, respectively. The bond angles of pristine SiCNT, denoted by Si1–C–Si2, Si2–C–Si3 and Si3–C–Si1, were estimated to be 120.1, 120.1 and 119.8°, respectively. The model of M–doped SiCNS was built based on the model of pristine SiCNS. One Si or C atom was replaced with a B or Ga atom. Geometry optimization was then carried out on these models. The optimized structures of M–doped SiCNSs are shown in Figure 2. When a Si or C atom in hexagonal ring on the center of pristine SiCNS was successfully replaced, the geometrical structures of the SiCNS presented dramatic changes caused from the doping effect. Bond lengths around the doping site of all M–doped SiCNSs obtained in this study were in the ranges of 1.595–2.300, 1.614–2.295, and 1.595–2.300 Å for M–Si1 or M–C1, M–Si2 or M–C2, and M–Si3 or M–C3, respectively, which were longer than bond lengths of undoped structures as listed in Table 1. The CO\(_2\) molecule was adsorbed onto the pristine or M–doped SiCNS to investigate the influence of the different doped atoms on the interactions between the SiCNS and the CO\(_2\) molecule. The configurations of the modeling systems after the DFT optimization are shown in Figures 3 and 4.

The selected geometrical parameters, binding distance (BD) and C–O bond length of CO\(_2\) adsorbed on pristine, B–, and Ga–doped SiCNS by pointing its C atom toward the adsorption site are also listed in Table 1. Comparing with the M–SiCNT without CO\(_2\) adsorption, bond lengths of the CO\(_2\) adsorbed on M–doped SiCNS systems were significantly longer than that of Si–M or C–M bond, while the Si–M–Si or C–M–C bond angles of CO\(_2\) adsorbed on M–SiCNT were narrower than the system without CO\(_2\) adsorption. The binding distances between the shortest CO\(_2\)–SiCNS bond was 3.620 Å and CO\(_2\)–M–SiCNS bonds were found in the range between 1.762 – 4.022 Å.

Fig. 1. The B3LYP/6–31g(d,p) optimized structures of the pristine SiCNS.
Fig. 2. The B3LYP/6–31g(d,p) optimized structures of (a) B–SiCNS, (b) B–SiCNS, (c) Ga–SiCNS, and (d) Ga–SiCNS.

Fig. 3. The B3LYP/6–31g(d,p) optimized structures of the CO₂ adsorbed on pristine SiCNS.

Fig. 4. The B3LYP/6–31g(d,p) optimized structures of CO₂ adsorbed on (a) B–SiCNS, (b) B–SiCNS, (c) Ga–SiCNS, and (d) Ga–SiCNS.
The binding abilities of B and Ga onto SiCNTs were in order: B > Ga. The adsorption energies of CO adsorption strength was in the following order: CO \_SiCNS > CO \_SiCNS > CO \_SiCNS. As shown in Table 2, the adsorption energy of CO adsorption on SiCNS was improved by B and Ga doping. Due to interaction between B or Ga atom and SiCNS, B atom interacting with SiCNS was much stronger than Ga atom remarkably.

<table>
<thead>
<tr>
<th>Systems</th>
<th>Bond lengths</th>
<th>Bond lengths</th>
<th>Bond lengths</th>
<th>Bond lengths</th>
<th>Bond lengths</th>
<th>Bond lengths</th>
<th>Bond lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiC</td>
<td>C–Si1 1.803</td>
<td>Si1–C–Si2 120.1</td>
<td>C–Si2 1.780</td>
<td>Si2–C–Si3 120.1</td>
<td>C–Si3 1.803</td>
<td>Si3–C–Si1 119.8</td>
<td></td>
</tr>
<tr>
<td>B_C–SiC</td>
<td>B–Si1 1.906</td>
<td>Si1–B–Si2 119.8</td>
<td>B–Si2 1.894</td>
<td>Si2–B–Si3 119.8</td>
<td>B–Si3 1.906</td>
<td>Si3–B–Si1 120.3</td>
<td></td>
</tr>
<tr>
<td>B_S_SiC</td>
<td>B–C1 1.595</td>
<td>C1–B–C2 120.1</td>
<td>B–C2 1.614</td>
<td>C2–B–C3 120.1</td>
<td>B–C3 1.595</td>
<td>C3–B–C1 119.6</td>
<td></td>
</tr>
<tr>
<td>Ga_C–SiC</td>
<td>Ga–Si1 2.300</td>
<td>Si1–Ga–Si2 99.6</td>
<td>Ga–Si2 2.295</td>
<td>Si2–Ga–Si3 99.6</td>
<td>Ga–Si3 2.300</td>
<td>Si3–Ga–Si1 100.5</td>
<td></td>
</tr>
<tr>
<td>Ga_S_SiC</td>
<td>Ga–C1 1.908</td>
<td>C1–Ga–C2 120.1</td>
<td>Ga–C2 1.917</td>
<td>C2–Ga–C3 120.1</td>
<td>Ga–C3 1.908</td>
<td>C3–Ga–C1 119.6</td>
<td></td>
</tr>
<tr>
<td>CO_2/SiC</td>
<td>C–Si1 1.950</td>
<td>Si1–C–CO_2 82.5</td>
<td>C–Si2 1.879</td>
<td>Si2–C–CO_2 107.0</td>
<td>C–Si3 1.858</td>
<td>Si3–C–CO_2 105.6</td>
<td></td>
</tr>
<tr>
<td>CO_2/B_C–SiC</td>
<td>B–Si1 1.982</td>
<td>Si1–B–Si2 115.7</td>
<td>B–Si2 1.924</td>
<td>Si2–B–Si3 113.2</td>
<td>B–Si3 1.940</td>
<td>Si3–B–Si1 115.9</td>
<td></td>
</tr>
<tr>
<td>CO_2/B_S_SiC</td>
<td>B–C1 1.596</td>
<td>C1–B–C2 120.2</td>
<td>B–C2 1.613</td>
<td>C2–B–C3 120.2</td>
<td>B–C3 1.595</td>
<td>C3–B–C1 119.4</td>
<td></td>
</tr>
<tr>
<td>CO_2/Ga_C–SiC</td>
<td>Ga–Si1 2.299</td>
<td>Si1–Ga–Si2 99.2</td>
<td>Ga–Si2 2.302</td>
<td>Si2–Ga–Si3 99.2</td>
<td>Ga–Si3 2.300</td>
<td>Si3–Ga–Si1 100.4</td>
<td></td>
</tr>
<tr>
<td>CO_2/Ga_S_SiC</td>
<td>Ga–C1 1.908</td>
<td>C1–Ga–C2 119.9</td>
<td>Ga–C2 1.916</td>
<td>C2–Ga–C3 120.3</td>
<td>Ga–C3 1.907</td>
<td>C3–Ga–C1 119.7</td>
<td></td>
</tr>
</tbody>
</table>

\( ^a \) C1, C2, C3, Si1, Si2, and Si3 are atoms on the SiCNS which are defined in Figure 1.
\( ^b \) B and Ga metal atom which is doped on SiCNS, see Figure 2.
\( ^c \) Bond lengths are in angstrom.
\( ^d \) Bond angles are in degree.
\( ^e \) Bonding distance (BD) between CO\_2/SiCNS or CO\_2–B or Ga doped–SiCNS in angstrom.
\( ^f \) C–O distance after CO\_2 adsorbed on SiCNS in angstrom.

The binding energy variation in the M–SiCNS was carefully studied to investigate the effect of the doped atoms on the SiCNS. As shown in Table 2, the binding abilities of B and Ga onto SiCNTs were in order: B\_S\_ > B\_C > Ga\_S\_ > Ga\_C. Due to interaction between B or Ga atom and SiCNS, B atom interacting with SiCNS was much stronger than Ga atom remarkably. The \( E_{ad} \) between the CO\_2 molecule and the pristine SiCNS was approximately \( -1.59 \) kcal/mol. (See Table 3). The adsorption energies of CO\_2 adsorbed on B– and Ga–doped SiCNSs were calculated to be in the range between \( -1.83 \) to \( -4.04 \) kcal/mol. The relative magnitude of adsorption strength was in the following order: CO\_2/Ga\_S\_–SiCNS (\( -4.04 \) kcal/mol) > CO\_2/Ga\_C–SiCNS (\( -2.23 \) kcal/mol) > CO\_2/B\_S\_–SiCNS (\( -2.08 \) kcal/mol) > CO\_2/B\_C–SiCNS (\( -1.83 \) kcal/mol). It could be noted here that the adsorption ability of CO\_2 on SiCNS was improved by B and Ga doping.
The partial charge transfers (PCTs) between B or Ga atom and pristine SWCNT, computed by using NBO analysis are shown in Table 4. It was found that NBO charges of B and Ga doping on C sites were in negative values whereas the NBO charges of B and Ga doping on Si sites were positive values. These results suggested that electron transfers between B or Ga atom and SiCNSs. The PCTs between CO₂ and the pristine, B and Ga–doped SiCNSs were qualitatively understood by the fact that the CO₂ adsorption trend to transform the atoms at binding sites from $sp^2$ hybridization to $sp^3$–like hybridization. Therefore, charges were transferred from CO₂ to the pristine and M–SiCNSs (0.007 to 0.516 e). The findings were very similar to that of the previous studies in the case of CO₂ interaction with Zn–, Pd–, and Os–doped single wall carbon nanotube (SWCNT) [20] and Co–, Rh–, and Ir–doped SWCNT [21].

### Table 2 Binding energies ($E_b$) of B– and Ga–doped SiCNSs, computed at the B3LYP/6–31g(d,p) level of theory

<table>
<thead>
<tr>
<th>Systems</th>
<th>$E_b$ (kcal/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B + SiC → B₁–SiC</td>
<td>−167.03</td>
</tr>
<tr>
<td>B + SiC → B₂–SiC</td>
<td>−235.50</td>
</tr>
<tr>
<td>Ga + SiC → Ga₁–SiC</td>
<td>−69.51</td>
</tr>
<tr>
<td>Ga + SiC → Ga₂–SiC</td>
<td>−151.36</td>
</tr>
</tbody>
</table>

### Table 3 Adsorption energies ($E_{ads}$) of CO₂ adsorbed on pristine, B–, and Ga–doped SiCNSs, computed at the B3LYP/6–31g(d,p) level of theory

<table>
<thead>
<tr>
<th>Systems</th>
<th>$E_{ads}$ (kcal/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ + SiC → CO₂/SiC</td>
<td>−1.59</td>
</tr>
<tr>
<td>CO₂ + B₁–SiC → CO₂/B₁–SiC</td>
<td>−1.83</td>
</tr>
<tr>
<td>CO₂ + B₂–SiCe → CO₂/B₂–SiC</td>
<td>−2.08</td>
</tr>
<tr>
<td>CO₂ + Ga₁–SiC → CO₂/Ga₁–SiC</td>
<td>−2.23</td>
</tr>
<tr>
<td>CO₂ + Ga₂–SiCe → CO₂/Ga₂–SiC</td>
<td>−4.04</td>
</tr>
</tbody>
</table>

### Table 4 Selected NBO charges and PCT (in e) of the pristine, B–, and Ga–doped SiCNSs and their CO₂ adsorption, computed at the B3LYP/LanL2DZ level of theory.

<table>
<thead>
<tr>
<th>Systems</th>
<th>Si or C $^a$</th>
<th>Si or C $^b$</th>
<th>B $^c$</th>
<th>Ga $^c$</th>
<th>C $^c$</th>
<th>O1 $^c$</th>
<th>O2 $^c$</th>
<th>PCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiC</td>
<td>1.921</td>
<td>1.923</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>B₁–SiC</td>
<td>1.685</td>
<td>1.671</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>B₂–SiC</td>
<td>−1.504</td>
<td>−</td>
<td>−</td>
<td>0.751</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Ga₁–SiC</td>
<td>1.265</td>
<td>1.265</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Ga₂–SiC</td>
<td>−0.434</td>
<td>−</td>
<td>−</td>
<td>0.069</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>CO₂/SiC</td>
<td>0.816</td>
<td>0.637</td>
<td>0.660</td>
<td>−</td>
<td>0.565</td>
<td>−0.493</td>
<td>0.444</td>
<td>0.516</td>
</tr>
<tr>
<td>CO₂/B₁–SiC</td>
<td>1.981</td>
<td>1.817</td>
<td>1.841</td>
<td>−</td>
<td>1.596</td>
<td>0.705</td>
<td>0.578</td>
<td>−0.850</td>
</tr>
<tr>
<td>CO₂/B₂–SiC</td>
<td>−1.626</td>
<td>−</td>
<td>−</td>
<td>0.739</td>
<td>1.032</td>
<td>−0.507</td>
<td>−0.518</td>
<td>0.007</td>
</tr>
<tr>
<td>CO₂/Ga₁–SiC</td>
<td>0.553</td>
<td>0.564</td>
<td>0.554</td>
<td>−</td>
<td>0.754</td>
<td>−0.348</td>
<td>−0.356</td>
<td>0.050</td>
</tr>
<tr>
<td>CO₂/Ga₂–SiC</td>
<td>−0.442</td>
<td>−</td>
<td>−</td>
<td>0.018</td>
<td>0.752</td>
<td>−0.363</td>
<td>−0.353</td>
<td>0.036</td>
</tr>
</tbody>
</table>

$^a$ Si and C are atoms on the SiCNS which are defined in Figure 1.

$^b$ B and Ga are atoms doped on SiCNSs as labeled in Figure 2.

$^c$ C and O are atoms of carbon dioxide adsorption on SiCNS as labeled in Figures 3 and 4.
Conclusions and Discussion

Adsorptions of carbon dioxide (CO$_2$) molecules on pristine, B– and Ga–doped on silicon carbide nanosheets (SiCNS) were investigated, using density functional theory calculation at the B3LYP/6–31G (d,p) theoretical level. The results indicated that the structural properties in term of bond lengths and bond angles of pristine SiCNT were changed by B or Ga doping atoms and by CO$_2$ adsorption. For the binding energies, the B atom showed stronger interaction with SiCNS than that of Ga atom, in which B atom doping on silicon site showed stronger interaction than that of carbon site. The adsorption energies showed that, B– and Ga–doped SiCNSs were more highly sensitive to CO$_2$ than that of pristine SiCNS, in which Ga doped silicon site of SiCNS showed strongest interaction with CO$_2$. The electron transfers between B or Ga atom to SiCNS were responsible for such peculiar adsorption behavior of CO$_2$ on B and Ga–doped SiCNSs. The electrons were transferred from CO$_2$ to the pristine, B– and Ga–doped SiCNSs suggesting that the strong interaction between CO$_2$ and SiCNS. The results revealed that the sensibility of SiCNS–based chemical gas sensors could be dramatically improved by introducing the B and Ga dopants, so B and Ga–doped SiCNS is more suitable for CO$_2$ detection than that of the pristine SiCNS.

Acknowledgements

The authors gratefully acknowledge the Computational Chemistry Center for Nanotechnology (CCCN), Department of Chemistry, Faculty of Science and Technology, and Research and Development Institute, Rajabhat Maha Sarakham University for the facilities provided. Our gratitude also extends to Supramolecular Chemistry Research Unit (SCRU) and the Postgraduate Education and Research in Chemistry (PERCH–CIC) program in the Department of Chemistry, Faculty of Science, Mahasarakham University for partial financial support.

References


Effect of Inorganic Fertilizer and Organic Fertilizer on Growth and Yield of Sweet Corn Var. Hi-Brix 3

Theerarat Chinnasaen*, Pimratch, S., Wetchakama, N.*, Praposri, N. and Yousin, T.

Program in Agriculture, Faculty of Agricultural Technology, Rajabhat Maha Sarakham, Maha Sarakham, 44000, Thailand

(*author for correspondence, E-mail: nongtheerarat@gmail.com; Fax: 043 725 439)

Abstract

Plant nutrition is one of the most important factors affecting quantity and quality of crop yield. In Thailand, sources of plant nutrient that usually support plant growth and yield are chemical fertilizer (inorganic fertilizer) or organic fertilizer. Therefore, the objective of this study was to investigate the effects of chemical fertilizer, bio-fertilizer or high quality organic fertilizer on growth and yield of sweet corn Hi-brix 3 variety, in field experiment. The study was undertaken during November, 2014 to February, 2015. A randomized complete block design (RCBD) with four replications was used; the fertilizer treatments were (1) no fertilizer as the control, (2) chemical fertilizer grades 15-15-15 at rate of 312.5 kg/ha with urea (46-0-0) at rate of 156.25 kg/ha, (3) organic fertilizer LDD 12 at rate of 1,875 kg/ha and (4) high quality organic fertilizer at rate of 2,500 kg/ha. The results showed that chemical fertilizer significantly increased growth and yield of sweet corn Hi-brix 3 variety. Sweet corn yield with husk and yield de-husk were 13.24 and 7.94 ton/ha, respectively with chemical fertilizer. However, the highest sweetness or total soluble solid was presented in application of high quality fertilizer, it was 15.43%. For sustainability of sweet corn production, the application of bio-fertilizer LDD 12 and high quality organic fertilizer need to study in long-term cultivation.

Keywords: Bio-fertilizer LDD 12, Inorganic, Organic, Fertilizer, Sweet Corn

Introduction

Sweet corn (Zea mays L. var. saccharata) is one of importance vegetable crops in Thailand, it useful ingredient in salad, dessert and other food ingredient or consume as snack after roast, boil or stream. Moreover, it contain of many nutrients; carbohydrate, protein, potassium, thiamin (vitamin B1) and vitamin C [1]. In 2014, Thai exported processed sweet corn products as 200,004 Ton/ 206 Million USD with 20% growth of quantity or 15% growth of value when compare with exported data in 2014 [2]. Hence, sweet corn is not only high nutrient were used in household level but also main product for export of Thailand. However, in current most of consumer or a major partner country were realized an emphasis of health hazard or the environmental pollution while for the convenience of sweet corn production, the farmer usually use chemical in production system especially chemical fertilizer that is the main source of plant nutrition. Although chemical fertilizer are rich in essential nutrients and ready for immediate supply to plants but the use of inorganic fertilizers alone has not been helpful under intensive agriculture because it aggravates soil degradation [3]. The degradation is brought about by loss of organic matter which consequently results in soil acidity, nutrient imbalance and low crop yields [4]. Including may affect biological aspect of soil [5].

Organic fertilizer is usually made from agricultural waste and need to change by biological process before plant uptake. Organic fertilizer that usually uses such as compost, manure, green manure and bio-extract, since application of organic fertilizer is provide much of organic matter, maintain soil fertility, and it is also environmentally friendly. Bio-fertilizer LDD12 was recommended by Land Development Department of Ministry of Agriculture and Cooperatives of Thailand, It is a group of effective microorganisms that can produce plant nutrient or convert insoluble of inorganic compounds into soluble form to increase soil fertility produce plant growth hormone to enhance plant growth[6]. Sangkhum et al. [7] reported that organic matter was increased after applied bio-fertilizer LDD 12 on growth of sweet corn INSEE 2 variety while Chumtep and Yimaon[8] indicated that the yield of SuphanBuri 1 rice variety which received bio-fertilizer LDD 12 was not significant when compared to application of chemical fertilizer. Moreover, the Land Development Department also promoted a high quality organic fertilizer for plant cultivation; high quality organic fertilizer is an organic fertilizer that made from organic or inorganic matter of agriculture, high plant nutrition and sufficient for plant growth and development [9]. Anugoolprasert and Rithichai[10] concluded that high quality organic fertilizers have an effect on quality of lettuce yield; less accumulated NO3-N and more phenolic compound when compare to application of chemical fertilizer and cattle manure.
Sweet corn variety Hi-brix 3 had distributed by Pacific Seeds (Thai) Ltd., average yield with husk is 23,244 kg/ha, sweetness is excellent and available cultivate throughout the year in all types of soil. For increase anappropriate cultivation of sweet corn with safety and security. Hence, the objective of this research was to study the effect of chemical fertilizer, bio-fertilizer (LDD 12) and high quality organic fertilizer on growth and yield of sweet corn variety Hi-brix 3.

Materials and Methods

This study was conducted under field condition at Don Han village, Tha Song Khon Sub-district, Meungmaha Sarakhams district, Maha Sarakham province, Thailand, during November, 2014 to February, 2015.

Plant and fertilizers

The seed of sweet corn (Zea mays L. var. saccharata) Hi-brix 3 variety was purchased from a commercial source. This variety is a commercial F1 hybrid and had searched by Pacific Seeds (Thai) Ltd. as well as chemical fertilizers 15-15-15 and 46-0-0 that bought from a commercial source, while high quality organic fertilizer was acquired from Land Development Department and organic fertilizer LDD 12 was conducted under Land Development Department advice by mixed bio-fertilizer LDD 12 100 g, bran 300 g and water 20 liters for 5 min after that pour on 300 kg of compost with control 70% of moisture content of organic fertilizer matter for 4 days [11].

Experimental design

The experimental design was a randomized complete block design (RCBD) with three different source of fertilizer, the treatment consist of (1) no fertilizer as the control, (2) chemical fertilizer grades 15-15-15 at rate of 312.5 kg/ha (at rate of 14.07 kg N/ha, 6.17 kg P/ha and 11.69 kg K/ha) with urea (46-0-0) at rate of 156.25 kg/ha (at rate of 21.56 kg N/ha) [12], (3) bio-fertilizer LDD 12 at rate of 1,875 kg/ha [11] and (4) high quality organic fertilizer at rate of 2,500 kg/ha [9], conducted 4 plots (replication) in each treatment.

Field Experiment

The land use was sandy clay loam soil in soil group 40 [13], with a texture comprising sand (67.9%), silt (11.6%) and clay (20.5%). The chemical properties include pH 4.90, 0.037 dS/m of electrical conductivity (EC), 0.55% organic matter (OM) and 0.26 total N. Macro nutrients comprise 35.65 mg/kg of available P (Bray II), 26.66 mg/kg of exchangeable K. The experimental field was cleared and divided into plots and each plot measures 4 m x 4 m (16 m²) with spacing of 1 m between each plot (Fig. 1). Fertilizer applications were done base on source of fertilizer, in case of chemical fertilizer was applied 2 times, at transplantation with basal application and side dressing at 25 days after transplanting (DAT), while 2 types of organic fertilizer were applied a week before planting. Sweet corn seed were germinated in plug tray in peat moss, with water being applied daily. At 14 day after germination (DAG), uniform seedlings were transplanted into plot. For transplantation, the spacing used for the experiment was 75 x 50 cm. Irrigation was provided by drip irrigation, 15 min (Fig. 2). Weeds were controlled manually during growing season.
Data collection

*Plant Growth* - Plant height was measured from the ground surface to the top of the plant with sampling 10 plants/plot at 14, 28, 42 and 56 DAT, as well as leaves number that counting when fully extended.

*Crop Yield* - Harvested yield at 75 DAT and sampling 10 ears/plot for evaluated ear length, ear diameter, yield with husk and yield de-husk. The sweetness or total soluble solids (TSS) was determined, with used kernel from 10 ears/plot, evaluated by refractometer and exposed as % TSS[14].

Statistical design and analysis

Analysis of variance was performed on data for each character. Treatment means were compared using Duncan multiple range test (DMRT's test) at the 5% level[15]. The analyses of variance at this stage were done using MSTAT-C package [16].

Results and Discussions

Plant high

The application of different nutrient source was an affected on growth and yield of sweet corn Hi-brix 3. The height of sweet corn Hi-brix 3 variety was significant in growing period. An application of chemical fertilizer 15-15-15 at rate of 312.5 kg/ha with urea (46-0-0) at rate of 156.25 kg/ha was highest of plant high at 28, 42 and 56 DAT as 120.25, 162.28 and 174.13 cm, respectively. At the same time, no fertilizer application (control) shown minimal height at all growing period at 56 DAT, plant height was 90.55 cm. While application of high quality organic fertilizer presented higher than bio-fertilizer in growing season at 56 DAT, plant height were 144.85 cm and 130.90 cm, respectively (Table 1). Sangkhumet al. [7] reported that applied chemical fertilizer 15-15-15 at rate of 375 kg/ha with urea (46-0-0) at rate of 43.75 kg/ha presented highest of plant height of sweet corn INSEE 2 variety (193.61 cm) but did not show significantly different when compared with others fertilizer source similar to the study reported by Chumtep and Yimaon[8], plant height of SuphanBuri 1 rice variety was non-significant, as applied organic fertilizer with chemical fertilizer. Furthermore, Gudugi et al. [17] presented that synthesis fertilizer, NPK (15-15-15) was applied at rate of 100 kg N/ha, 50 kg P2O5/ha and 50 kg K2O/ha supported significantly plant height when compare with poultry manure at rate of 0, 5 and 10 ton/ha, at 12 weeks after planting in 2011, it was 120.6, 72.8, 85.4 and 93.2 cm, respectively, but non significantly different with 15 ton/ha of poultry manure. The nutrients in inorganic fertilizers are usually readily available shortly after application and are taken up during active growth [18].

Table 1 Effect of fertilizer sources on plant height of sweet corn Hi-brix 3 variety at 14, 28, 42 and 56 DAT.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14 DAT</td>
</tr>
<tr>
<td>No fertilizer applied</td>
<td>32.68a</td>
</tr>
<tr>
<td>Chemical fertilizer grades 15-15-15 (312.5 kg/ha) and urea (156.25 kg/ha)</td>
<td>78.20a</td>
</tr>
<tr>
<td>Bio-fertilizer LDD 12 (1,875 kg/ha)</td>
<td>42.55b</td>
</tr>
<tr>
<td>High quality organic fertilizer (2,500 kg/ha)</td>
<td>80.18a</td>
</tr>
<tr>
<td>F-test</td>
<td>*</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>41.70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>14 DAT</th>
<th>28 DAT</th>
<th>42 DAT</th>
<th>56 DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fertilizer applied</td>
<td>32.68a</td>
<td>40.75c</td>
<td>68.05d</td>
<td>90.55d</td>
</tr>
<tr>
<td>Chemical fertilizer grades 15-15-15 (312.5 kg/ha) and urea (156.25 kg/ha)</td>
<td>78.20a</td>
<td>120.25a</td>
<td>162.28a</td>
<td>174.13a</td>
</tr>
<tr>
<td>Bio-fertilizer LDD 12 (1,875 kg/ha)</td>
<td>42.55b</td>
<td>72.15b</td>
<td>99.55c</td>
<td>130.90c</td>
</tr>
<tr>
<td>High quality organic fertilizer (2,500 kg/ha)</td>
<td>80.18a</td>
<td>112.25a</td>
<td>133.78b</td>
<td>144.85ab</td>
</tr>
<tr>
<td>F-test</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>41.70</td>
<td>42.89</td>
<td>35.32</td>
<td>25.71</td>
</tr>
</tbody>
</table>

Means in the same column with the same letters are not different significantly different at p<0.05 by DMRT. * Significant at p< 0.05.

Leaves number

Leaves number significantly influenced by fertilizer treatments and location (Table 2). Leaves number comparison between the fertilizers source at 56 DAT showed that maximum value is related to plants received chemical fertilizer (12.50 leaf), it was followed by high quality organic fertilizer (10.16 leaf), bio-fertilizer LDD 12 (9.82 leaf) and no fertilizer applied (8.90 leaf). Gudugi et al. [17] reported that the number of leaves produced
significantly differed among the fertilizer treatments at 12 week after planting in 2011, the highest of leaves number was presented when applied with inorganic fertilizer, it was 941.3 number of leaves/12 m².

Table 2 Effect of fertilizer sources on leaves number of sweet corn Hi-brix 3 variety at 14, 28, 42 and 56 DAT.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Leaves number (leaf)</th>
<th>14 DAT</th>
<th>28 DAT</th>
<th>42 DAT</th>
<th>56 DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fertilizer applied</td>
<td></td>
<td>3.72a</td>
<td>4.60a</td>
<td>6.47a</td>
<td>8.90c</td>
</tr>
<tr>
<td>Chemical fertilizer grades 15-15-15 (312.5 kg/ha) and urea (156.25 kg/ha)</td>
<td></td>
<td>5.70a</td>
<td>7.90a</td>
<td>10.85a</td>
<td>12.50a</td>
</tr>
<tr>
<td>Bio-fertilizer LDD 12 (1,875 kg/ha)</td>
<td></td>
<td>4.12b</td>
<td>5.82b</td>
<td>7.82bc</td>
<td>9.82bc</td>
</tr>
<tr>
<td>High quality organic fertilizer (2,500 kg/ha)</td>
<td></td>
<td>5.85a</td>
<td>8.12a</td>
<td>8.12b</td>
<td>10.16b</td>
</tr>
</tbody>
</table>

* C.V. (%)                                                                                   22.38  42.89  22.26  27.50
* * Means in the same column with the same letters are not different significantly different at p<0.05 by DMRT.
* * Significant at p<0.05.

Crop Yield

Yield components (ear length and ear diameter) were significant with maximum in plots supplied with chemical fertilizer grades 15-15-15 (312.5 kg/ha) and urea (156.25 kg/ha), it was 20.23 cm as ear length and ear diameter was 5.02 cm. Moreover, ear length were follow by high quality organic fertilizer (2,500 kg/ha) (17.11 cm) and bio-fertilizer LDD 12 (1,875 kg/ha) (17.11 cm) that was non-significant between organic fertilizer. According to, ear diameter that applied with chemical fertilizer presented maximum (5.02 cm), it was followed by high quality organic fertilizer (4.81 cm) and bio-fertilizer LDD 12 (4.57 cm) (Table 3). Akintoye and Olaniyan [14] reported that for the yield components considered, the NPK fertilizer treatment produced higher yield components (ear length and ear diameter) was significant with maximum in plots supplied with chemical fertilizer, 13.24 and 7.94 ton/ha, respectively and least yield with husk were significant different between fertilizer sources. In sweet corn INSEE 2 variety, the longest ear length was obtained from the inorganic fertilizer as NPK (16-6-8) at rate of 468.75 kg/ha (19.74 cm) and NPK (15-15-15) at rate of 375 kg/ha with urea (46-0-0) at rate of 43.75 kg/ha (20.70 cm) when compared with organic fertilizer or organic fertilizer with chemical fertilizer [7].

Table 3 Effect of fertilizer sources on ear length and ear diameter of sweet corn Hi-brix 3 variety that harvested at 75 DAT.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ear length (cm)</th>
<th>Ear diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fertilizer applied</td>
<td>16.28a</td>
<td>4.45c</td>
</tr>
<tr>
<td>Chemical fertilizer grades 15-15-15 (312.5 kg/ha) and urea (156.25 kg/ha)</td>
<td>20.23a</td>
<td>5.02a</td>
</tr>
<tr>
<td>Bio-fertilizer LDD 12 (1,875 kg/ha)</td>
<td>17.10bc</td>
<td>4.57b</td>
</tr>
<tr>
<td>High quality organic fertilizer (2,500 kg/ha)</td>
<td>17.11b</td>
<td>4.81b</td>
</tr>
<tr>
<td>F-test</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>
| C.V. (%)                                                                                   9.86   5.36
* * Means in the same column with the same letters are not different significantly different at p<0.05 by DMRT.
* Significant at p<0.05.

At the same time, yield with husk and yield de-husk were significant different between fertilizer source, greater in treatment that supplied with chemical fertilizer, 13.24 and 7.94 ton/ha, respectively and least in control at 5.65 ton/ha of yield with husk, yield de-husk as 3.48 ton/ha. While yield with husk and yield de-husk that supplied with bio-fertilizer LDD 12 was shown 7.08 ton/ha and 4.26 ton/ha but not significantly different with applied with high quality organic fertilizer that present 7.65 ton/ha of yield with husk and yield de-husk as 4.26 ton/ha (Table 4). Akintoye and Olaniyan [14] reported that application of NPK fertilizer treatment yielded significantly higher than organic fertilizer, sweet corn yield 3,063 kg/ha and 3,333 kg/ha in 2003 and 2004 at 120 kg N/ha in organic fertilizer rate compared to 1,803 kg/ha and 996 kg/ha in 2003 and 2004 respectively, with organominerial fertilization. Oroszet [19] also reported that highest yield of sweet corn was achieved in response to the NPK basic treatment (222.5 kg N/ha, 22.5 kg P₂O₅/ha and 143 kg K₂O/ha). Similar to the presented of Gudugiet al. [17] who observed that application of synthetic fertilizer supported...
significantly greatest grain yield of sweet corn (2.0 ton/ha) compared with differences among of poultry manures. In sweet corn INSEE 2 variety, Sangkhum et al. [7] reported that the average of yield husk and yield de-husk were highest as applied with inorganic fertilizer, 13.76 and 9.19 ton/ha, respectively, while applied with high quality organic fertilizer and bio-fertilizer LDD 12 presented 9.38 and 8.43 ton/ha, respectively of yield with husk, yield de-huskswere 7.10 and 6.61 ton/ha, respectively.

However, the application of high quality fertilizer was highest of sweetness or total soluble solid (TSS); it was 15.43% and significantly difference when compared with other fertilizer treatment, followed by chemical fertilizer (13.94%) that did not show significantly different with bio-fertilizer as 12.22% and minimum of TSS was measured in no fertilizer applied as control (12.07%) (Table 4).

Inorganic and organic fertilizers applied to the soil supply plant nutrients for crop growth and affect the plant’s physiological processes, which serve as important instruments in yield development. Furthermore, plant nutrition is one of the most important factors affecting quantity and quality of crop yield. Normally, inorganic fertilizer provides readily available nutrients to crops but application of commercial fertilizers provides a great potential for N contamination of surface and ground water [20] or often associated with excessive absorption of nitrate and sulphate that may cause health problems in human [21] especially in intensive agriculture that emphasize heavy chemical application is led to adverse environmental, ecological; and health consequences [22], including its inaccessibility to majority of the farmers due to high cost and infrastructural problems in developing country [23].

While for organic fertilizer, Vessey [24] suggested that bio-fertilizer can promote plant growth by increasing the supply or availability of macro and micro nutrient through the natural process with slow release plant nutrient. Addition of organic matter, from different resources may through improving physical and chemical properties of soil can affects the growth and development of plant roots and shoots and accumulation of essential oils [25]. Jannmohammad et al. [5] suggested that organic fertilizer may improve the use efficiency of essential mineral elements and reduced the amount of chemical fertilizers application, also prevented the environment contamination from widespread application of chemical fertilizers.

### Table 4: Effect of fertilizer sources on yield with husk, yield de-husk and total soluble solid of sweet corn Hi-brix 3 variety that harvested at 75 DAT.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield with husk (ton/ha)</th>
<th>Yield de-husk (ton/ha)</th>
<th>Total soluble solid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fertilizer applied</td>
<td>5.65&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.48&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.07&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Chemical fertilizer grades 15-15-15 (312.5 kg/ha) and urea (156.25 kg/ha)</td>
<td>13.24&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.94&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Bio-fertilizer LDD 12 (1,875 kg/ha)</td>
<td>7.08&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>4.26&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>12.22&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>High quality organic fertilizer (2,500 kg/ha)</td>
<td>7.65&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15.43&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>F-test</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>39.61</td>
<td>37.67</td>
<td>11.84</td>
</tr>
</tbody>
</table>

<sup>c</sup> Means in the same column with the same letters are not different significantly different at p<0.05 by DMRT.

<sup>a</sup> Significant at p< 0.05.

### Conclusions

The results from this study can be concluded that in sweet corn Hi-brix 3 variety, the application of chemical fertilizer NPK (15-15-15) with urea (46-0-0) produced higher plant growth and yield than bio-fertilizer LDD 12 and high quality organic fertilizer, while high quality organic fertilizer was showed the greatest of sweetness.

### References

The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University

******************************************************************************

Association (TFPA) to the World in January -December 2014.


251
A Constructivist Learning Environments in Biology Classes for upper Secondary Students at Grade-Tenth Level in Burapha Pittayakharn Municipal School

Phakamart Sangsai¹, Sukrita Phengpan² and Toansakul Santiboon¹,²

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Science Learning Group Section, Burapha Pittayakharn Municipal School, Maha Sarakham, Thailand 44000
Corresponding Author E-mail: toansakul35@yahoo.com.au

Abstract

Focused on the validation, comparison, association, and use of Thai versions of the Constructivist Learning Environment Survey (CLES) in biology classroom learning for upper secondary education in Burapha Pittayakharn Municipal School was studied. The new version of the CLES was designed to obtain measures of five key elements of a critical constructivist learning environment from the students’ perception. It was administered to 108 students from 4 classes, data analysis supported each scale’s internal consistency reliability, factor structure and ability to differentiate between classrooms, and revealed interesting differences between average scale scores of actual and preferred of students’ perceptions to their biology classes. Using the mean scale scores, Cronbach alpha reliability, One-way ANOVA results (eta²) were analyzed. Adapting the Test of Biology-Related Attitude (TOBRA) was associated of their perceptions. It has found that statistically significant differences were found between the students’ perception of actual and preferred biology classroom learning environments, students’ perceptions and their attitudes toward their biology classroom learning environment were found. While as the confirmatory factor analyses provide support for the theoretical framework behind the questionnaire were found. The multiple correlations R² is significant for the CLES and considered associations with the TOBRA, and value indicates that 31% of the variance in students’ attitude was also determined. Students’ interpretations of items were, therefore, more likely to differ to those of the biology students. This was a poignant factor that researchers felt noteworthy, as it serves as a reminder that quantitative data on its own can be open to misinterpretation.

Keywords: Learning, Biology classroom, Student, Burapha Pittayakharn Municipal School

Introduction

Historical Background

Following Piaget and Vygotsky, constructivism, both in its radical or social form, has been enthusiastically discussed and greatly supported as an efficient and alternative approach to learning (von Glasersfeld, 1995, 1998; Wang & Walberg, 2001; Brooks, 2002). The basic and the most fundamental assumption of constructivism is that knowledge is not independent of the learner; it is constructed by the learner. The constructivist view of learning has made a major impact on science education, particularly during the past decade. The implications for a science curriculum centered on a constructivist philosophy were identified initially in a number of research studies which focused on students’ concept learning in science. The constructivist view of learning has had a most noticeable influence on curriculum thinking in science since (Treagust, Duit, & Fraser, 1996).

A constructivist approach to learning is based on the idea that the learner constructs his or her own knowledge through negotiation of meaning. Tobin and Tippins (1993) suggested that constructivism has been used as a referent for building a classroom that maximizes student learning. In such a classroom, the teacher takes account of what students know, maximizes social interactions between learners so that they can negotiate meaning, and provides a variety of sensory experiences from which learning is built, they noted the following five assumptions shared by mathematics and science educators for reorganizing the curriculum and teaching to improve learning in school science and mathematics from a constructivist perspective: first, more emphasis is usually given to the applicability of science and mathematics knowledge in situations in which students are interested; second, introduction into the curriculum of issues of meta-knowledge about science and mathematics is needed; third, extinguishing students’ everyday conceptions is impossible and inadvisable; fourth, constructivist approaches are student-centered; and, fifth, the norms and patterns of classroom interaction are a fundamental influence on the effectiveness of reform efforts. They also suggested that innovation processes could be implemented in terms of developing new media, including science textbooks, revising traditional
The aim of this study was to investigate the extent to which this new Biology Laboratory Learning Environment has influenced the constructivist nature of grade 10 biology classroom learning environments. As students in grade 10 had not been exposed to the new curriculum it could be expected that those grades were not as constructivist in nature as grade 10 from the Basic Education Core Curriculum B.E. 2558 (A.D. 2015) will be used in 2016.

Science Constructivist Research on Classroom Learning Environment

Although most classroom environment research has focused on the assessment and improvement of learning and teaching, it has done so largely within the context of traditional epistemology underpinning the established classroom environment (Taylor, Fraser & Fisher, 1997). However, the traditional teacher-centered, didactic approach to teaching has been extensively criticized and there is a better understanding of the nature of knowledge development. Therefore, the Constructivist Learning Environment Survey (CLES) was developed with a psychological view of learning that focused on students as co-constructors of their own knowledge. Originally, the CLES was found to be and to contribute insightful understanding of classroom learning environment (Taylor, Fraser & Fisher, 1997).

But Taylor, Fraser & White (1994) found major socio-cultural constraints to the development of constructivist learning environment and developed a new version of the CLES based on critical constructivism, which combines key elements of the radical constructivist theory and the critical social. The new CLES is composed of the five scales of Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation, which recognizes that the cognitive constructivist activity of the individual learner occurs within, and is constructed by, a socio-cultural context.

Approaches to Study on Science Classroom Learning Environments

Using students’ perceptions to this study educational environments can be approached to studying science classroom environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits of qualitative method when studying educational environments (Fraser & Tobin 1991).

Instruments for Assessing Classroom Environment

Different instruments have been used (QTI, SLEI, CLES, WIHIC, TPPI) by educational researches to identify the characteristics of constructivist learning environment. The instruments used to collect student data were: What is happening in this class? (WIHIC); Constructivist Learning Environment Survey (CLES); and, the Modified Attitude Scale Modelled on Test of Science Related Attitudes (TOSRA). These instruments were chosen because other researchers have used them and their validity has been established. In this study of the research for upper secondary school in Thailand, the CLES and TOSRA questionnaires were applied.

Materials and Methods

Selected the Research Instruments

The Constructive Learning Environment Survey (CLES)

Two forms of the CLES have been developed to gather students’ perceptions of science classrooms. These forms are named the Student Actual and Student Preferred (Taylor, Dawson, & Fraser, 1995). Although item wording is almost identical in the actual and preferred forms, words such as “I wish” are included in the preferred form to remind students that they are rating their preferred, or ideal classroom, rather than the actual classroom environment. For example, the statement, “In this class, I learn about the world outside of school” in the actual form of the CLES is changed in the preferred form to, “In this class, I wish that I learned about the world outside of school”. It was decided to investigate differences between students’ perceptions of their actual and preferred constructivist learning environments in this study. The CLES has 30 items with 5-response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation).

According to the constructivist view, meaningful learning is a cognitive process in which individuals make sense of the world in relation to the knowledge which they already have constructed, and this sense-making process involves active negotiation and consensus building. The CLES developed to assist researchers and teachers to assess the degree to which a particular classroom’s environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching.
practice. The CLES has 30 items with 5-response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation).

**The Test of Biology-Related Attitudes (TOBRA)**

To investigate of associations between students’ perceptions of their biology laboratory classroom environment constructivist and their attitudes toward biology laboratory learning classes for upper secondary educational students at Burapha Pittayakharn Municipal School, Mahasarakham Province. This study modified the Test of Biology-Related Attitudes (TOBRA) from the original of the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981; Santiboon, 2011, 2013) of Thai version was designed to measure eight distinct classroom-related attitudes among upper secondary educational students at upper secondary education in Burapha Pittayakharn Municipal School classes, Mahasarakham Province. The eight items are suitable for group administration and all can be administered within the duration of a learning and biology classroom constructivist. Furthermore, TOBRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Research Purposes**

1. To assess and investigate of constructivist learning environment of student’s perceptions to their biology laboratory environment classes of the upper secondary educational students at Grade 10 in Burapha Pittayakharn Municipal School, Mahasarakham Province.
2. To compare between students’ perceptions of their actual and preferred biology laboratory environment classes of the upper secondary educational students at Grade 10 in Burapha Pittayakharn Municipal School, Mahasarakham Province.
3. To associate between students’ biology attitudes and their actual perceptions toward their biology laboratory environment classes for upper secondary educational students at Grade 10 in Burapha Pittayakharn Municipal School, Mahasarakham Province.

**Literature Review**

The purposes of this study were to validate an instrument to explore students’ preferences toward the constructivist learning environments for biology classroom environments at the upper secondary educational classes. The instrument was customized and modified from the Constructivist Learning Environment Survey (CLES) questionnaire. Taylor, Fraser, & White (1994) reported of their study on an instrument for assessing and investigating the development constructivist learning environments of items in revised CLES scales. The five scales of the revised CLES were refined and reduced to seven items each. It included five components of constructivist learning: Personal Relevance, Science Uncertainty, Shared Control, Critical Voice and Student Negotiation, the allocation of the 30 items is to the 5 scales.

These criticisms were responded to in Korea’s new sixth National Science Curriculum which tried to reduce the amount of content knowledge and give an added emphasis to students’ problem solving in everyday contexts. This is particularly so in General Science which was introduced as a compulsory subject for all high school students and reflects the constructivist view was assessed. Students are expected to learn about and understand basic scientific concepts through student-centered activities and negotiation. The content is organized in a way that relates it to actual, concrete problems encountered by students in daily life. The intention is to facilitate the students’ understanding of science knowledge and the process of scientific inquiry. However, other biology subjects, such as Physics, Chemistry, Biology, and Earth Science, have remained academically content oriented in Korea (Heui-Baik Kim, 2006).

**Steps on Assessing Students’ Perceptions with the CLES and TOBRA**

Using the CLES was follow as for assessing students’ perception of their actual form on the 11th week, and preferred form on the 14th week and the TOBRA on the 15th week for associating biology laboratory environment in biology laboratory constructivist classes for upper secondary educational students at Burapha Pittayakharn Municipal School, Mahasarakham Province.

Each scale of the CLES were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1, 2, 3, 4, 5, and 6; the second scale; Biology Uncertainty is composed the item of 7, 8, 9, 10, 11, and 12 ;the third scale; Critical Voice is composed the item of 13, 14, 15, 16, 17, and 18 ;the fourth scale, Shared Control is composed the item of 19, 20, 21, 22, 23, and 24; the fifth scale, Student Negotiation is composed the item of 25, 26, 27, 28, 29, and 30.

**Data Analysis**

Data resulting from the CLES and the TOBRA (administered to their students) will be discussed. From a total of 108 students surveyed with the TOSRA questionnaire, there are valid students. The measures of the central tendency: mean score, median, variance and the standard deviation for the total of 30 items of all five
scales are calculated by the Statistical Package for the Social Sciences (SPSS). Quantitative data were obtained using the two questionnaires (CLES and TOBRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual CLES scale to investigate whether students have significant different perceptions of their actual and preferred biology laboratory environment constructivist classes for upper secondary educational students at Burapha Pittayakharn Municipal School.

Sample
This study is improved and developed biology laboratory constructivist learning environment classes for the upper secondary educational students in Burapha Pittayakharn Municipal School classes of their biology learning classroom environments with actual and preferred student’s perceptions with sample size of 108 biology laboratory environment students in 4 classes at Grade level 10 in Mahasarakham Province, Thailand.

Results

Validity and Reliability of Research Instrument

A. Validation of the CLES
Description of quantitative data of analyzing responses for Master of Biology teacher student’s assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the CLES

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>Actual</td>
<td>19.90</td>
<td>3.31</td>
<td>0.10</td>
<td>0.32</td>
</tr>
<tr>
<td>Biology Uncertainty</td>
<td>Preferred</td>
<td>25.34</td>
<td>4.22</td>
<td>0.29</td>
<td>0.53</td>
</tr>
<tr>
<td>Critical View</td>
<td>Actual</td>
<td>16.12</td>
<td>2.68</td>
<td>0.06</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>16.90</td>
<td>2.81</td>
<td>0.13</td>
<td>0.36</td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>16.12</td>
<td>2.68</td>
<td>0.06</td>
<td>0.26</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>Preferred</td>
<td>12.81</td>
<td>2.13</td>
<td>0.07</td>
<td>0.26</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five CLES scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 6 and 30, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the CLES. For the remaining five scales, namely; Personal Relevance, Biology Uncertainty, Critical View, Shared Control, Student Negotiation scales.
Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the CLES.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>Actual</td>
<td>0.74</td>
<td>0.68</td>
<td>5.75</td>
<td>0.27</td>
<td>0.00***</td>
</tr>
<tr>
<td>Biology</td>
<td>Preferred</td>
<td>0.88</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Actual</td>
<td>0.80</td>
<td>0.65</td>
<td>4.60</td>
<td>0.19</td>
<td>0.02*</td>
</tr>
<tr>
<td>Critical View</td>
<td>Preferred</td>
<td>0.88</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>0.85</td>
<td>0.66</td>
<td>4.80</td>
<td>0.20</td>
<td>0.00**</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>Preferred</td>
<td>0.90</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version CLES used in this study was determined by calculating Cronbach alpha coefficient for the 30 items of the CLES using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the CLES, which ranged from 0.74 to 0.85 when using the students’ actual climate scores and from 0.88 to 0.93 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the CLES, which suggests that each scale of the CLES was able to differentiate significantly (p <0.05) between students’ perceptions in my school and my dream school environmental climates in the same school classes. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 4.35 to 5.75 for different scales, respectively.

B. The Circumpex Nature of the CLES

To investigate the circumpex nature of the CLES correlations between the scales were calculated. The sample in Table is presented the results show that the correlations between a scale and the next scale. The circumpex nature of the CLES, to correlate between the scales was calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 2.
Scale Intercorelations for the CLES Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pr</th>
<th>Uc</th>
<th>Cv</th>
<th>Sc</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr</td>
<td>Actual</td>
<td>Preferred</td>
<td>0.97***</td>
<td>0.94**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uc</td>
<td>Actual</td>
<td>Preferred</td>
<td>0.90***</td>
<td>0.96**</td>
</tr>
<tr>
<td></td>
<td>Cv</td>
<td>Actual</td>
<td>Preferred</td>
<td>0.95**</td>
<td>0.90***</td>
</tr>
<tr>
<td></td>
<td>Sc</td>
<td>Actual</td>
<td>Preferred</td>
<td>0.93**</td>
<td>0.91**</td>
</tr>
<tr>
<td></td>
<td>Sn</td>
<td>Actual</td>
<td>Preferred</td>
<td>0.61***</td>
<td>0.67***</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

C. Factor loading Analysis of the CLES

The Actual and Preferred Forms of the CLES were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 3.
Factor Loading for Items in the Actual and Preferred Forms of the CLES

<table>
<thead>
<tr>
<th>Item</th>
<th>Pr</th>
<th>Uc</th>
<th>Cv</th>
<th>Sc</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.79</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.75</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.72</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.71</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.49</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.48</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.89</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.87</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.84</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.78</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.74</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.70</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>0.89</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.89</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.87</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0.78</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.74</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0.31</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.89</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>0.84</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>0.78</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>0.71</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>0.64</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0.58</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>0.82</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>0.80</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>0.76</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.75</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>0.71</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>0.67</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**D. Validation of the TOBRA**

To measure biology laboratory constructivist learning environment classes for upper secondary educational students at Grade 10 in Burapha Pittayakharn Municipal School to their attitudes towards biology learning constructivist environment classes, the present study adapted the eight-item the Test Of Biology-Related Attitude (TOBRA) (Fisher, Rickards, Goh, & Wong, 1997; Santiboon & Fisher, 2005; Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the TOBRA had a value of 0.83 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of their Actual and Preferred Biology Laboratory Constructivist Learning Environment Classes

Table 1 and 2 are comparing differences between the students’ perceptions of their actual and preferred biology laboratory constructivist learning environment classes for upper secondary educational students at Grade 10 in Burapha Pittayakharn Municipal School environment classes show in Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Personal Relevance, Biology Uncertainty, Critical View, Shared Control, and Student Negotiation scales than students’ actual perceptions.
The results of this study also indicate that using the CLES helps biology laboratory environment constructivists’ classes for the upper secondary educational students in Burapha Pittayakharn Municipal School environment classes for biology teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the biology laboratory constructivist environment classes for the upper secondary educational students in Burapha Pittayakharn Municipal School environment constructivist’s classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the biology educational assessment and investigation of their classes.

Associations between Students’ Perceptions of Actual Biology Classroom Learning Constructivist’s Environments with the TOBRA

In this study, it was also considered important to investigate associations between biology laboratory learning constructivist environment classes for the upper secondary educational students in Burapha Pittayakharn Municipal School environment classes of their biology classroom learning environments with their attitude toward biology classes. The Cronbach alpha reliability of the selected the TOBRA was 0.83, when using individual student as the unit of analysis. This suggests that the TOBRA is reliable for measuring students’ attitudes in biology classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOBRA that’s reported in Table 5.

Table 5. Associations between CLES Scale and Attitude Scale to Biology Classroom Learning Assessing and investigating Constructivist Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regression Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>0.26***</td>
<td>0.25***</td>
</tr>
<tr>
<td>Biology Uncertainty</td>
<td>0.20*</td>
<td>0.21*</td>
</tr>
<tr>
<td>Critical View</td>
<td>0.25**</td>
<td>0.24**</td>
</tr>
<tr>
<td>Shared Control</td>
<td>0.19*</td>
<td>0.20*</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>0.13**</td>
<td>0.13**</td>
</tr>
<tr>
<td>Multiple Correlation</td>
<td>0.5578**</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.3112**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their biology laboratory environment constructivist classroom on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Biology Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their biology laboratory constructivist classes. In the other hand, the sample correlation values (r) are reported which shows statistically significant correlations between students’ attitudinal outcomes and assessing and investigating their biology laboratory learning environment constructivist’s classroom environment on all scales of the Actual Form.

Conclusions and Discussions

The actual and preferred perceptions of 108 biology laboratory environment constructivist’s students for the upper secondary education in 4 classes in Burapha Pittayakharn Municipal School of their biology laboratory environment constructivist’s classes were measured with the CLES. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their biology laboratory environment constructivist’s classes. In generally, students’ perceptions of their preferred biology laboratory environment constructivist’s classes were to greater than what they actually perceive to be provided. The results of this study also indicate that using the CLES helps for assessing and investigating biology laboratory environment constructivist’s classes for the upper secondary educational students at Grade 10 in Burapha Pittayakhrn Municipal School of biology teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their biology classroom learning constructivist classes, with regard to the CLES, it was found that all of five scales were positively associated with students’ attitude to biology laboratory environment constructivist’s classes. The multiple correlation R is significant for the CLES and shows that when the scales are considered together there are significant associations with the TOBRA. The $R^2$ values indicate that 51%, with actual form of the valiance in students’ attitudes to their biology laboratory environment constructivist’s classes were attributable to their perceptions of their biology laboratory classroom environments. The beta weights ($\beta$) show that in classes where the students perceived greater than all scales in their biology laboratory environment constructivist’s lessons.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Biology teacher could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate Constructive Learning Environment Survey (CLES). This instrument provides the information of students’ perceptions on actual and preferred biology laboratory environment constructivist’s classes. The information from this instrument could be used for improvement and effectiveness teaching in biology subject to their laboratory classroom learning constructivist.

As described in the results section, upper secondary educational students at Burapha Pittayakhrn Municipal School classes show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the CLES questionnaire. Focusing on biology laboratory environment classes for upper secondary educational students in 4 classes in Burapha Pittayakhrn Municipal School classes show relatively favorable perceptions of their biology laboratory environment constructivist’s lessons, with the higher score occurring for the whole prefer scales of the CLES. It seems that biology laboratory constructivist environment classes to improve and investigate developing constructivist lesson activities related to biology laboratory environment subject classes are operated rather as supplementary to theory classes rather than being independently important in their own right.

Overall, this study replicated previous studies using the CLES, with the findings being consistent with the situation in assessing and investigating biology laboratory environment constructivist environment constructivist’s classes in Burapha Pittayakhrn Municipal School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from this school environment. The present study produced several potentially fruitful results, but typically indicated directions for future classroom learning environment research in Thailand. Versions of the CLES are available to assess teachers’ perceptions of their own classroom environments and differences between teachers’ perceptions and those of their students could be a fruitful line of research. Previous learning environment research has indicated differences in the perceptions of students in the same classes and this also would be worth investigating, that also are needed to
enhance our understanding of the results obtained from quantitative studies like this study, responsibility.

Acknowledgements

Firstly, I would like to thank the 883 physics students in Burapha Pittayakharn Municipal School at the Grade level 12 who were part of the study. Thank you to the Sompong Madtan, Sukanya Jammor, and Sukrita Phengpan who allowed students to complete the questionnaire.

Secondary, I would like to my fellow Master of Science students, Miss Sopida Senanorit to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout the this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Predicting the Achievement of the Grade 12th Upper Secondary School Students Towards Biology from their Perceptions of the Classroom Learning Environment in Chiang Yuen Pittayakom School

Pornnapha Wichachi¹, Panwilai Chomchid², Soonthorn Sattaroj³, and Toansakul Santiboon*¹

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
³Science Learning Group Section, Chiang Yeun Pitayakhom School, Maha Sarakham, Thailand 45000
Corresponding Author E-mail: toansakul35@yahoo.com.au

Abstract

In addition to its many researches on classroom learning environment changes, more comprehensive statistical information about the My Class Inventory (MCI) is provided, and published research involving the MCI is reviewed. Despite international interest on research in the area of biology classroom learning environment in guiding practical improvements for 108 upper secondary educational biology students at Grade 12 in Chiang Yuen Pittayakom School in 3 classes whereas a sample size was administered. Using the economical short forms of the 25-Items My Class Inventory (MCI) classroom learning instrument (original from Fisher and Fraser, 1998) was administered. Associations between students’ perceptions and their attitudes toward biology classroom learning climates were determined with a short form of the Test Of Biology-Related Attitude (TOBRA) (original modified from the Test Of Science-Related Attitude) (Fraser, 1981). The methods for improving classrooms are illustrated to describe on biology laboratory classroom learning environments. Students’ perceptions of their actual and preferred were assessed and compared, which as translated into Thai language for administrating research methodology. It has found that statistically significant differences between the students’ perceptions of actual and preferred also were found. These factors were analyzed to appear to be affecting student perceptions of their responses to their research instrument. The multiple correlations $R^2$ is significant for the MCI and considered associations with the attitude scale, and value indicates that 32% of the variance in students’ attitude was also determined with student’s perceptions to their classroom climate are improved and developed learning Genes and chromosomes teacher’s teaching plan.

Keywords: Actual forms, My Class Inventory (MCI), Biology classroom, Learning, Student perceptions

Introduction

The classroom learning environment research has spanned more than three decades with significant contributions to the field of education. Reviews of research (Fraser, 1986; Fraser, 1998; Fraser & Walberg, 1991; Haertel, Walberg & Haertel, 1981) reported that most of the studies on classroom learning environments used the perceptual measures approach to investigate the nature of classroom learning environments. This approach involved the use of classroom environment instruments to measure teachers’ and students’ perceptions of their classroom environments for investigating the nature of the classroom learning environment. These studies had developed many well-validated and robust classroom environment instruments for use in many countries in different classroom contexts (Fraser, 1998).

A psychometric study examining the validity and reliability of the My Class Inventory-Short Form for Teachers, an accountability measure for elementary school counselors to use as they evaluate aspects of their school counseling programs was developed. As a companion inventory to the student version of the MCI Form, this instrument assesses teachers’ perceptions of the classroom climate as they relate to five scales: overall student satisfaction with the learning experience, peer relations, difficulty level of classroom materials, student competitiveness, and school counselor impact on the learning environment. Implications for practice are included.

Focusing on the early 2001, the Ministry of Education began developing new national curricula in an endeavor to model the system of education on child, or student-centered learning methods. The years from 2001 to 2009 showed some of the greatest improvements in education, experiments had also been tried with restructuring the administrative regions for education or partly decentralizing the responsibility of education to real change and many attempts to establish a clear form inappropriate or mismatched syllabus in the schools that it should be followed as the Thai policy government. The purpose of this study is beyond the scope of this article.
summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children's social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Chiang Yean Pittayakom School at Grade 12 in Mahasarakham Province for demonstrating the reliability and validity of the My Class Inventory (MCI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Biology-Related Attitude (TOBRA), the instruments need to be thoroughly analyzed psychometrically.

Science Education Classroom Learning Environment

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers' use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institutes, current trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998).

Historical Background of Science Classroom Learning Environment

In the past three decades, there are educational researchers (Walberg & Moos, 2011) began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos & Trickett 1984). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley 1990; von Salderen 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).

Instrument for Assessing Classroom Environment

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974) scheme for classifying human environments.

Classroom Learning Environment Instrument for this Study

My Class Inventory (MCI)

The My Class Inventory (MCI) was the major instrument used in the present study (Abdul Majeed, Barry J. Fraser & Jill M. Aldridge, 2001). The initial development and validation of the Learning Environment Inventory (LEI) began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research). The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser & Walberg, 1982; Fraser & O'Brien, 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study). The MCI differs in five important ways. Firstly, in order to minimize fatigue among younger children, the MCI contains only five of the LEI's original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI's four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O'Brien (1985) developed a short 25-item version. Typical items are “Children are always fighting with each other” (Friction) and “Most children can do their school work without help” (Difficulty).
To obtain a quick and easy assessment of their classroom environments, teachers can use the MCI. It satisfies two basic criteria (Fraser & Fisher, 1983a). First, the total number of items is small, thus providing economy in testing and scoring time. Second, because many teachers do not have ready access to computerized scoring methods, the MCI is suitable for easy hand scoring. Table 1 provides a scale description and sample item for the original form of the MCI.

Because the MCI provides the lowest reading level of all existing classroom environment instruments, it was the natural choice for the present study which involved students for whom English was not the first language. Nevertheless, the original form of the MCI (which was developed more than 20 years ago) still has some important shortcomings that needed to be taken into consideration in the present study.

Table 1

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>Extent of enjoyment of class work</td>
<td>The pupils enjoy their school work in my class.</td>
</tr>
<tr>
<td>Friction</td>
<td>Amount of tension and quarrelling among students</td>
<td>Many children in our class like to fight.</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Emphasis students competing with each other</td>
<td>Most children want their work to be better than their friend's work.</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Extent to which students find difficulty with the work of the class.</td>
<td>Most children can do their school work without help.</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Extent to which students know, help and are friendly towards each other</td>
<td>Some pupils in my class are not my friends.</td>
</tr>
</tbody>
</table>

The Test Of Biology-Related Attitude (TOBRA)

This study investigated associations between Actual and Preferred students’ perceptions of their biology laboratory environment classes in Chiang Yean Pittayakom School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected to the Test Of Biology-Related Attitude (TOBRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among biology laboratory environment classes in Chiang Yean Pittayakom School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their biology laboratory environment classes. Furthermore, the TOBRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Actual and Preferred Form Scales

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow’.

Materials and Methods

Research Objectives

1. To assess student’s perceptions of their biology laboratory environment classes at Grade 12 in Chiang Yuen Pittayakom School, Mahasarakham Province.
2. To compare between student’s perception of their actual and preferred biology laboratory environment classes at Grade 12 in Chiang Yuen Pittayakom School, Mahasarakham Province.
3. To associate student’s attitudes of their perceptions to their actual biology laboratory environment classes at Grade 12 in Chiang Yuen Pittayakom School, Mahasarakham Province.

Research procedure

Using the MCI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOBRA on the 15th week for associating biology laboratory classroom
learning environments in biology classroom learning environment for upper secondary educational students at Grade 12 in Chiang Yean Pittayakom School, Mahasarakham Province.

Each scale of the MCI were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3,8,18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.

**Data Analyses**

The scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred MCI forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the MCI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the MCI with students’ attitudes to associate were analyzed.

**Sample**

This study is improved and developed students’ biology laboratory classroom environment with actual and preferred student’s perceptions with a sample size 108 upper secondary educational students at Grade level 12 in 3 classes in Chiang Yuen Pittayakom School, Mahasarakham Province, in the second semester in academic year 2014.

**Results**

**Validity and Reliability of Research Instruments**

**A. Validation of the MCI**

Description of quantitative data of analyzing responses for student’s perceptions is reported in Table 2.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>20.22</td>
<td>4.04</td>
<td>0.35</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.25</td>
<td>4.45</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>19.88</td>
<td>3.98</td>
<td>0.26</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>21.84</td>
<td>4.37</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>17.59</td>
<td>3.52</td>
<td>0.51</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>19.94</td>
<td>3.99</td>
<td>0.40</td>
<td>0.63</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>19.94</td>
<td>3.99</td>
<td>0.30</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>21.13</td>
<td>4.23</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>20.72</td>
<td>4.14</td>
<td>0.35</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.13</td>
<td>4.43</td>
<td>0.24</td>
<td>0.49</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the five MCI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the MCI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.

**B. Factor Loading Analysis of the MCI**

The Actual and Preferred Forms of the MCI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.
Table 3.
Factor Loading for Items in the Actual Form of the MCI.

<table>
<thead>
<tr>
<th>Item</th>
<th>SC</th>
<th>TS</th>
<th>IV</th>
<th>IN</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>11</td>
<td>0.83</td>
<td>0.82</td>
<td>0.74</td>
<td>0.57</td>
</tr>
<tr>
<td>21</td>
<td>6</td>
<td>0.77</td>
<td>0.80</td>
<td>0.75</td>
<td>0.76</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>0.76</td>
<td>0.78</td>
<td>0.74</td>
<td>0.57</td>
</tr>
<tr>
<td>16</td>
<td>21</td>
<td>0.75</td>
<td>0.76</td>
<td>0.74</td>
<td>0.57</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>0.74</td>
<td>0.57</td>
<td>0.74</td>
<td>0.57</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>0.80</td>
<td>0.67</td>
<td>0.80</td>
<td>0.67</td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td>0.80</td>
<td>0.50</td>
<td>0.75</td>
<td>0.45</td>
</tr>
<tr>
<td>17</td>
<td>22</td>
<td>0.75</td>
<td>0.45</td>
<td>0.69</td>
<td>0.41</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.69</td>
<td>0.41</td>
<td>0.65</td>
<td>0.35</td>
</tr>
<tr>
<td>22</td>
<td>2</td>
<td>0.65</td>
<td>0.35</td>
<td>0.71</td>
<td>0.91</td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td>0.71</td>
<td>0.91</td>
<td>0.79</td>
<td>0.79</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>0.70</td>
<td>0.87</td>
<td>0.70</td>
<td>0.87</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>0.58</td>
<td>0.80</td>
<td>0.58</td>
<td>0.80</td>
</tr>
<tr>
<td>18</td>
<td>8</td>
<td>0.28</td>
<td>0.73</td>
<td>0.24</td>
<td>0.23</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>0.24</td>
<td>0.23</td>
<td>0.24</td>
<td>0.23</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>0.79</td>
<td>0.79</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>19</td>
<td>24</td>
<td>0.75</td>
<td>0.69</td>
<td>0.70</td>
<td>0.75</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td>0.69</td>
<td>0.63</td>
<td>0.55</td>
<td>0.70</td>
</tr>
<tr>
<td>24</td>
<td>14</td>
<td>0.60</td>
<td>0.62</td>
<td>0.46</td>
<td>0.35</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>0.60</td>
<td>0.53</td>
<td>0.35</td>
<td>0.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>59.23</td>
<td>53.26</td>
<td>54.68</td>
<td>49.85</td>
<td>45.65</td>
<td>56.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54.68</td>
<td>47.49</td>
<td>50.04</td>
<td>42.05</td>
<td>55.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.97</td>
<td>2.66</td>
<td>2.74</td>
<td>2.37</td>
<td>2.49</td>
<td>2.28</td>
<td>2.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.74</td>
<td>2.37</td>
<td>2.50</td>
<td>2.50</td>
<td>2.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 108 students

The Actual Form of the MCI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the MCI. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

The Internal Consistency Reliability of the Version MCI
The internal consistency reliability of the version MCI used in this study was determined by calculating Cronbach alpha coefficient for the 25 items of the MCI using both actual and preferred environmental climates’ perceptions scores. Table 3 reports the internal consistency of the MCI, which ranged from 0.69 to 0.82 when using the students’ actual climate scores and from 0.76 to 0.84 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the MCI, which suggests that each scale of the MCI was able to differentiate significantly (p<0.001) between students’ perceptions in biology laboratory physics laboratory environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 2.08 to 6.13 for different scales, respectively.
Table 4.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>0.82</td>
<td>0.72</td>
<td>2.08</td>
<td>0.12</td>
<td>0.04*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.84</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.71</td>
<td>0.75</td>
<td>2.53</td>
<td>0.15</td>
<td>0.03*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.79</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>0.71</td>
<td>0.75</td>
<td>6.13</td>
<td>0.25</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.69</td>
<td>0.76</td>
<td>3.75</td>
<td>0.20</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>0.77</td>
<td>0.74</td>
<td>3.90</td>
<td>0.23</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

C. The Circumplex Nature of the MCI
To investigate the circumplex nature of the MCI, correlations between the scales were calculated. The sample in Table 5 is presented the results show that the correlations between a scale and the next scale.

Table 5 shows the correlations between the scales were calculated. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 5. Scale Intercorrelations for the MCI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>CO</th>
<th>FR</th>
<th>DI</th>
<th>SA</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>Actual</td>
<td>CO</td>
<td>0.86**</td>
<td>FR</td>
<td>0.47**</td>
<td>DI</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td>0.83**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR</td>
<td>Actual</td>
<td>0.27*</td>
<td></td>
<td>0.78**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.41**</td>
<td></td>
<td>0.52**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI</td>
<td>Actual</td>
<td>0.55**</td>
<td>0.68**</td>
<td>0.65**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75**</td>
<td>0.78**</td>
<td>0.66**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>Actual</td>
<td>0.76**</td>
<td>0.68**</td>
<td>0.27*</td>
<td>0.55**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.87**</td>
<td>0.89**</td>
<td>0.36*</td>
<td>0.80**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

D. Validation of the TOBRA
To measure biology students’ attitudes towards physics laboratory classroom learning environment in science learning group, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005, Santiboon & Fisher, 2005; Santiboon, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the TOBRA had a value of 0.83 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the MCI helps biology laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when
planning and designing the biology laboratory classroom learning environment curriculum for the Chiang Yean Pittayakom School students in biology classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in biology laboratory classroom learning environments.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the MIC.

**Associations between Students’ Perceptions of their Actual and Preferred Biology Laboratory Classroom Learning Environments toward their Attitude (TOBRA)**

In this study, it was also considered important to investigate associations between students’ perceptions of their biology laboratory classroom learning environments with their attitude toward biology laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOBRA was 0.83, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in biology laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOBRA that it’s reported in Table 6.

Table 6.
**Associations between MCI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actural Form</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regress Weigh Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>0.39</td>
<td>0.19**</td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>0.21</td>
<td>0.15*</td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>0.49</td>
<td>0.20**</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0.28</td>
<td>0.16*</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>0.31</td>
<td>0.17*</td>
<td></td>
</tr>
<tr>
<td><strong>Multiple Correlation (R)</strong></td>
<td>0.5680**</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.3225**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

In Table 6, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their biology laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students...
perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their biology laboratory classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their biology laboratory classroom learning environments on all scales of the Actual Form.

Conclusions and Discussion

Table 6 is compared to investigate associations between biology students’ perceptions of their biology laboratory classroom learning environments with their attitude toward biology laboratory classes. Using the MCI instrument in the higher education level, Chiang Yean Pittayakom School, Thailand, will help teachers to evaluate their learning environments in biology laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the MCI could be useful as the guide to enhance the effectiveness of biology laboratory classes. The effectiveness in biology laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of biology laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 108 student of their biology laboratory classroom learning environments were measured with the MCI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their biology laboratory classroom learning environments. In general, students’ perceptions of their preferred biology laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the MCI helps biology teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their biology laboratory classroom learning environments with regard to the MCI, it was found that all of five scales were positively associated with students’ attitude to biology laboratory classroom learning environments. The multiple correlation $R$ is significant for the MCI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 56%, with actual form of the valiance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights ($\beta$) show that in classes where the students perceived greater than all scales in their biology laboratory classroom learning environments lessons.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (MCI),This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in biology laboratory classroom learning environments.

Overall, this study replicated previous studies using the MCI, with the findings being consistent with the situation in Chiang Yuen Pittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the biology laboratory classroom learning environments, interestingly.

Acknowledgements

I am heartily thankful to my supervisors; Assist. Prof. Dr. Toansakul Santiboon and Dr. Panwilai Chomchid of Master of Science of Education Program, Faculty of Education, Chiang Yean Pittayakom School , whose encouragement, guidance and support instruments and computing system for analysis of this research. I am grateful to my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Chiang Yuen Pittayakom School.

References


Measuring Students’ Perceptions of their Chemistry Learning Classes in Rajabhat Maha Sarakham University Demonstration School

Monwipha Mueangprafang, Toansakul Santiboon* and Panwilai Chomchid

Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, 44000, Thailand

(*author for correspondence, Email: toansakul35@yahoo.com.au)

Abstract

The first purpose of this study was to validate the What Is Happening In this Class (WIHIC) questionnaire with a small sample of eleventh-grade chemistry classes in upper secondary educational students in Rajabhat Maha Sarakham University Demonstration School. To investigate associations between students’ perceptions of their chemistry classroom learning environments to their attitudes toward their chemistry were associated. The WIHIC questionnaire was used to measure students’ perceptions of their actual and preferred chemistry classroom learning environments with a sample of 127 eleventh-grade chemistry students who responded to the 56-items on the WIHIC and the 8-Scales, the Test Of Chemistry-Related Attitude (TOCRA) was used to measure the attitudes of students toward chemistry classes. Associations between students’ perceptions of their attitude to their chemistry classes were assessed. Students’ perceptions of their chemistry classes with high prefer quality status is more satisfied with collaborative efforts the amount of attention they receive from the teacher than are actually. Associations between students’ perceptions of their attitudes toward their chemistry classes were chosen as the dependent variable and associated to the summary of the model to the correlation coefficient significant for the WIHIC and considered associations with the TOCRA of 45% of the variance in students’ attitude were also provided. Suggestions that teacher training programs should consider incorporating and modeling learning environment methodologies as a means of ensuring that teachers know of the alternatives exist in evaluating and adjusting the classroom environment for the betterment of students.

Keyword: Chemistry classroom, Education, Learning, Student perception

Introduction

Generally, it has been suggested that at the end of secondary schooling, a student will have spent as much as 15,000 hours in school (Fraser, 1989). Most of their time is spent interacting among themselves as well as with their teachers. Besides, they use a variety of tools and information resources in their pursuit of learning activities in the classroom. The classroom can indeed be considered a miniature society, which consists of individual students with varying interests, diverse backgrounds and wide-ranging personalities. One class may be quiet and passive, but another can be noisy and active. The nature of the classroom environment and psychosocial interactions can make a difference in how the students learn and achieve their goals. In over two past decades, the study of the classroom learning environment has been gaining momentum and making significant contributions to the improvement of teaching and learning.

A great deal of research and evaluation in education has been heavily dependent on measures of academic achievement and other learning outcomes; however, these measures cannot provide a complete description of the educational process. Over the past 40 years, significant progress has been made in the conceptualization, assessment, and investigation of the learning environments of classrooms and schools (Aldridge & Fraser, 2000; Fisher & Khine, 2006; Fraser, 2002, 2007; Khine & Fisher, 2003). This research has enabled educators to develop a more in-depth understanding of how students learn and the complexity of the factors that can affect the teaching and learning process. Convincing evidence has been provided that the quality of the classroom environment in schools is a significant determinant of student learning (Fraser, 2007; Wubbels & Levy, 1993).

While the above mentioned learning environment research instrument contributed to a better understanding of the socio-psychological climate of the classrooms, some researchers felt that there was a need for a single instrument which incorporated some of the best features of the instruments previously constructed. Based on past studies, Fraser, Fisher, and McRobbie (1996) developed a new learning environmental instrument named What Is Happening In This Class? (WIHIC), which incorporate scales have been used and proven to be significant predictors of learning outcomes. They also included additional scales which were designed to measure current concerns in the classrooms, such as equity issues.
Since its development, the WIHIC has been used to measure the psychosocial aspects of the classroom learning environment in various contexts. In some research, the questionnaire has been used without any modification, and in others the questionnaire was adapted to suit a specific context. To date the original questionnaire in English has been translated into the Chinese language for use with Chinese medium students in Taiwan and Singapore, and the Korean language for use in Korea.

The science classroom learning researches were developed and explored to study in terms of cultural differences was highlighted and it appears that the education system in Taiwan is examination-driven and teaching styles are adapted to suit this particular situation. It was found that in Taiwan the most important element of being a good teacher was perceived as having good content knowledge, but in Australia, having good interpersonal relations between teacher and students may be considered the most important element in the education process. Taiwanese classrooms offer a teacher-centered lesson in which students appear to play a passive role and there were only few opportunities to discuss or question. This study suggests that the WIHIC questionnaire was able to differentiate between cultural differences and therefore maybe suitable for cross-cultural studies.

Associations between perceptions of learning environment and attitudinal outcomes were reported by Hunus and Fraser (1997) when they used a modified version of WIHIC for 644 students in Year 10 chemistry classes in Brunei. In their study, reliability coefficients of 0.75 to 0.89 were found and simple and multiple correlation analyses show that there was a significant relationship between the set of environment scales and students’ attitudes towards chemistry theory classes. Using the individual student as the unit of analysis, Student Cohesiveness, Teacher Support, Involvement, and Task Orientation scales were found to be positively associated with the students’ attitudes. The results further suggested that students perceived moderately positive learning environments in chemistry theory classes in terms of Student Cohesiveness, Teacher Support, Involvement and Investigation. A highly positive environment on Task Orientation and Cooperation was also detected in the chemistry classrooms. However, the students in Brunei perceived that they had relatively little autonomy and independence in their classes.

The What is Happening in this Class (WIHIC) questionnaire, adapted by Adolphe (2002) from the earlier version developed by Fraser, Fisher and McRobbie (1996), was used to measure students’ perceptions of their classroom environment. The five possible responses were: Almost Never; Never; Sometimes; Often; and Almost Always. The 56-Item questionnaire contained the following eight scales with seven items. The purpose of this study will be to investigate the background of the study of learning environment and to introduce a recently developed questionnaire called What is Happening in This Class? (WIHIC), that it will be used in education system in Thailand. The questionnaire will be designed to measure students’ perception of their science classroom environment in upper secondary education various school classes.

Materials and Methods

Research Purposes

4. To assess student’s perceptions of their chemistry laboratory classroom learning environment for upper secondary educational students at Grade 11 in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province.

5. To compare between students’ perceptions of their actual and preferred chemistry laboratory classroom learning environment for upper secondary educational students at Grade 11 in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province.

6. To associate between students’ chemistry laboratory attitudes and their actual perceptions toward their chemistry laboratory classroom learning environment for upper secondary educational students at Grade 11 in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province.

Literature Review

Smith and Ezeife (2010) studied in Canada to determine if there was a statistically significant relationship between students’ perceptions of the classroom environment and their attitudes toward chemistry laboratory in grade nine applied chemistry laboratory. The following research question guided the study. What is the strength of the relationship between students’ perceptions of their classroom environment and their attitudes to chemistry laboratory in grade nine applied chemistry laboratory classrooms?

Aldridge, Fraser and Ntuli (2009) examined the viability of using feedback from a learning environment instrument to guide improvements in the teaching practices of in-service teachers undertaking a distance-education programme. The 31 teachers involved administered a primary school version of the What Is Happening In this Class? (WIHIC–Primary) questionnaire to their 1,077 learners in order to determine preferred and actual classroom environments. Feedback about discrepancies between learners’ actual preferred learning environments were used to formulate teaching strategies to reduce discrepancies over a 12-week
intervention period. In-service teachers’ reports, contact sessions, interviews between teachers and researchers, and three case studies based on classroom visits (one of which is reported here) provided thick descriptions of teachers’ reactions to utilizing the learning environment instrument. Our research provided the first learning environment study at the primary school level in South Africa, cross-validated an IsiZulu version of the WIHIC when used for the first time in South Africa, and supported the success of teachers’ use of a learning environment questionnaire in guiding improvements in their teaching.

Perry den Brok (2006) utilized the What Is Happening In this Class (WIHIC) questionnaire to examine factors that influence Californian student perceptions of their learning environment. Data were collected from 665 USA middle school chemistry laboratory students in 11 Californian schools. Several background variables were included in the study to investigate their effects on students’ perceptions, such as student and teacher gender, student ethnic background and socio-economic status (SES), and student age. Class and school variables, such as class ethnic composition, class size and school socio-economic status were also collected. A hierarchical analysis of variance was conducted to investigate separate and joint effects of these variables. Results from this study indicate that some scales of the WIHIC are more inclined to measure personal or idiosyncratic features of student perceptions of their learning environment whereas other scales contain more variance at the class level. Also, it was found that different variables affect different scale scores. A variable that consistently affected students' perceptions, regardless of the element of interest in the learning environment was student gender. Generally speaking perceived girls perceived their learning environment more positively than did boys.

Dorman (2003) reported of the using The What Is happening In this Class? (WIHIC) questionnaire was validated cross-nationally with a sample of 3,980 high school students in Australia, the UK and Canada. Confirmatory factor analysis supported the seven-scale a priori structure of the instrument. Fit statistics indicated a good fit of the model to the data. While all items loaded strongly on their a priori factor, model fit indices revealed the degree of scale overlap of the whole instrument scales. The use of multi-sample analyses with structural equation modeling substantiated invariant factor structures for three grouping variables: country, grade level and student gender. This study supported the wide international applicability of the WIHIC as a valid measure of classroom psychosocial environment.

Chionh and Fraser (1998) used Actual and Preferred forms of WIHIC to further validate the instrument and to investigate associations between the actual classroom environment and the outcomes of examination scores, self-esteem and attitudes. The questionnaire was administered to 2,310 students from 75 randomly selected Grade 11 geography and mathematics classes in Singapore. The alpha reliability of the scales in the instrument was found to be from 0.88 to 0.97. The study revealed that better examination scores were found in geography and mathematics classrooms where students perceived the environment as being more cohesive. It was also found that self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity.

Khoo and Fraser (1997) used a modified version of the WIHIC to measure classroom environment in adult computer courses in Singapore. When the questionnaire was introduced to 250 working adults, it was found that scale alpha reliabilities ranged from 0.77 to 0.92. In investigating the differential effectiveness of computer courses for each gender, they found that males perceived significantly greater Involvement and Trainer Support. On the other hand, females perceived significantly higher levels of Equity in the computer classroom environment. In addition, it was found that older females have more positive perceptions than younger females in this context.

**Actual and Preferred Classroom Learning Environments**

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow.’

**Classroom Learning Environment Instruments**

*The What Is Happening In This Class (WIHIC) Questionnaire*

The original 90-item nine-scale version was refined by both statistical analysis of data from 355 junior high school chemistry laboratory students’ questionnaire responses (Fraser, Fisher & McRobbie 1996). Only 54 items in seven scales survived these procedures, although this set of items was expanded to 80 items in eight scales for the field testing of the second version of the WIHIC. This led to a final form of the WIHIC containing the seven eight-item scales. The WIHIC has been used successfully in its original form or in modified form in studies involving 250 adult learners in Singapore (Khoo & Fraser 1997) and 2,310 high school students in Singapore (Chionh & Fraser 1998).
The Test of Chemistry-Related Attitudes (TOCRA)

To investigate associations between students’ perceptions of their chemistry laboratory classroom environment constructivist and their attitudes toward chemistry laboratory learning classes for upper secondary educational students at Grade 11 in Rajabhat Maha Sarakham University Demonstration School. This study modified from the original of the Test of Chemistry-Related Attitudes (TOCRA) (Fraser, 1981; Santiboon, 2011, 2013) from the original of the Test of Chemistry laboratory-Related Attitudes (TOSRA) (Fraser, 1981) was designed to measure eight distinct classroom-related attitudes among upper secondary educational students. The eight items are suitable for group administration and all can be administered within the duration of learning in chemistry laboratory environment chemistry laboratory. Furthermore, TOCRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Assessing Students’ Perceptions with the WIHIC and TOCRA

Using the WIHIC was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSCA on the 15th week for associating chemistry laboratory classroom learning environments in chemistry laboratory classroom learning environment monitoring constructivists for upper secondary educational students at Grade 11 in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province.

Each scale of the WIHIC were composed with the 8-item, minimum score is 8 and maximum score is 56 items. The first scale, Student Cohesiveness is composed the item of 1, 2, 3, 4, 5, 6, 7, 8; The second scale, Teacher Support is composed the item of 9, 10, 11, 12, 13, 14, 15, 16; The third scale, Involvement is composed the item of 17, 18, 19, 20, 21, 22, 23, 24; The fourth scale, Investigation is composed the item of 25, 26, 27, 28, 29, 30, 31, 32; The fifth scale, Task Orientation 33, 34, 35, 36, 37, 38, 39, 40; The sixth scale, Cooperation of 41, 42, 43, 44, 45, 46, 47, 48; The seventh scale, Equity of 49, 50, 51, 52, 53, 54, 55, 56.

Data Analysis

Quantitative data were obtained using the two questionnaires (WIHIC and TOCRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual WIHIC scale to investigate whether students have significant different perceptions of their actual and preferred classroom learning. Assuming that the scaling of the items approximated a 5-point Likert scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred WIHIC Forms and the TOCRA. Factorial validity and adequacy of fit for the dimensionality of the WIHIC were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their chemistry laboratory classes learning environment classes for the Actual Form of the WIHIC with students’ attitudes to associate were analyzed.

Sample

This study is improved and developed chemistry laboratory classroom learning environment for upper secondary educational students at Grade 11 in Rajabhat Maha Sarakham University Demonstration School classes of their chemistry laboratory learning classroom environments to actual and preferred student’s perceptions with sample size of 127 students in 3 classes at Grade 11 in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province.
Results

Validity and Reliability of Research Instrument

A. Validity and Reliability of WIHIC

Description of quantitative data of analyzing responses for eleventh-grade chemistry laboratory students of Rajabhat Maha Sarakham University Demonstration School assessments is reported in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>28.72</td>
<td>3.59</td>
<td>0.05</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>37.59</td>
<td>4.70</td>
<td>0.15</td>
<td>0.39</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>28.72</td>
<td>3.59</td>
<td>0.05</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>37.59</td>
<td>4.70</td>
<td>0.15</td>
<td>0.39</td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>28.59</td>
<td>3.57</td>
<td>0.08</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.81</td>
<td>4.60</td>
<td>0.13</td>
<td>0.36</td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>28.34</td>
<td>3.54</td>
<td>0.08</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.94</td>
<td>4.62</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>28.12</td>
<td>3.51</td>
<td>0.08</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.06</td>
<td>4.51</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>28.47</td>
<td>3.56</td>
<td>0.07</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.97</td>
<td>4.62</td>
<td>0.15</td>
<td>0.39</td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>28.87</td>
<td>3.61</td>
<td>0.06</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.72</td>
<td>4.59</td>
<td>0.11</td>
<td>0.33</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the seven WIHIC scales, that they contain eight items, so that the minimum and maximum score possible on each of these scales is 7 and 56 items, respectively. Because of this difference in the number of items in the seven scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the WIHIC. For the remaining seven scales, Personalization, Participation, Independence, Investigation, and Differentiation scales.

Table 2.

Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the WIHIC.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>0.58</td>
<td>0.63</td>
<td>3.07***</td>
<td>0.25***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.94</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>0.67</td>
<td>0.59</td>
<td>4.81***</td>
<td>0.27***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89</td>
<td>0.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>0.71</td>
<td>0.58</td>
<td>2.93***</td>
<td>0.24***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.87</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>0.63</td>
<td>0.60</td>
<td>2.68***</td>
<td>0.21***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>0.58</td>
<td>0.61</td>
<td>2.85***</td>
<td>0.22***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>0.53</td>
<td>0.62</td>
<td>2.48***</td>
<td>0.19***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.84</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>0.63</td>
<td>0.60</td>
<td>2.85***</td>
<td>0.21***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.91</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
The internal consistency reliability of the version WIHIC used in this study was determined by calculating Cronbach alpha coefficient for the 56 items of the WIHIC using both actual and preferred environmental climates’ perceptions scores. Table III reports the internal consistency of the WIHIC, which ranged from 0.53 to 0.71 when using the students’ actual climate scores and from 0.84 to 0.91 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the WIHIC, which suggests that each scale of the WIHIC was able to differentiate significantly \((p<0.001)\) between students’ perceptions in my school and my dream school environmental climates in the same school. The \(t\)-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 2.48 to 4.81 for different scales, respectively.

**B. The Circumplex Nature of the WIHIC:**

To investigate the circumplex nature of the WIHIC correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale. Table 3.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>TS</th>
<th>IV</th>
<th>IN</th>
<th>TO</th>
<th>CO</th>
<th>EQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>Actual</td>
<td>0.67**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>Actual</td>
<td>0.52**</td>
<td>0.66**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.84***</td>
<td>0.91***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Actual</td>
<td>0.52**</td>
<td>0.58**</td>
<td>0.53**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78**</td>
<td>0.74**</td>
<td>0.78**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Actual</td>
<td>0.61**</td>
<td>0.78**</td>
<td>0.69**</td>
<td>0.61**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88***</td>
<td>0.93***</td>
<td>0.90**</td>
<td>0.85***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TO</td>
<td>Actual</td>
<td>0.63**</td>
<td>0.83**</td>
<td>0.73**</td>
<td>0.44*</td>
<td>0.73**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.73**</td>
<td>0.85***</td>
<td>0.92***</td>
<td>0.74**</td>
<td>0.87***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.44*</td>
<td>0.69**</td>
<td>0.71**</td>
<td>0.42*</td>
<td>0.76**</td>
<td>0.66**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76**</td>
<td>0.73**</td>
<td>0.85***</td>
<td>0.70**</td>
<td>0.86***</td>
<td>0.82**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
Table 4. Factor Loading for Items in the Actual Form of the WIHIC

<table>
<thead>
<tr>
<th>Item</th>
<th>SC</th>
<th>Pref</th>
<th>TS</th>
<th>Pref</th>
<th>IV</th>
<th>Pref</th>
<th>IN</th>
<th>Pref</th>
<th>TO</th>
<th>Pref</th>
<th>CO</th>
<th>Pref</th>
<th>EQ</th>
<th>Pref</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>0.91</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>0.83</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.82</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>0.78</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.72</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>0.72</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>0.63</td>
<td>0.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.61</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>0.82</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>0.67</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>13</td>
<td>0.67</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>10</td>
<td>0.65</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>0.62</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>0.59</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.54</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>0.40</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>21</td>
<td>0.75</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>22</td>
<td>0.68</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>23</td>
<td>0.63</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>17</td>
<td>0.54</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>18</td>
<td>0.49</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>24</td>
<td>0.45</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>20</td>
<td>0.43</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>19</td>
<td>0.31</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>29</td>
<td>0.82</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>28</td>
<td>0.79</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>25</td>
<td>0.77</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>30</td>
<td>0.74</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>26</td>
<td>0.74</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>27</td>
<td>0.68</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>31</td>
<td>0.57</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>32</td>
<td>0.31</td>
<td>0.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>39</td>
<td>0.89</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>33</td>
<td>0.82</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>35</td>
<td>0.80</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>37</td>
<td>0.77</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>38</td>
<td>0.75</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>36</td>
<td>0.73</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>40</td>
<td>0.72</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>34</td>
<td>0.51</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>47</td>
<td>0.83</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>45</td>
<td>0.70</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>42</td>
<td>0.69</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>41</td>
<td>0.68</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>48</td>
<td>0.67</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>46</td>
<td>0.65</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>44</td>
<td>0.58</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>43</td>
<td>0.36</td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>50</td>
<td>0.78</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>54</td>
<td>0.72</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>49</td>
<td>0.67</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>52</td>
<td>0.62</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>51</td>
<td>0.54</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D. Validation of the Test Of Chemistry-Related Attitude (TOCRA)

To measure chemistry students’ attitudes towards chemistry laboratory classroom learning environment subject, the present study adapted the eight-item of the TOCRA (Santiboon & Fisher, 2005; Santiboon, 2011, 2013, 2014). Using internal consistency reliability the Attitude Scale had a value of 0.84 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of their Actual and Preferred Chemistry laboratory Classes

On comparing differences between the students’ perceptions of their actual and preferred chemistry laboratory classroom learning environment in Table 5 and Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Student Cohesiveness, Teacher, Involvement, Investigation, Task Orientation, Cooperation, and Equity scales than student’s actual perceptions.

The results of this study also indicate that using the WIHIC helps chemistry laboratory teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the chemistry laboratory educational management curriculum for the eleventh-grade chemistry laboratory students from Rajabhat Maha Sarakham University Demonstration School environments. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the eleventh-grade chemistry laboratory students from Rajabhat Maha Sarakham University Demonstration School classes.

Associations between Students’ Perceptions of Actual Chemistry Laboratory Classroom Learning Environments with the TOCRA

In this study, it was also considered important to investigate associations between chemistry laboratory classroom learning environment constructivists for eleventh-grade chemistry laboratory students from Rajabhat Maha Sarakham University Demonstration School environment classes of their chemistry laboratory classroom learning environment with their attitude toward chemistry laboratory. The Cronbach alpha reliability of the selected the TOCRA was 0.84, when using individual student as the unit of analysis. This suggests that the TOSRA is reliable for measuring students’ attitudes in chemistry laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOSRA that it’s reported in Table 5.
Table 5.

Associations between WIHIC Scale and Attitude Scale to Chemistry laboratory Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple Correlate.</td>
<td>Std. Regress.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attitude (r)</td>
<td>Weight Attitude(β)</td>
<td></td>
</tr>
<tr>
<td>Student Cohesiveness</td>
<td>0.14</td>
<td>0.17*</td>
<td></td>
</tr>
<tr>
<td>Teacher Support</td>
<td>0.54</td>
<td>0.32**</td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>0.14</td>
<td>0.18*</td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>0.61</td>
<td>0.36***</td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.17</td>
<td>0.16*</td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.61</td>
<td>0.31**</td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>0.83</td>
<td>0.28**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6684**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.4505**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their chemistry laboratory educational constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Student Cohesiveness, Teacher, Involvement, Investigation, Task Orientation, Cooperation, and Equity environments there was a more favourable attitude towards their chemistry laboratory educational constructivist class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their classroom environment on all scales of the Actual Form. The multiple correlations $R^2$ is significant for the WIHIC and considered association with the TOCRA, and value indicates that 45% of the variance in students’ attitudes was also determined.

DISCUSSIONS AND CONCLUSIONS

The actual and preferred perceptions of 164 students of their chemistry laboratory classroom environment in Rajabhat Maha Sarakham University Demonstration School were measured with the WIHIC. The comparisons of the Actual Form with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their chemistry laboratory management classes. In general, students’ perceptions of their preferred classroom in chemistry laboratory management classes to be greater than what they actually perceive to be provided. The results of this study also indicate that using the WIHIC helps Rajabhat Maha Sarakham University Demonstration School’s teachers or lecturers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their chemistry laboratory management classes, with regard to the WIHIC, it was found that all of seven scales were positively associated with students’ attitude to chemistry laboratory management class. The multiple correlation $R$ is significant for the WIHIC and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 45%, with actual form of the variance in students’ attitudes to their chemistry laboratory management class was attributable to their perceptions of their chemistry laboratory management classroom environment. The beta weights ($β$) show that in class where the students perceived greater than all scales in their chemistry laboratory management learning classroom.

Learning environment is an important aspect in education process. It is not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments What Is Happening In This Class (WIHIC) Questionnaire. This instrument provides the information of students’ perceptions on actual and preferred chemistry laboratory educational management learning environment. The information from this instrument could be used for improvement and effectiveness teaching in chemistry laboratory educational management course.

Overall, this study replicated previous studies using the WIHIC, with the findings being consistent with the situation in Rajabhat Maha Sarakham University Demonstration School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province in Thailand.
ACKNOWLEDGMENT

Firstly, I would like to thank the 164 students in chemistry laboratory classroom in Borabu Wittayakhan School who allowed students to complete the questionnaire. My greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my supervisor, and Dr. Panwilai Chomchid, as the co-advisor too. This work was supported in part by a grant from Rajabhat Maha Sarakham University, Thailand.

REFERENCES


Assessing Chemistry Laboratory Classroom Learning Inventory in Upper Secondary Wapeepatum School at Eleventh Grade Level

Waraporn Kratud-ngern¹, Natchanok Jansawang², Jandi Bion³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 4400
²Deperment of Chemistry Program Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 4400
³Science Learning Group Section, Wapeepatum School, Maha Sarakham

*( author for correspondence, E-mail: toansakul35@yahoo.com)

Abstract

Describes the development of the Science Laboratory Environment Inventory (SLEI), which assesses perceptions of psychosocial environment in science laboratory classrooms, and validation of the instrument was adapted. Initial development was guided by the criteria of consistency with the literature on laboratory teaching, consistency with instruments for settings in chemistry laboratory classroom learning inventory. Consequently, adaptation the SLEI to the 35-Items of the Chemistry Laboratory Environment Inventory (CLEI), was designed to assess students’ perceptions of five scales: Student Cohesiveness, Open-Endedness, Integration, Rule Clarity and Material Environment. Each CLEI scale exhibited satisfactory internal consistency reliability, discriminant validity, and factorial validity, and differentiated between the perceptions of students in different classes. Research administration is based on a sample of 93 upper secondary students at the Eleventh-Grade level in Wapipatum School to association between actual students’ perceptions of their CLEI to their attitude with the Test Of Chemistry-Related Attitude (TOCRA) toward chemistry studies were analyzed. In terms of the CLEI ought to be considered to be a relatively good measure of chemistry laboratory classroom environment. The multiple correlation R is significant for the actual form of the CLEI and indicated that the five scales are considered together there is significant (ρ < 0.05) association with the TOCRA, the \( R^2 \) value expecting measurement that 21% of the variance in students’ attitude to their chemistry class was attributable to their perceptions of their individual classroom learning environment in chemistry laboratory classes, opportunity.

Keywords: Actual form, Associations, Student, Wapipatum school, Chemistry laboratory

Introduction

Background of Science Educational System in Thailand

Education in Thailand is provided mainly by the Thai government through the Ministry of Education from preschool to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years’ school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable (Ministry of Education, 2010).

The school structure is divided into four key stages: the first three years in elementary school, the first primary level or Prathom 1–3, are for age groups 7–9 (Grade 1-3); the second primary level or Prathom 4 through 6 are for age groups 10–12 (Grade 4-6); the third lower secondary level or Matthayom 1–3, is for age groups 13–15 (Grade 7-9). The upper secondary level of schooling consists of Matthayom 4–6 for age groups 16–18 (Grade 10-12), and is divided into academic and vocational streams. There are academic upper secondary schools, vocational upper secondary schools and comprehensive schools offering academic and vocational tracks. Students who choose the academic stream usually intend to enter a university. Vocational schools offer programs that prepare students for employment or further studies.

Admission to an upper secondary school is through an entrance exam. On the completion of each level, students need to pass the NET (National Educational Test) to graduate. Children are required to attend six years of elementary school and at least the first three years of high school. Those who graduate from the sixth year of high school are candidates for two decisive tests: O-NET (Ordinary National Educational Test) and A-NET (Advanced National Educational Test). The school year is divided into two semesters. The first begins in the beginning of May and ends in October; the second begins in November and ends in March.
An assessment of the quality of secondary school education has indicated that only 40% of 3 secondary learners received adequate preparation for readiness in learning before attending university. Although Thailand has a very high percentage of youth learners attending child development centers, if such centers are not supported properly through strengthening capacity and management, the quality of secondary development and young children’s preparation for primary and secondary schooling can be seriously affected (UNESCO, 2011). Most students attend formal educational institutions administered by the Ministry of Education and about half of these children enroll in learning childcare/development centers of the formal education system, mainly administered by the Department of Local Administration. The Office of Basic Education Commission (OBEC) prepares the basic core curriculum and disseminates it to all Educational Service Area (ESA) Offices for distribution to parents, guardians and teachers, so as to ensure that all key stakeholders combine efforts to provide school children with quality education. The 10-Year Plan and Policy for the Basic Educational Secondary Development (2006-2015) provides a blueprint for achieving universal student education for all Thai children. The 10-Year Plan and Policy gives priority to three main strategies, namely; (1) to support youth development; (2) to support parents and other stakeholders; and (3) to promote an environment that facilitates secondary educational learners.

The Institute for the Promotion of Teaching Science and Technology (IPST)
There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as; curricula, teaching/learning process, media and materials then publicize them to all relevant organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner’s development. To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations (IPST, 2011).

Science Classroom Learning Environments
During the past 35 years, the study of classroom environments has received increased attention by researchers, teachers, school administrators and administrators of school systems. The concept of environment, as applied to educational settings, refers to the atmosphere, ambience, tone, or climate that pervades the particular setting. Research on classroom environments has focused historically on its psychosocial dimensions, those aspects of the environment concerned with human behaviour in origin or outcome (Boy and Pine, 1988). Reviews of classroom environment research by Fraser (1998b), Dorman (2002), Goh and Khine (2002) and Khine and Fisher (2003) have delineated at least 10 areas of classroom environment research including: associations between classroom environment and outcomes, evaluation of educational innovations, differences between students’ and teachers’ perceptions of classrooms, comparisons of actual and preferred environments, effect on classroom environment of antecedent variables (for example, gender, year level, school type, subject), transition from primary to secondary school, school psychology, teacher education, educational productivity research, and using environment instruments to facilitate changes in classroom life.

Instruments for Assessing Classroom Environment
Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCIEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos’s (1974) scheme for classifying human environments. Moos’s three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur) and System Maintenance and System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Context of Wapipathum School
Normally, almost all villages have an elementary school. Most sub-districts have a school for ages 6 through 14 and all districts have secondary schools for ages 12 through 17. Many have vocational colleges for students from age 15. The government is not able to cope with the entire number of students, thus the private sector, which is supervised by the government, provides a significant contribution. The level of education in the private
sector is generally, but not always, higher than that of the government schools. Expensive, exclusive private and international schools provide for a high level of achievement and a large number of their students continue their education at universities abroad. Charitable organizations (missionary societies or diocesan), and other religions provide the backbone of non-government, low-fee, general education and some established universities, and their standard is relatively high. Cheaper, newer and individual private schools, are occasionally run more for profit and government subsidies than for results, and are often indistinguishable from government schools in terms of quality of buildings, resources, teaching competency, and overcrowded classrooms. Their only real benefit is the prestige afforded to the parents for schooling their children in the private sector. In rural schools, absenteeism among both students and teachers is high due to family and farming commitments. Some schools close down during rice planting and harvesting seasons.

Focused on Wapipathum School is a rural or government school located in downtown as Nongsang Subdistrict, Wapipathum District, Maha Sarakham Province, Thailand. It admits from lower to upper secondary students (Grade level at of 7-12) and has the largest yearly enrolment in Wapipathum District in Maha Sarakham Province. Founded in 1954 as a Nongsang Subdistrict, Wapipathum District, Maha Sarakham Province, Thailand for being supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. Wapipathum School has among the development, enhancement, and improvement entry rates for local Thai schools. The school has 7 buildings, 72 classrooms. This school composes with 3,228 students, 138 senior professional teachers, a schooling administrator is Mr. Phisit Wannasri, and Udomlak Wanitchang is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

**Important Problems in Science Secondary Educational Classroom Learning Environment in this Study**

Thailand has formulated a policy and framework for action on education for all in the 1992 National Education Scheme in compliance with the World Declaration on Education for All adopted by all UNESCO Member States during the World Conference on Education for All in March, 1990 at Jomtien, Chonburi, Thailand. The scheme aims at guiding all related agencies to implement their activities. The World Declaration will have reached one-decade old in 2000 since its adoption. An assessment on education for all will be conducted to follow up the progress of the management of education for all in UNESCO Member States. UN agencies, namely, UNESCO, UNICEF, UNDP, UNFPA, and the World Bank, have jointly published a Guideline for the Assessment as well as provided technical assistance to Member States.

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the transition to lower and upper secondary education levels was approximately 90% and it tends to be on a continual increase. The provision of pre-primary education was obviously extended as the number of school age children having obtained this level of education was relatively higher from 1990 to 68.64%. The approaches of the provision of this level of education are offered through the Community Child Care Centers, Child Care attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary education is 91.32% with equal opportunity in terms of gender. These are some of the successful models of education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to undertake the national activities in providing education for all.

This study has been made possible by the assistance of agencies relating to basic education for all, both central and regional offices under the Ministry of Education as well as other relevant agencies outside the Ministry of Education. Additionally, UNESCO has also rendered its technical and financial support to the Ministry while UNICEF has assisted in translating the report into English. The Thai Ministry of Education, as the focal point of the Assessment of EFA 2000, would like to express its sincere appreciation to all concerned and hope that this report would be of benefited to wider circles of readers.

Unfortunately that isn’t the kind of good news for Asia that Thailand can share. The PISA tests of all know that Thai students don’t belong in the same class as the world-class East Asian. Of course Thailand has a few of our own some stellar students who win medals at the math and science Olympiads but their scholastic achievements are at odds with the general performance of their peers in the Thai education system. Thai students’ performance in international standardized tests is generally below average. That’s not a surprise given such appalling scores they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor. However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is on school students, the international test that is the most relevant and highly regarded for measuring performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA.
2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above 15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan, Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such as Chile, Turkey and Romania.

Focusing on this research study, Chemistry laboratory classroom environment dimensions have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of school. This study will be established associations between teacher personality and classroom environment, and will report differences in the Chemistry laboratory classroom environment perceptions of Wapipathum School students, the individual cultural differences in student perceptions of teacher-student interaction and their classroom learning environments. This study wills also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample Chemistry students in one classes and a school environment instrument to 1 teachers of these classes, only weak associations between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

Research Purposes

1. To explore the science classroom learning environment instruments for using these research instruments in learning classroom research in the secondary education in Thailand.

2. To describe and investigate of actual students’ perception in Chemistry Classroom learning environment for using the CLEI in Wapipathum school at level 11.

3. To analyze of reliability and validity of the CLEI and the TOCRA research instrument will use in Wapipathum school at level 11.

4. To associate between students’ perceptions of their actual individual chemistry classroom learning environment and their chemistry attitudes.

Previous Research

The Science Laboratory Environment Inventory (SLEI) is a recently developed classroom environment instrument for assessing students’ or teachers’ perceptions of their science laboratory classroom environment. This paper describes its development and reports on the validation and application of its modified form, the Chemistry Laboratory Environment Inventory (CLEI), with a Singapore secondary school sample. The sample consisted of 1 592 final-year secondary school (i.e. tenth grade) chemistry students from 56 intact classes from 28 randomly selected co-educational government secondary schools in Singapore. Various item and factor analyses supported the reliability and validity of the instrument for assessing students’ perceptions of their chemistry laboratory environment specifically in Singapore (Angela F. L. Wong & Barry J. Fraser,1997).

Quek Choon Lang, Angela FL Wong and Barry J Fraser (2002) investigated differences in boys’ and girls’ perceptions of their chemistry laboratory classroom environment using the Chemistry Laboratory Environment Inventory (CLEI). The CLEI has five scales for assessing Student Cohesiveness, Open-Endedness, Integration, Rule Clarity and Material Environment. The sample comprised 312 boys and 185 girls in 18 secondary 4 (year 10) chemistry classes from 3 independent schools in Singapore. Overall, the CLEI was found to be a reliable and valid instrument for use in the Singapore context. When students’ responses to actual and preferred versions of the CLEI were compared, statistically significant differences were found between the boys’ and girls’ perceptions of their chemistry laboratory classroom environment. This study showed that girls perceived their learning environment more favourably than boys. These differences in perceptions are presented and some implications for chemistry laboratory teaching are discussed.

Quek Choon Lang, Angela F. L. Wong, Barry J. Fraser (2005) investigated the chemistry laboratory classroom environment, teacher–student interactions and student attitudes towards chemistry among 497 gifted and non-gifted secondary-school students in Singapore. The data were collected using the 35-item Chemistry Laboratory Environment Inventory (CLEI), the 48-item Questionnaire on Teacher Interaction (QTI) and the 30-item Questionnaire on Chemistry-Related Attitudes (QOQRA). Results supported the validity and reliability of the CLEI and QTI for this sample. Stream (gifted versus non-gifted) and gender differences were found in actual and preferred chemistry laboratory classroom environments and teacher–student interactions. Some statistically significant associations of modest magnitude were found between students' attitudes towards chemistry and both the laboratory classroom environment and the interpersonal behaviour of chemistry teachers. Suggestions for
improving chemistry laboratory classroom environments and the teacher–student interactions for gifted students are provided.

Fraser (2005) used Dull classroom environments, poor students’ attitudes and inhibited conceptual development led to the creation of an innovative mathematics program, the Class Banking System (CBS), which enables teachers to use constructivist ideas and approaches. To assess the effectiveness of the CBS, the Individualised Classroom Environment Questionnaire (ICEQ), Constructivist Learning Environment Survey (CLES), Test of Mathematics-Related Attitudes (TOMRA), and concept map tests were administered to two groups of fifth-grade students as pretests and posttests over an academic year. To enrich the data collected from those questionnaires, three case studies (one for the experimental group and two for the control group) were undertaken based on observations and interviews of selected students. Relative to non-CBS students, CBS students experienced more favorable changes in terms of mathematics concept development, attitudes to mathematics, and perceived classroom environments on several dimensions of the CLES (e.g., Personal Relevance, Shared Control) and the ICEQ (e.g., Participation and Differentiation). Qualitative information based on classroom observations and student interviews reinforced and enriched the patterns of results obtained from the concept test and questionnaires.

Methodology

Research Procedures

Using the CLEI was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating chemistry laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 11 in Wapiipathum School, Maha Sarakham Province.

The CLEI has a total of 35 items, with seven items in each scale. The response format of the CLEI is a five-point frequency rating scale consisting of Very Often, Often, Sometimes, Seldom and Never, which are scored 5, 4, 3, 2 and 1, respectively. There were no major changes made to the 35 items of the SLEI for the actual and preferred versions of the instrument except for the replacement of the word ‘science’ with ‘chemistry’. The 35 items are arranged in cyclic order in groups each comprising one item from each of the five dimensions: Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment.

Data Analyses

Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred CLEI forms and the Attitude scale as specified in Santiboon (2014). Factorial validity and adequacy of fit for the dimensionality of the CLEI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the CLEI with students’ attitudes to associate were analyzed.

Sample

This study is explored and described based on the developing students’ chemistry laboratory classroom environment with actual and preferred student’s perceptions with a sample size 93 upper secondary educational students at Grade level 11 in Wapiipathum School, Maha Sarakham Province, in the first semester in academic year 2015.

Research Instrument

Chemistry Laboratory Classroom Learning Inventory (CLEI)

The SLEI has also been used for chemistry laboratory; however, Quek, Wong and Fraser (2002, 2005) developed a particular Chemistry Laboratory Environment Inventory (CLEI) parallel to SLEI with five dimensions: student cohesiveness, open-endedness, integration, rule clarity, and material environment. Kijkosol (2005) has provided the definitions of these variables. According to him student cohesiveness is “an extent to which students know, help and are friendly towards each other”. Open-endedness is “an extent to which laboratory activities emphasize an open-ended, divergent approach to experimentation”. Integration is “an extent to which laboratory activities are integrated with nonlaboratory and theory classes”. Rule clarity deals with the “emphasis on clear rules, on knowing the consequences for rules-breaking, and on the teacher dealing consistently with students who break rules”. Material environment is “an extent to which books, equipments, material, space, and lighting are adequate”. These five dimensions are not unique for SLEI and CLEI but also constitute many other inventories related to classroom environment. The CLEI has widely been used in various studies. Wong and Fraser are prominent figures who have conducted many research studies in Singapore and their collaboration is significant that they have a lot of research related with chemistry laboratory learning environment (Wong, Young, & Fraser 1997; Wong, & Fraser 1994; Quek, Wong, & Fraser 2002).
In another study, Domin (2007) has reported a questionnaire with 7 statements, which he used with seventeen students at the end of the second semester regarding their perceptions of the different chemistry laboratory instructional environments, i.e., traditional lab style or problem-based style. In the past, Welberg and Moos are the eminent pioneers who worked on classroom events in terms of individual’s perceptions in late 1960s (Fraser 1986, p.16). Since then number of new instruments have been developed related to investigation on classroom environment.

**The Test of Chemistry-Related Attitude (TOCRA)**

This study investigated associations between Actual students’ perceptions of their chemistry laboratory environment classes in Wapipathum School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) and Santiboon (2014) was modified, adapted, and selected to the Test Of Chemistry-Related Attitude (TOCRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in Wapipathum School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their chemistry laboratory environment classes. Furthermore, the TOCRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Results**

**Validity and Reliability of Research Instruments**

*Validation of the CLEI*

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean score</th>
<th>Mean Variance</th>
<th>Standard Validation</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>29.01</td>
<td>4.14</td>
<td>0.05</td>
<td>4.49</td>
<td>0.79</td>
<td>0.81</td>
</tr>
<tr>
<td>Open-Endedness</td>
<td>27.90</td>
<td>3.98</td>
<td>0.06</td>
<td>4.44</td>
<td>0.82</td>
<td>0.80</td>
</tr>
<tr>
<td>Integration</td>
<td>29.59</td>
<td>4.23</td>
<td>0.09</td>
<td>4.37</td>
<td>0.84</td>
<td>0.80</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>29.06</td>
<td>4.15</td>
<td>0.03</td>
<td>4.37</td>
<td>0.81</td>
<td>0.81</td>
</tr>
<tr>
<td>Material Environment</td>
<td>28.00</td>
<td>4.00</td>
<td>0.02</td>
<td>4.53</td>
<td>0.78</td>
<td>0.82</td>
</tr>
</tbody>
</table>

*8.54***

*11.60*

*2.11***

*6.62***

*3.50***
The Actual and Preferred Forms of the CLEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score. Table 2 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

**Factor Loading for Items in the Actual Form of the CLEI.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Student Cohesiveness</th>
<th>Open-Endedness</th>
<th>Integration</th>
<th>Rule Clarity</th>
<th>Material Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>0.38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td>0.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td>0.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td>0.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.67</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.66</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.48</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.47</td>
</tr>
<tr>
<td>% of Variance</td>
<td>46.63</td>
<td>48.49</td>
<td>52.46</td>
<td>47.96</td>
<td>44.26</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 88 students*

The Actual Form of the CLEI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the CLEI. Table 2 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

**The Circumplex Nature of the CLEI**

To investigate the circumplex nature of the CLEI correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale.
Table 3 shows the investigation of the circumplex nature of the CLEI, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 3.

Scale Inter-correlations for the CLEI Using the Actual Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Student Cohesiveness</th>
<th>Open-Endedness</th>
<th>Integration</th>
<th>Rule Clarity</th>
<th>Material Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.85**</td>
<td>0.82**</td>
<td>0.82**</td>
<td>0.74*</td>
</tr>
<tr>
<td>Student Cohesiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-Endedness</td>
<td>0.83**</td>
<td>0.82**</td>
<td>0.74**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>0.88**</td>
<td>0.76**</td>
<td>0.75**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Associations between Student Attitudes and Chemistry Classroom Environments

The strongest tradition in past classroom environment research has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics.

Table 4.

Associations between CLEI scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlate Attitude (r)</th>
<th>Std. Regress Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.18*</td>
<td>0.52*</td>
<td></td>
</tr>
<tr>
<td>Open-Endedness</td>
<td>0.21*</td>
<td>0.47*</td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>0.19*</td>
<td>0.43*</td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>0.10*</td>
<td>0.31*</td>
<td></td>
</tr>
<tr>
<td>Material Environment</td>
<td>0.34**</td>
<td>0.48**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.4630**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.2144**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this study, it was also considered important to investigate associations between students’ perceptions of their chemistry classroom learning environments with their attitudes toward chemistry. The selection of an evaluation and assessment instrument suitable for confirming the third research purposes was required. The internal consistency of the selected TOPRA was 0.77, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in chemistry classes.

Two main methods of data analysis were used to investigate this environment attitude relationship. These involved: simple correlational analyses of relationships between students’ perceptions of actual chemistry laboratory classroom environments with their attitude toward chemistry; and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOPRA. The summary of the result of this analyse is reported in Table 4.

The simple correlation values (r) are reported in Table 4 which show significant correlations (p<0.01) between students’ attitudinal outcomes and chemistry laboratory classes on all Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment of five scales. These associations are positive for all of scales of scales. That is, in chemistry laboratory class environment where the teachers perceived a more favourable attitude towards their chemistry laboratory environment.
The strongest tradition in chemistry classroom environment of this study has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their performances. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics. This study involves tabulation of 40 past studies in science education shows that associations between outcome measures and classroom environment perceptions have been replicated for a variety of cognitive and affective outcome measures, a variety of classroom environment instruments and a variety of samples.

This research study has been conducted on educational environments; less has been done to help teachers to improve the environments of their own classrooms or schools. This result reports how feedback information based on student perceptions can be employed as a basis for reflection upon, discussion of, and systematic attempts to improve classroom and school environments. The proposed methods have been applied successfully in studies upper secondary levels. The attempt at improving classroom environments described below made use of the short 35-item version of the CLEI discussed previously. The class involved in the study consisted of grade 11 males and females of mixed ability studying science at a government school in Thailand. The procedure followed by the teacher of this class incorporated the following five steps, such as; Assessment, Feedback, Reflection and discussion, Intervention, and Reassessment.

These results summarised show that some change in actual environment occurred during the time of the intervention. When tests of statistical significance were performed, it was found that differences were significant (p<0.05) only for: Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment. These findings are noteworthy because two of the dimensions on which appreciable changes were recorded were those on which the teacher had attempted to promote change. Although the second administration of the environment scales marked the end of this teacher's attempt at changing a classroom, it might have been thought of as simply the beginning of another cycle.

This study evidences confirmation of the research studies at the four past decades, for example; using the SLEI, associations with students' cognitive and affective outcomes have been established for a sample of approximately 80 senior high school chemistry classes in (Fraser & McRobbie 20035; McRobbie & Fraser 2005), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 2007) and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser 2006). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (2005a) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the QTI, associations between student outcomes and perceived patterns of teacher-student interaction were reported for samples of 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 2005), 3,994 high school science and mathematics students in Australia (Fisher, Fraser & Rickards 2007) 1,512 primary school mathematics students in Singapore (Goh, Young & Fraser 2005) and 2256 lower secondary science dream school project students in Thailand (Santiboon, 2013).

Acknowledgments

Firstly, I would like to thank the 93 chemistry students in Wapiopathum School at the Grade level 11 who were part of the study. Thank you to the Mr. Phisit Wannasri, Mrs. Laksamee Muangkla and Mrs. Jandi Bion who allowed students to complete the questionnaire.

Secondary, I would like to my fellow Master of Science students, Atipong Phukaokaew to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Thirdly, I must thank you my supervisor; Dr.Natchanok Jansawang and my co-supervisor; they understood and never pushed me to build up of my research that it was going on work, completely.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Research into the Environment of Physics Laboratory Classes in Upper Secondary Students at the Tenth-Grade Level

Wiphaphron Phanphrom, Toansakul Santiboon, Panwilai Chomchid and Winai Suriya

Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, 44000, Thailand

(*author for correspondence, E-mail: toansakul35@yahoo.com.au; wi_piratsya@hotmail.com)

Abstract

This study determined how students assess the various components of their physics laboratory environment. It also identified how the laboratory environment affects students’ learning outcomes. The modified ex-post facto design was used. A sample of 128 randomly selected students was taken from a population of all upper secondary educational school physics students at Grade 10 in Rajabhat Maha Sarakham University Demonstration School in Mahasarakham Province, Thailand. The research instruments, the 35-item Physics Laboratory Environment Inventory (PLEI) original modified from the Science Laboratory Environment Inventory (SLEI) designed and validated by Fraser, Giddings & McRobbie, 1993) was administered and the Test Of Physics-Related Attitude (Fraser, 1981) was associated between students perceptions of their actual and preferred physics laboratory environment classes to their attitudes were assessed on the selected students. Data analysis was done using statistics of Cronbach Alpha Reliability, One-way ANOVA (eta²), Factor Loading Analysis, Simple and Multiple Correlations were analyzed. The results also showed that the five components of the science laboratory environment are positively correlated with students’ academic performance. Cronbach’s alpha reliability coefficients for the scales were adequate (0.60-0.85), while confirmatory factor analyses provided support for the theoretical framework behind the questionnaire (0.47-0.94 omitted). The multiple correlation R² is significant for the PLEI and considered associations with the TOPRA, and value indicate that 46% of the variance in students’ attitude were also determined. Suggestions that these findings are discussed with a view to improving the quality of the laboratory environment, subsequent academic performance in physics and ultimately the enrolment and retaining of learners in physics.

Keyword: Physics laboratory, Learning, Environment, Perception, Tenth-Grade level

Introduction

Researches on the classroom learning environment have spanned more than four decades with significant contributions to the field of education. Reviews of research (Fraser, 1986[1]; Fraser, 1998[2]; Fraser & Walberg, 1991[3]; Haertel, Walberg &Haertel, 1981[4]) reported that most of the studies on classroom learning environments used the perceptual measures approach to investigate the nature of classroom learning environments. This approach involved the use of classroom environment instruments to measure teachers’ and students’ perceptions of their classroom environments for investigating the nature of the classroom learning environment. These studies had developed many well-validated and robust classroom environment instruments for use in many countries in different classroom contexts (Fraser, 1998)[2]. In terms of the Science Laboratory Environment Inventory (SLEI) was developed to examine students' perspectives about their science laboratory courses (Fraser et al., 1993)[5]. The SLEI is unique in that it comes in two parallel forms, one which addresses the current class. The SLEI examines five subscales: integration, rule clarity, student cohesiveness, open-endedness, and material environment (Fraser et al., 1993). The SLEI consists of 7 items for each subscale, yielding 35 total items which are answered through a 5-Point Likert scale. This research describes the development of a new instrument for assessing student perceptions of psychosocial environment in science laboratory classrooms, and reports comprehensive validation information for large samples of senior high school and university students from Rajabhat Maha Sarakham University Demonstration School, Mahasarakham in Thailand. The work is distinctive because it extends classroom environment research in non-laboratory settings to science laboratory classes, and provides one of the few classroom environment studies conducted in Thailand during the last decade. The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the
Student Perceptions of Actual and Preferred Environments

Research reviews on student perceptions of Actual and Preferred Environment were differentiated and reviewed. The previous two decades have witnessed considerable international interest in the conceptualization, measurement, and investigation of perceptions of psychosocial characteristics of learning environment in elementary, secondary, and higher education classrooms (Fraser, 1986, 1989, in press; Fraser & Walberg, 1991).

Most recent classroom environment instruments have distinct versions measuring student perceptions of actual and preferred classroom environment. The preferred forms include goals and value orientations and preferred classroom environment. In the present study, parallel actual and preferred versions were developed and field-tested in six countries.

The most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of classroom environment. In the present study, parallel actual and preferred versions were developed and field-tested in six countries.

Science Education Classroom Learning Environment

Science education classroom learning environment of research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currents trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998)[12].

Studying Educational Environment Approaches

To approach students’ perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991).[6]

Background of Science Education Learning Environment Instruments

In the four last decades, there are educational researchers (Walberg & Moos, 2011)[17] began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968)[9], Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979[9]; Moos &Trickett 1984)[10]. The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994[11]; MacAuley, 1990[12]; von Saldern, 1992[13]) and monographs sponsored by the American Educational Research Association’s Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).[14]

Developing the contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974)[15] scheme for classifying human environments.

Student Perceptions of Actual and Preferred Environments

Research reviews on student perceptions of Actual and Preferred Environment were differentiated and reviewed. The previous two decades have witnessed considerable international interest in the conceptualization, measurement, and investigation of perceptions of psychosocial characteristics of learning environment in elementary, secondary, and higher education classrooms (Fraser, 1986, 1989, in press; Fraser & Walberg, 1991).

Most recent classroom environment instruments have distinct versions measuring student perceptions of actual and preferred classroom environment. The preferred forms include goals and value orientations and preferred classroom environment. In the present study, parallel actual and preferred versions were developed and field-tested in six countries.

The most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of classroom environment. In the present study, parallel actual and preferred versions were developed and field-tested in six countries.
the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. A typical item in the actual form of the Student Cohesiveness scale is: “Students in this laboratory class get along well as a group.” The wording of the preferred version is almost identical except for the use of such words as “would.” For example, the item “Our laboratory class has clear rules to guide student activities” in the actual version is reworded in the preferred version to read “Our laboratory class would have to clear student activities”

**Using Instruments on Science Laboratory Environment Inventory (SLEI) Classes**

The Science Laboratory Environment Inventory (SLEI) was developed to examine students’ perspectives about their science laboratory courses (Fraser et al., 1993). The SLEI is unique in that it comes in two parallel forms, one which addresses the current class, and one which addresses how they would prefer the class to be (Fraser et al., 1993). The SLEI examines five subscales: integration, rule clarity, student cohesiveness, open-endedness, and material environment (Fraser et al., 1993). The SLEI consists of 7 items for each subscale, yielding 35 total items which are answered through a 5-Point Likert scale.

Assessments of the Science Laboratory Environment Inventory of students’ or teachers’ perceptions of five dimensions of actual or preferred classroom environment, namely, Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment. The instrument was field-tested in Canada, Australia, the United States, England, Israel, and Nigeria, both in secondary and in post-secondary institutions. Various analyses attested to each scale’s internal consistency, reliability, discriminant validity, factorial validity, predictive validity, and ability to differentiate between the perceptions of students in different classes. The instrument is equally valid for use in its actual and preferred versions, for senior secondary school and university laboratory classes, for the individual or the class mean as the unit of analysis, and for each of the six countries.

As above criteria led to an instrument containing eight scales, although only the following five scales survived field-testing and item/factor analyses and appear in the final version. Student Cohesiveness assesses the extent to which students know, help, and are supportive of one another; Open-Endedness assesses the extent to which laboratory activities emphasize an open-ended, divergent approach to experimentation; Integration assesses the extent to which laboratory activities are integrated with non-laboratory and theory classes; Rule Clarity assesses the extent to which behaviour in the laboratory is guided by formal rules; and Material Environment assesses the extent to which laboratory equipment and materials are adequate. (The names of the three omitted scales were Teacher Supportiveness, Involvement, and Organization.) The Open-Endedness scale was included because, despite many calls for science laboratory classes to be more open-ended (for example, National Research Council, 1990)[16], and various studies have revealed that most laboratory activities are closed-ended (for example, Lumpe, 1991)[17]. By writing new items and rewriting existing ones, we redefined and modified scales selected from inventories for non-laboratory settings to suit them to science laboratory classes. We based further revisions of items on reactions from colleagues with expertise in questionnaire construction and in science teaching at the secondary and higher education levels, paying careful attention to suit item each for measuring both actual and preferred classroom

**The Test Of Physics-Related Attitude (TOPRA)**

To investigate of associations between Actual and Preferred students’ perceptions of their science laboratory environment classes in RajabhatMahaSarakham University Demonstration School. A Test Of Science-Related Attitude (TOPRA) previously by Fraser (1981)[18] was modified, adapted, and selected for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOPRA is designed to measure eight distinct science-related attitudes among science laboratory environment classes in RajabhatMahaSarakham University Demonstration School’s students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred students’ perceptions of their science laboratory environment classes. Furthermore, the TOPRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Research Purposes**

1. To assess student’s perceptions of their physics laboratory environment classes at Grade 10 in three classes in RajabhatMahaSarakham University Demonstration School, Mahasarakham Province.
2. To compare between student’s perception of their actual and preferred physics laboratory environment classes in three classes at Grade 10 level in RajabhatMahaSarakham University Demonstration School, Mahasarakham Province.
3. To associate student’s attitudes of their perceptions to their actual physics laboratory environment classes in three classes at Grade 10 level in RajabhatMahaSarakham University Demonstration School, Mahasarakham Province.

---

295
Literature Review

Researches review on classroom environment instruments have served as sources of predictor and criterion variables in international studies in secondary schools. Student perceptions of actual classroom environment are consistently related to student cognitive and affective outcomes (Haertel, Walberg, 1981). For example, Fraser and Fisher’s (1982) study involving 116 Australian science classes established sizeable associations between several inquiry skills and science-related attitudes and classroom environment dimensions measured by the Classroom Environment Scale and the Individualized Classroom Environment Questionnaire. Furthermore, research on person-environment fit has shown that students achieve better in classroom environments they prefer (Fraser & Fisher, 1983a).

Studies reviewed by Fraser (1986) and involving the actual form of scales as criterion variables have revealed that classroom psychosocial climate varies among different types of schools and between coeducational and single-sex schools. Both researchers and teachers have usefully employed classroom climate dimensions as criteria of effectiveness in curriculum evaluation because they differentiate revealingly between alternative curricula when student outcome measures show little sensitivity (Fraser, 1981). Research in several countries (Fraser, 1986) compared students’ and teachers’ perceptions and found that, first, both students and teachers prefer a more positive classroom environment than they perceive as being actually present and, second, teachers perceive the classroom environment more positively than do their students in the same classrooms. In promising small scale practical applications, teachers have used assessments of their students’ perceptions of their actual and preferred classroom environment to identify and discuss actual-preferred discrepancies, followed by a systematic attempt to improve classrooms (Fraser & Fisher, 1986).

Aladejana (2007) reported of her study to determine how students assess the various components of their science laboratory environment. It also identified how the laboratory environment affects students’ learning outcomes. The modified ex-post facto design was used. A sample of 328 randomly selected students was taken from a population of all Senior Secondary School science students in a state in Nigeria, using Science Laboratory Environment Inventory (SLEI) designed and validated by Fraser et., al. (1993) was administered on the selected students. Findings revealed that students could assess the five components of the laboratory environment. Student cohesiveness has the highest assessment while material environment has the least. The results also showed that the five components of the science laboratory environment.

Santiboon (2012) reported the research described science student programs’ perceptions of their physics laboratory classroom learning environments in Udon Thani Rajabhat University, Thailand. Associations between these perceptions and students’ attitudes toward physics laboratory were also determined. Using the 35-item Physics Laboratory Environment Inventory (PLEI), which was a modified from the original Science Laboratory Environment Inventory (SLEI) (Fraser, McRobbie, and Giddings,1993) was assessed with the Actual and a Preferred Forms. Students’ attitudes were assessed with the Test Of Physics-Related Attitude (TOPRA) modified from the Test of Science-Related Attitude (TOSRA) (Fraser, 1981). The questionnaires administered to a sample of 577 students in 13 science and technological program classes. Statistically significant differences were found (p<0.001). The results also showed that the five components of the science laboratory environment.

Methodology

The initial development of the new instrument, called the Science Laboratory Environment Inventory (SLEI), was guided by five criteria; (1) Consistency with the literature on laboratory teaching important in the unique environment of the science laboratory class (Hofstein&Lunetta), (2) Consistency with instruments for non-laboratory settings to guidance obtained by examining all scales settings (Fraser, 1986), (3) Coverage of Moos’ general categories that scales provided coverage of the three general categories of dimensions identified by Moos (1974). (4) Salience to teachers and students the secondary and university levels showed that SLEI’s dimensions and individual items were salient. (5) To achieve economy in terms of the time needed for answering and scoring, the SLEI had a relatively small number of reliable scales, each containing items.

Research procedure

Using the PLEI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOPRA on the 15th week for associating science laboratory classroom learning environments in science classroom learning environment for secondary educational students at Grade 10 in 3 classes in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province.

Each scale of the PLEI were composed with the 7-item, minimum scoring is 7 and maximum score is 35. The first scale, Student Cohesiveness is composed the item of 1, 6, 11, 16, 21, 26, 31; the second scale, Open-Endedness is composed the item of 2, 7, 12, 17, 22, 27, 32; the third scale, Integration is composed the item of
3, 8, 13, 18, 23, 28, 33; the fourth scale, Rule Clarity is composed of 4, 9, 14, 19, 24, 29, 34; and the fifth scale, Material Environment is composed of 5, 10, 15, 20, 25, 30, 35.

Data Analyses
The scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred SPEI forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy for the dimensionality of the SPEI were assessed through principal component analyses. The multiple correlations were significant of students' perceptions of their school climate for the Actual Form of the SPEI with students' attitudes to associate were analyzed.

Sample
This study is improved and developed students' science laboratory classroom environment with actual and preferred student's perceptions with a sample size 128 upper secondary educational students in three physics classes at Grade level 10 level in Rajabhat Maha Sarakham University Demonstration School, Mahasarakham Province, in the second semester in academic year 2014.

Results

Validity and Reliability of Research Instruments

B. Validation of the SLEI
Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

Table 1.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the SLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>29.47</td>
<td>4.21</td>
<td>0.44</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>29.75</td>
<td>4.25</td>
<td>0.58</td>
<td>0.34</td>
</tr>
<tr>
<td>Opened-Endedness</td>
<td>Actual</td>
<td>25.31</td>
<td>3.61</td>
<td>0.47</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.38</td>
<td>3.77</td>
<td>0.49</td>
<td>0.24</td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>28.97</td>
<td>4.13</td>
<td>0.42</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>29.19</td>
<td>4.16</td>
<td>0.44</td>
<td>0.20</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>27.84</td>
<td>3.97</td>
<td>0.51</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>28.93</td>
<td>4.13</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>Material Environment</td>
<td>Actual</td>
<td>27.96</td>
<td>3.99</td>
<td>0.53</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>24.53</td>
<td>3.50</td>
<td>0.39</td>
<td>0.15</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five SLEI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 7 and 35, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the SLEI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.
Table 2. 
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the SLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach's alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results(eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>0.51</td>
<td>0.68</td>
<td>5.19</td>
<td>0.23</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened-Enlosedness</td>
<td>Actual</td>
<td>0.68</td>
<td>0.65</td>
<td>7.06</td>
<td>0.25</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.72</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>0.61</td>
<td>0.63</td>
<td>29.33</td>
<td>0.32</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.71</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>0.70</td>
<td>0.69</td>
<td>9.55</td>
<td>0.26</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.74</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Environment</td>
<td>Actual</td>
<td>0.65</td>
<td>0.67</td>
<td>60.93</td>
<td>0.42</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.70</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)  
**Correlation is significant at the 0.01 level (2-tailed)  
***Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version SLEI used in this study was determined by calculating Cronbach alpha coefficient for the 35 items of the SLEI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the SLEI, which ranged from 0.51 to 0.68 when using the students’ actual climate scores and from 0.70 to 0.85 when using the students’ preferred climate scores. The SLEI was able to differentiate significantly ($p<0.05$) between students’ perceptions in science laboratory environment. The $t$-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 5.19 to 60.93 for different scales, respectively.
B. Factor Loading Analysis of the PLEI

The Actual and Preferred Forms of the SLEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 3.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>11</td>
<td>0.72</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>0.70</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>26</td>
<td>0.66</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>0.60</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>31</td>
<td>0.55</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.50</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>6</td>
<td>0.40</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>27</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>0.63</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>2</td>
<td>0.61</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>22</td>
<td>0.58</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>17</td>
<td>0.53</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>0.48</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>0.17</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>0.77</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>0.58</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td>0.55</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td>0.40</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>0.69</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td>0.65</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td>0.51</td>
<td>0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.90</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.83</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.69</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.63</td>
<td>0.45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>11</td>
<td>39.30</td>
<td>0.72</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>39.29</td>
<td>0.70</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>26</td>
<td>46.26</td>
<td>0.66</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>34.00</td>
<td>0.60</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>31</td>
<td>38.25</td>
<td>0.55</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>37.01</td>
<td>0.50</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>6</td>
<td>2.76</td>
<td>0.40</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>27</td>
<td>2.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>2</td>
<td>2.45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>22</td>
<td>2.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 128 students.

The Actual Form of the PLEI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the PLEI. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

C. The Circumplex Nature of the PLEI:

To investigate the circumplex nature of the PLEI, correlations between the scales were calculated. The sample in Table 4 is presented the results show that the correlations between a scale and the next scale. Table 4 shows the results to investigate the circumplex nature of the PLEI, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale
next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 4. 
Scale Intercorrelations for the SLEI Using the Actual and Preferred Forms of the PLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>OE</th>
<th>In</th>
<th>RC</th>
<th>ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>0.45**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.51**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened-Endedness</td>
<td>Actual</td>
<td>0.65**</td>
<td>0.62**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78**</td>
<td>0.57**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>0.31*</td>
<td>0.23</td>
<td>0.59*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.70**</td>
<td>0.50**</td>
<td>0.77**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>0.38*</td>
<td>0.60**</td>
<td>0.68*</td>
<td>0.70*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.65**</td>
<td>0.72**</td>
<td>0.67**</td>
<td>0.67**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

D. Validation of the TOPRA

to measure science students’ attitudes towards science laboratory classroom learning environment in science learning group, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol& Fisher, 2005, Santiboon& Fisher, 2005; Santiboon, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOPRA) (Fraser, 1981). Using internal consistency reliability the TOPRA had a value of 0.80 which was considered satisfactory for further use in this study.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the SLEI.

The results of this study also indicate that using the SLEI helps science laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the science laboratory classroom learning environment curriculum for the RajabhatMahaSarakham University Demonstration School students in physics laboratory classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in science laboratory classroom learning environments.

Associations between Students’ Perceptions of their Actual and Preferred Physics Laboratory Classroom Learning Environments toward their Attitude (TOPRA)

In this study, it was also considered important to investigate associations between students’ perceptions of their science laboratory classroom learning environments with their attitude toward physics laboratory classroom learning environments subject.
Table 5. Associations between PLEI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form Simple Correlation Attitude (r)</th>
<th>Standard Regress Weigh Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.17*</td>
<td>0.16*</td>
</tr>
<tr>
<td>Opened-Endedness</td>
<td>0.18*</td>
<td>0.19*</td>
</tr>
<tr>
<td>Integration</td>
<td>0.15*</td>
<td>0.15*</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>0.25**</td>
<td>0.26**</td>
</tr>
<tr>
<td>Material Environment</td>
<td>0.24**</td>
<td>0.25**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6805**</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.4631**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

The Cronbach alpha reliability of the selected TOPRA was 0.84, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in science laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOPRA that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their science laboratory classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their science laboratory classroom learning environments on all scales of the Actual Form.

Discussion and Implementations

Table 5 is compared to investigate associations between science students’ perceptions of their science laboratory classroom learning environments with their attitude toward science laboratory classes. Using the SLEI instrument in the higher education level, Rajabhat Maha Sarakham University Demonstration School, Thailand, will help teachers to evaluate their learning environments in science laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the SLEI could be useful as the guide to enhance the effectiveness of science laboratory classes. The effectiveness in science laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of science laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 128 student of their science laboratory classroom learning environments were measured with the PLEI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their science laboratory classroom learning environments. In general, students’ perceptions of their preferred science laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the PLEI helps science teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science laboratory classroom learning environments with regard to the PLEI, it was found that all of five scales were positively associated with students’ attitude to science laboratory classroom learning environments. The multiple correlation R is significant for the PLEI and shows that when the scales are considered together there are significant associations with the TOPRA. The $R^2$ values indicate that 46%, with actual form of the variance in students’ attitudes to their classes was attributable to their perceptions of physics classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their science laboratory classroom learning environments lessons.
Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments PLEI. This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science laboratory classroom learning environments.

Overall, this study replicated previous studies using the PLEI, with the findings being consistent with the situation in RajabhatMahaSarakham University Demonstration School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the science laboratory classroom learning environments, interestingly.

Acknowledgements

I am heartily thankful to my supervisors; Assist. Prof. Dr. ToansakulSantiboon and Dr. PanwilaiChomchid of Master of Science of Education Program, Faculty of Education, RajabhatMahaSarakham University Demonstration School, whose encouragement, guidance and support instruments and computing system for analysis of this research. I am grateful to my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of RajabhatMahaSarakham University Demonstration School.

References

Educational Research.


An Application of the Questionnaire on Teacher Interaction in Physics Laboratory Classroom Learning Environments for Upper Secondary Students at Grade 10th Level in Thakhonyangpittayakom School

Siriwan Yaitoi¹, Kamon Phonkum², Prapamong Khainongsung³ and Toansakul Santiboon⁴

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
²Department of Physics Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
³Science Learning Group Section, Thakhonyang Pittayakom School, Maha Sarakham, Thailand
⁴Department of Physics Education Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand

(*) Author for correspondence, E-mail: toansakul35@yahoo.com.au; Fax: +6643713206

Abstract

The aim of this study was to apply the classroom learning environment instrument to identify and describe the actual and preferred interpersonal behaviours of physics teachers. These physics teacher interpersonal behaviours were identified through very favourable scores on particular scales of the Questionnaire on Instructor Interaction (QII). The study involved a sample of 50 upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School in Mahasarakham, Thailand. Students’ perceptions of their actual (assesses the class as it actually is) and preferred (arks the students what they would prefer their class to be like – the ideal situation) on physics interpersonal behaviours were used. To investigate students’ perceptions of their attitude toward their physics teacher interpersonal behaviours in their physics laboratory classroom learning environment management classes were investigated. The questionnaire on teacher interactional behaviours were obtained with the 48-item Questionnaire on Instructor Interaction (QII) (adapted version from original modified the Questionnaire on Teacher Interaction (QTI) (Wubbles & Levy, 1993) and student’s attitudes were assessed with the Test Of Physics-Related Attitude (TOPRA) (original modified from the Test Of Science-Related Attitude) (Fraser, 1981) that they were translated into Thai version for administrating research methodology. Statistically significant differences were found between student’s perceptions of actual and preferred physics teacher interpersonal behaviours of their attitude toward their physical laboratory classes were found. Cronbach’s alpha reliability coefficients for the scales were adequate (0.76-0.98), while confirmatory factor loading analyses were provided to support for the theoretical framework behind the questionnaire (0.44-0.97). The multiple correlations R² is significant for the QTI and considered associations with the TOPRA, and value indicates that 38% of the variance in students’ attitude was also determined. This result is to improve and develop the physics laboratory classroom learning environments with student’s perceptions on their teacher interpersonal behaviours, responsibility.

Keywords: Questionnaire on Teacher Interaction (QTI), Student, Perceptions, Physics teacher, Behaviors

Introduction

The conceptualization of teaching considers teaching as a form of communication. Following Watzlawick, Beavin, and Jackson (1967), we assume that behavior that someone displays in the presence of someone else is communication. This choice is an element of the so-called ‘systems approach’, that assumes that one cannot not communicate when in the presence of someone else, whatever a person’s intentions are, others will infer meaning from this behavior. For example, if teachers ignore students’ questions because they do not hear them, students might make a variety of inferences (i.e., that the teacher is too busy, the teacher thinks the students are too dull to understand, or that the teacher considers the questions impertinent).

Researches on teacher-student interpersonal behaviours reported on results of research from a 25-year program of studies investigating teacher-student relationships in secondary classrooms (Wubbels, Brekelmans, den Brok, & Tartwijk, 2006). Starting in the Netherlands, this line of research now has developed too many other countries such as Australia, Canada, Israel, Slovenia, Turkey, Korea, Taiwan, Singapore and the US. In our research we analyze teaching from an interpersonal perspective; that means in terms of the relationship between teacher and students. Two elements are central to this perspective: the communicative systems approach and a model to describe teacher-student relationships in terms of teacher behavior. We will discuss these two elements before turning to measurement instruments developed to map teacher-student relationships. The remainder of the paper reviews studies on diverse issues covering teacher-student relations and student
outcomes, non-verbal behavior and the spatial position of the teacher in the class, differences between teacher
and student perceptions of the relationship, and interventions to improve relationships in class.

A Western Australian study (Tobin & Fraser 1988) focused on case studies of classroom practices
employed by ‘exemplary’ teachers. The project was explicitly framed within constructivist principles, which are
claimed to lead to greater value being placed on higher order cognitive learning (Tobin & Fraser 1990). The
project reported considerable diversity in the methods these teachers used, but nevertheless produced four

Historical Classroom Learning Environment Instruments

In the past four decades, there are educational researchers began seminal independent programs of
research which form the starting points for the work reviewed in this study. Walberg developed the widely-used
Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project
Physics (Walberg & Anderson 1968). Moos began developing the first of his social climate scales, including
those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development
of the Classroom Environment Scale (CES) (Moos 1979, Moos & Trickett 1987). The way in which the
important pioneering work of Walberg and Moos on perceptions of classroom environment developed into
major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser &
Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley 1990; von Saldern 1992)
and monographs sponsored by the American Educational Research Association’s Special Interest Group (SIG)
on the Study of Learning Environments (Fisher 1994).

Instruments for Assessing Classroom Environment

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom
Environment Scale (CES); Individualized Classroom Environment Questionnaire (ICEQ); My Class Inventory
(MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher
Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment
Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. the name of each scale in each
instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of
items contained in each scale, and the classification of each scale according to Moos’s (1974) scheme for
classifying human environments.

Actual and Preferred Form Scales

A distinctive feature of most of the instruments is that they have, not only a form to measure
perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of
‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations
and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is
similar for actual and preferred forms, slightly different instructions for answering each are used. For example,
an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the
preferred form to ‘There would be a clear set of rules for students to follow’.

This study was thus decided to build on this past research and focus this study on the identification and
description of exemplary physics teachers. However, the study is distinct in that it uses the perceptions of
students in the identification of these teachers. Because this was our first investigation of the use of the QTI in
such a way, this study has been preferred to use the term better to describe these physics schooling teachers in
ThakhonyangPittayakom School in Mahasarakham Province, Thailand.

Research Objective

1. To analyze a valid and reliable the actual and preferred forms of the Questionnaire on Teacher
Interaction instrument when used in this study.
2. To investigate the factors influencing student’s perceptions of their teacher interpersonal behaviours in
physics classroom learning environments at Grade 10 in ThakhonyangPittayakom School classes.
3. To compare between students’ perceptions of their actual and preferred teacher interpersonal
behaviours in physics classroom learning environments at Grade 10 in ThakhonyangPittayakom School classes.
4. To associate between students’ perceptions of their science attitudes to their actual teacher
interpersonal behavioustowardphysics classroom learning environments at Grade 10 in ThakhonyangPittayakom
School classes.
Literature Review

This study discusses the physics classroom learning environment instrument selected for use in this research. The rationale for the selection of the Questionnaire on Teacher Interaction (QTI) is followed by a discussion of the climate of classroom environment including how administrating is one of unique features of educational reform with in science classroom environment and therefore, the selection of the Test Of Physics-Related Attitude (TOPRA). Because students’ perceptions of physics classroom environment have been favourably associated with student’s attitude to physics classroom environment’s management, it was decided to select an appropriate measure of students’ attitudes.

Recent reviews (Fraser 1998, Fraser & Walberg 1991) show that science education researchers have led the world in the field of classroom environment over the last four decades, and that this field has contributed much to understanding and improving science education. For example, classroom environment assessments provide a means of monitoring, evaluating and improving science teaching and curriculum. A key to improving student achievement and attitudes is to create learning environments that emphasize those characteristics that have been found to be linked empirically with student outcomes. However, classroom environment research has been somewhat limited at the primary level compared with the secondary level.

The QTI has been shown to be a valid and reliable instrument when used in The Netherlands (Wubbels& Levy 1993). When the 64-item USA version of the QTI was used with 1,606 students and 66 teachers in the USA, the cross-cultural validity and usefulness of the QTI were confirmed. Using the Cronbach alpha coefficient, Wubbels and Levy (1993) reported acceptable internal consistency reliabilities for the QTI scales ranging from 0.76 to 0.84 for student responses and from 0.74 to 0.84 for teacher responses. Regarding students’ cognitive outcomes, the more those teachers demonstrated strict, leadership and helping/friendly behaviour, the higher were cognitive outcomes scores. Conversely, student responsibility and freedom, uncertain and dissatisfied behaviours were related negatively to achievement. Wubbels and Brekelmans (1998) stated that student outcomes are related to student perceptions of teacher behaviours with affective outcomes displaying a greater association than cognitive outcomes. In fact, studies into student teacher interactions suggest that teachers 'using open teaching styles are able to control student input and procedures in class in order to avoid disorder (Wubbels& Brekelmans 1998). Wubbels and Levy (1993) claimed that student perceptions of interpersonal teacher behaviour appear to account for 70 percent of the variability in student achievement and 55 percent for attitude outcomes.

The Questionnaire on Teacher Interaction (QTI) was constructed as a set of 77 items describing teacher interpersonal behavior in terms of the eight scales or sectors of the MITB, thus representing the two (interpersonal) dimensions. The QTI has become a popular instrument in research on teaching, teacher education and learning environments, has been translated into more than 15 languages and has been the focus of well over 120 (learning environment) studies in many countries since its development (den Brok et al., 2004). The Australian version of the QTI has 48 items which are arranged in cyclic order in blocks of four to facilitate hand scoring by teachers. Items 1 to 24 assess the four scales called Leadership, Understanding, Uncertain and Admonishing behaviours, and Items 25 to 48 assess the scales called Helping/Friendly, Student Responsibility/Freedom, Dissatisfied and Strict behaviours. The questionnaire items are given in Table 1. Students respond on a five-point scale ranging from "Never" to "Always". Current experience indicates that students can complete the QTI in about 30 minutes. These studies confirmed the reliability and validity of the QTI and noted that generally, the dimensions of the QTI were found to be significantly associated with student attitude scores. In particular, students’ attitude scores were higher in classrooms in which students perceived greater leadership, helpful/friendly, and understanding behaviours in their teachers.

Waldrip and Fisher (2002) reported of their purpose of the study described in this paper was to identify and describe exemplary science teachers using the Questionnaire on Teacher Interaction (QTI). With a sample of 493 science students, the reliability of the QTI scales ranged from 0.69 to 0.87. The better (exemplary) teachers could be identified as those whose students’ perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied and Admonishing scales. The construct validity of the QTI to identify exemplary teachers was confirmed through interviews with students.

Results of past studies with the QTI usually demonstrated the importance of students’ perceptions of their teachers’ behavior for both cognitive and affective student outcomes, den Brok and his colleagues (2004) reported positive relations of both dimensions to cognitive and affective students’ outcomes. In another study, higher students’ perceptions on the Influence dimension were associated with higher student outcomes on a Physics test (Brekelmans, Wubbels, & den Brok, 2002). Although not always straightforward, relationships between Proximity and cognitive outcomes were determined in many studies (for an overview see Wubbels et., al., 2006), some of which have also been reported in the Journal of Classroom Interaction (den Brok, Fisher, &Koul, 2005a; den Brok, Levy, Brekelmans, &Wubbels, 2005; Kyriakides, 2005). While positive effects of
both dimensions on affective outcomes were found in most studies, stronger effects have been reported for Proximity than for the Influence dimension (den Brok et al., 2004; Wubbels et al., 2006).

Methodology

The aim of this study was to use the QTI to identify and describe the better physics teachers. These better teachers were identified through very favourable scores on particular scales of the Questionnaire on Teacher Interaction (QTI). Associations between students’ perceptions and their attitude toward physics classroom learning environments were determined with students.

Materials and Methods

Research Procedure

Using the QTI instrument was followed as for assessing students’ perceptions of their actual form on the 10th - 12th week, and preferred form on the 14th week and the TOCRA on the 15th week for associating physics classroom learning environments in upper secondary education students at Grade 10-12 level in 6 classes in Thakhonyang Pittayakom School classes. Each scale of the QTI were composed with 6-item, minimum scoring is 0 and maximum score is 24. The first scale, Leadership behaviour is composed the item of 1, 5, 9, 13, 17 and 21; the second scale, Helpful and Friendly behaviour is composed the item of 2, 6, 10, 14, 18 and 22; the third scale, Uncertain behaviour is composed the item of 3, 7, 11, 15, 19 and 23; the forth scale, Dissatisfied behaviour is composed the item of 4, 8, 16, 20 and 24; the fifth, Student Responsibility and Freedom scale is composed the item of 25, 29, 33, 37, 41 and 45; the sixth, Understanding behavior is composed the item of 26, 30, 34, 38, 42 and 46; the seventh, Admonishing behaviour is composed the item of 27, 31, 35, 43 and 47; the eighth, Strict behavior is composed the item of 28, 32, 35, 44 and 48.

Research Instruments

Questionnaire on Teacher Interaction (QTI)

Research which originated in The Netherlands focuses on the nature and quality of interpersonal relationships between teachers and students (Creton, Hermans & Wubbels 1990; Wubbels, Brekelmans & Hooymayers 1991; Wubbels & Levy 1993). Drawing upon a theoretical model of proximity (cooperation-opposition) and influence (dominance-submission), the QTI was developed to assess student perceptions of eight behaviour aspects. Each item has a five-point response scale ranging from Never to Always. Typical items are ‘She/he gives us a lot of free time’ (Student Responsibility and Freedom behaviour) and ‘She/he gets angry’ (Admonishing behaviour).

![An influence dimension and a proximity dimension of the QTI](image1)

![Leary model of interpersonal behaviour](image2)

Figure 1. An influence dimension and a proximity dimension of Leary model of interpersonal behavior - the QTI

Although research with the QTI began at the senior high school level in The Netherlands, cross-validation and comparative work has been completed at various grade levels in the USA (Wubbels & Levy, 1993).
An instrument to measure these perceptions in terms of the MITB, the Questionnaire on Teacher Interaction (QTI), the interpersonal behavior of a teacher is described along two dimensions - an influence dimension and a proximity dimension. The influence dimension describes the degree of control of the teacher over the communication process, the proximity dimension the degree of cooperation or opposition between the teacher and the students. The two dimensions can be depicted in a two-dimensional plane that can be further subdivided into eight categories or sectors of behavior: Leadership (DC), Helpful/Friendly (CD), Understanding (CS), Student Freedom (SC), Uncertain (SO), Dissatisfied (OS), Admonishing (OD) and Strictness (DO). Each sector can be described in terms of the two dimensions: Leadership, for example, contains a high degree of Influence and some degree of Cooperation; Helpful/Friendly behavior some degree of dominance and a high degree of cooperation (see Figure 1). Each sector can be described in terms of the two dimensions: Leadership, for example, contains a high degree of Influence and some degree of Cooperation; Helpful/Friendly behavior some degree of dominance and a high degree of cooperation (see Figure 2). Classroom environment research has involved students in Western countries; Turkey is a relatively new participant in this domain.

**The Test Of Physics-Related Attitude (TOPRA)**

In addition to the main questionnaires QTI, and the Test Of Physics-Related Attitudes (TOPRA), this adapted version from the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981a). The TOPRA questionnaire was selected to use with the aim of investigating any possible relationships with students’ perceptions about their physics teacher's interpersonal behaviour in management on physics classroom learning environments in upper secondary educational school classes of classroom’s administration environments. The TOPRA consists of eight items.

**Data Analysis**

Quantitative data were obtained using the two questionnaires (QTI and TOPRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual QTI scale to investigate whether students have significant different perceptions of their actual and preferred teacher interpersonal behaviours.

**Sample**

The main study involved, improved and developed the upper secondary educational students’ physics classroom learning environments of their actual and preferred perceptions with a sample size of 50 students in 2 physics classes at Grade 10 in Thakhonyang Pittayakom School, Muang District in Mahasarakham province, Thailand.

**Results**

**Validity and Reliability of Research Instrument**

**C. Validation of the QTI**

Description of quantitative data of analyzing responses for students’ perceptions Master of Science teacher student’s assessments is reported in Table 1.

The results given in Table 1 shows that on average item means for each of the five QTI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 0 and 24, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the QTI. For the remaining eight scales, namely; Leadership, Helpful/Friendly, Understanding, Student Responsibility and Freedom, Dissatisfied, Uncertain, Admonishing, and Strict scales.
Table 1. 
**Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the QTI**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>20.91</td>
<td>3.48</td>
<td>0.48</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.06</td>
<td>3.67</td>
<td>0.21</td>
<td>0.62</td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>Actual</td>
<td>20.53</td>
<td>3.42</td>
<td>0.43</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>21.65</td>
<td>3.60</td>
<td>0.39</td>
<td>0.46</td>
</tr>
<tr>
<td>Understanding</td>
<td>Actual</td>
<td>20.56</td>
<td>3.42</td>
<td>1.40</td>
<td>1.18</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.46</td>
<td>3.74</td>
<td>0.21</td>
<td>0.45</td>
</tr>
<tr>
<td>Student Responsibility</td>
<td>Actual</td>
<td>20.21</td>
<td>3.51</td>
<td>0.31</td>
<td>0.55</td>
</tr>
<tr>
<td>and Freedom</td>
<td>Preferred</td>
<td>20.87</td>
<td>3.47</td>
<td>0.40</td>
<td>0.63</td>
</tr>
<tr>
<td>Uncertain</td>
<td>Actual</td>
<td>4.68</td>
<td>0.55</td>
<td>0.67</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>4.28</td>
<td>0.71</td>
<td>1.27</td>
<td>1.12</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>Actual</td>
<td>4.46</td>
<td>0.75</td>
<td>0.95</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>3.53</td>
<td>0.58</td>
<td>0.92</td>
<td>0.96</td>
</tr>
<tr>
<td>Admonishing</td>
<td>Actual</td>
<td>3.68</td>
<td>0.61</td>
<td>1.40</td>
<td>1.18</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>3.28</td>
<td>0.54</td>
<td>1.34</td>
<td>1.15</td>
</tr>
<tr>
<td>Strict</td>
<td>Actual</td>
<td>4.43</td>
<td>1.29</td>
<td>0.70</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>10.00</td>
<td>1.66</td>
<td>0.97</td>
<td>0.97</td>
</tr>
</tbody>
</table>

In Table 2 the internal consistency reliability of the version QTI used in this study was determined by calculating Cronbach alpha coefficient for the 48 items of the QTI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the QTI, which ranged from 0.58 to 0.68 when using the students’ actual climate scores and from 0.83 to 0.85 when using the students’ preferred climate scores.

This characteristic was explored using a series of one-way analyses of variance on the scales of the QTI, which suggests that each scale of the QTI was able to differentiate significantly ($p<0.05$) between students’ perceptions in my school and my dream school environmental climates in the same school.

Table 2. 
**Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the QTI.**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>ANOVA results</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>0.79</td>
<td>0.65</td>
<td>11.11</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88</td>
<td>0.75</td>
<td>3.55</td>
<td>0.000***</td>
</tr>
<tr>
<td>Helpful/friendly</td>
<td>Actual</td>
<td>0.62</td>
<td>0.68</td>
<td>2.88</td>
<td>0.003**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.76</td>
<td>4.34</td>
<td>0.000***</td>
</tr>
<tr>
<td>Understanding</td>
<td>Actual</td>
<td>0.53</td>
<td>0.70</td>
<td>12.97</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.70</td>
<td>0.78</td>
<td>14.29</td>
<td>0.000***</td>
</tr>
<tr>
<td>Student responsibility</td>
<td>Actual</td>
<td>0.58</td>
<td>0.68</td>
<td>1.43</td>
<td>0.047*</td>
</tr>
<tr>
<td>and Freedom</td>
<td>Preferred</td>
<td>0.70</td>
<td>0.77</td>
<td>3.48</td>
<td>0.000***</td>
</tr>
<tr>
<td>Uncertain</td>
<td>Actual</td>
<td>0.68</td>
<td>0.63</td>
<td>2.21</td>
<td>0.005***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.77</td>
<td>1.63</td>
<td>0.022*</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>Actual</td>
<td>0.75</td>
<td>0.66</td>
<td>7.67</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.79</td>
<td>0.77</td>
<td>7.15</td>
<td>0.000***</td>
</tr>
<tr>
<td>Admonishing</td>
<td>Actual</td>
<td>0.58</td>
<td>0.68</td>
<td>11.75</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.67</td>
<td>0.78</td>
<td>11.81</td>
<td>0.000***</td>
</tr>
<tr>
<td>Strict</td>
<td>Actual</td>
<td>0.70</td>
<td>0.66</td>
<td>36.80</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82</td>
<td>0.76</td>
<td>34.93</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
In Table 2 the internal consistency reliability of the version QTI used in this study was determined by calculating Cronbach alpha coefficient for the 48 items of the QTI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the QTI, which ranged from 0.53 to 0.79 when using the students’ actual climate scores and from 0.78 to 0.92 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the QTI, which suggests that each scale of the QTI was able to differentiate significantly ($p<0.05$) between students’ perceptions in my school and my dream school environmental climates in the same school.

The $t$-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 0.63 to 31.33 for different scales, respectively.
Factor loading Analysis of the QTI
The Actual and Preferred Forms of the QTI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 3.

<table>
<thead>
<tr>
<th>Item</th>
<th>Lea</th>
<th>Hrr</th>
<th>Und</th>
<th>Stu</th>
<th>Unc</th>
<th>Dis</th>
<th>Adm</th>
<th>Stc</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>1</td>
<td>0.95</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>0.95</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>13</td>
<td>0.94</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>0.94</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.73</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>21</td>
<td>0.72</td>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>6</td>
<td>0.93</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>14</td>
<td>0.88</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>22</td>
<td>0.85</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>0.74</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>0.73</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.48</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>0.96</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>19</td>
<td>0.91</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>0.90</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>7</td>
<td>0.85</td>
<td>0.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>0.82</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>23</td>
<td>0.69</td>
<td>0.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>0.97</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>24</td>
<td>0.95</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>0.95</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>0.94</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>8</td>
<td>0.85</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.74</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>29</td>
<td>0.97</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>41</td>
<td>0.84</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>45</td>
<td>0.83</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>33</td>
<td>0.64</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>37</td>
<td>0.61</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>25</td>
<td>0.43</td>
<td>0.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>42</td>
<td>0.95</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>34</td>
<td>0.92</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>26</td>
<td>0.87</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>30</td>
<td>0.86</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>46</td>
<td>0.87</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>38</td>
<td>0.83</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>39</td>
<td>0.88</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>31</td>
<td>0.86</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>43</td>
<td>0.75</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>27</td>
<td>0.69</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>35</td>
<td>0.54</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>47</td>
<td>0.24</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>40</td>
<td>0.89</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>36</td>
<td>0.83</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>28</td>
<td>0.77</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>32</td>
<td>0.74</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>44</td>
<td>0.73</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>48</td>
<td>0.54</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>47.98</td>
<td>45.32</td>
<td>34.44</td>
<td>36.51</td>
<td>72.61</td>
<td>49.32</td>
<td>52.09</td>
<td>43.78</td>
<td>45.32</td>
<td>34.44</td>
<td>36.51</td>
<td>72.61</td>
<td>49.32</td>
<td>52.09</td>
<td>43.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**loading smaller than 0.30 omitted. The sample consisted of 50 students**
The Circumplex Nature of the QTI

To investigate the circumplex nature of the QTI correlations between the scales were calculated in the sample in Table 4.

Table 4.
Scale Intercorrelations for the QTI Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Lea</th>
<th>Hfr</th>
<th>Und</th>
<th>Stu</th>
<th>Unc</th>
<th>Dis</th>
<th>Adm</th>
<th>Stc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lea</td>
<td>Actual</td>
<td>0.72***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.83***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hfr</td>
<td>Actual</td>
<td>0.71***</td>
<td>0.51**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.65***</td>
<td>0.61***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Und</td>
<td>Actual</td>
<td>0.65***</td>
<td>0.47**</td>
<td>0.67***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.47**</td>
<td>0.53**</td>
<td>0.59**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stu</td>
<td>Actual</td>
<td>-0.33*</td>
<td>-0.45**</td>
<td>-0.43*</td>
<td>-0.47**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.36*</td>
<td>-0.56**</td>
<td>-0.54**</td>
<td>-0.52**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unc</td>
<td>Actual</td>
<td>-0.77***</td>
<td>-0.56**</td>
<td>-0.50*</td>
<td>-0.49**</td>
<td>0.49**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.82***</td>
<td>-0.70***</td>
<td>-0.63***</td>
<td>-0.56**</td>
<td>0.55***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dis</td>
<td>Actual</td>
<td>-0.58**</td>
<td>-0.53**</td>
<td>-0.62***</td>
<td>-0.46**</td>
<td>0.48*</td>
<td>0.41**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.69**</td>
<td>-0.57**</td>
<td>-0.72***</td>
<td>-0.54**</td>
<td>0.53**</td>
<td>0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adm</td>
<td>Actual</td>
<td>-0.43*</td>
<td>-0.47**</td>
<td>-0.41*</td>
<td>-0.38*</td>
<td>0.42*</td>
<td>0.43*</td>
<td>0.46**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.52**</td>
<td>-0.55**</td>
<td>-0.49**</td>
<td>-0.46**</td>
<td>0.52**</td>
<td>0.51**</td>
<td>0.55**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

Validation of the TOPRA

To measure Master of Science teacher students’ attitudes towards science educational management class, the present study adapted the eight-item the Test Of Physics-Related Attitude (TOPRA) (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol& Fisher, 2005, Santiboon& Fisher, 2004; Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014; Sittikosol& Malone, 2008), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the Attitude Scale had a value of 0.81 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of Their Actual and Preferred Forms in Physics Classroom Learning Environment

On comparing differences between the students’ perceptions of their actual and preferred Physics teacher interpersonal behaviour at Grade 10 level in Figure 1. Each student in the sample responded to the QTI and the results for each class were calculated as scores on each scale of the QTI. The better teachers were identified as those, whose students' perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied, Admonishing, and Strict scales.
**Figure 1.** Significant differences between science students’ perceptions of their actual and preferred scores on the QTI.

Figure 1 indicates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the Physics laboratory educational management classes.

The results of this study also indicate that using the QTI helps Physics teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the Physics classroom learning environment for upper secondary education students at Grade 10.

**Associations between Master of Science Teacher Students’ Perceptions of Science Educational Management Learning Environment with the TOPRA**

In this study, it was also considered important to investigate associations between Physics students’ perceptions of their Physics classroom learning environment with their attitude toward Physics classes. The Cronbach alpha reliability of the selected the TOPRA was 0.81, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in Physics classroom learning environments. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOPRA that it’s reported in Table 5.

**Table 5**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Standard Regress. Weight Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>0.14*</td>
<td>0.15*</td>
</tr>
<tr>
<td>Helpful/friendly</td>
<td>0.23**</td>
<td>0.24**</td>
</tr>
<tr>
<td>Understanding</td>
<td>0.29**</td>
<td>0.28**</td>
</tr>
<tr>
<td>Student responsibility/freedom</td>
<td>0.29**</td>
<td>0.30**</td>
</tr>
<tr>
<td>Uncertain</td>
<td>-0.14*</td>
<td>-0.15*</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>-0.28**</td>
<td>-0.29**</td>
</tr>
<tr>
<td>Admonishing</td>
<td>-0.28**</td>
<td>-0.29**</td>
</tr>
<tr>
<td>Strict</td>
<td>-0.29**</td>
<td>-0.31**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6138**</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.3767**</td>
<td></td>
</tr>
</tbody>
</table>

_N =196, *p<.05, **p < .01, ***ρ < .001_

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science educational management classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their science educational
management class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their physics laboratory classroom environment on all scales of the Actual and Preferred Forms.

Table 5 is compared to investigate associations between students’ perceptions of their physics classroom learning environments with their attitude toward physics classes. Using the QTI instrument in the upper secondary education level, ThakhonyangPittayakom School, Thailand, will help teachers to evaluate their learning environments in physics classroom learning environmental management in order to improve their education process. Furthermore, the information from the QTI could be useful as the guide to enhance the effectiveness of physics classes. The effectiveness in physics classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of the physics classroom learning management of their teaching is for improving and developing students’ learning achievement successfully.

Conclusions and Discussion

The actual and preferred perceptions of 50 physics students at Grade 10 of their physics classroom learning environments were measured with the QTI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their science educational management class. In general, students’ perceptions of their preferred classroom science environment in science educational management class to be greater than what they actually perceive to be provided. The results of this study also indicate that using the QTI helps teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science educational management class, with regard to the QTI, it was found that all of five scales were positively associated with students’ attitude to science educational management class. The multiple correlation R is significant for the QTI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 38%, with actual and preferred forms of the valiance in students’ attitudes to their physics classroom learning environments was attributable to their perceptions of their physics classroom learning environments. The beta weights ($\beta$) show that in classes where the students perceived greater than all scales in their physics classroom learning environment lessons.

As described in the results section, ThakhonyangPittayakom’s students show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the QTI questionnaire. Overall, ThakhonyangPittayakom students show relatively favourable perceptions of their science educational management lessons, with the lowest score occurring for the Differentiation scale. It seems that physics classroom learning environments lesson activities related to physics classes are operated rather as supplementary to theory classes rather than being independently important in their own right.

Overall, this study replicated previous studies using the QTI, with the findings being consistent with the situation in ThakhonyangPittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the physics upper secondary education level at Grade 10, interestingly.

Acknowledments

Firstly, I would like to thank the 192 students in Physics laboratory classroom in ThakhonyangPittayakom School who allowed students to complete the questionnaire.

Secondary, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Predicting Students’ Outcomes from their Perceptions of Biology Classroom Learning Environments at Tenth-Grade Level in Wat Sathong Municipal School

Siwanat Ninsu¹, Panwilai Chomchid¹, Sonsanguan Passago², Chulak Wiengsamut³, and Toansakul Santiboon¹,²

¹Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Thailand
²Administrator of the Institute of Research and Development of Rajabhat Maha Sarakham University, 44000, Thailand
³Trainee Teacher at Wat Sathong Municipal School

Abstract

The Individualized Classroom Environment Questionnaire (ICEQ) (Rentoul & Fraser, 1979) and the Test Of Biology-Related Attitudes (TOBRA), modified from the Test Of Science-Related Attitudes (TOSRA) (Fraser, 1981) were used. The aims of this study are to determine students’ perceptions of their biology classroom situation. There are several versions of the test available, Actual and Preferred Forms. To administer with a sample size of 98 upper secondary educational students at Grade 10 in Wat Sathong Municipal School was used. The short version the ICEQ test takes about 10-15 minutes to administer and scores are obtained for five sections: personalization, participation, independence, investigation, and differentiation scales. Data analyses supported the factor structure, internal consistency reliability and discriminant validity of the WIHIC questionnaire and the attitude scales from TOBRA, as well as ICEQ scales’ ability to differentiate between classrooms. Data analyses also supported the internal consistency reliability and its ability to differentiate between classrooms. Also, the circumplex nature of the ICEQ was supported by analyzing its pattern of scale inter-correlations. Simple correlation and multiple regression analyses revealed positive associations between the learning environment and students’ attitudes. Associations between students’ perceptions of their attitudes toward their biology classes were chosen as the dependent variable of the model to the correlation coefficient significant for the ICEQ and considered associations with the TOBRA at 51% of the variance in students’ attitude were also provided. Also, this research has practical implications that suggest that teachers wishing to improve their students’ attitudes and achievements should place greater emphasis in their classroom.

Keywords: Predicting, Perception, Biology classroom, Learning environment

Introduction

Background on Classroom Learning Environment

Comprehensive reviews of prior research in the field of classroom environment are available elsewhere in several books (Moos, 1979; Walberg, 1979; Fraser, 1981), a meta-analysis (Haertel, Walberg, & Haertel, 1981), a guest-edited journal issue (Fraser, 1980), and numerous reviews (Randhawa & Fu, 1973; Anderson & Walberg, 1974; Walberg, 1976; Walberg & Haertel, 1980; Fraser, 1981; & Fraser & Walberg, 1981). These sources indicate that the strongest tradition in past research has involved investigation of the predictability of students’ cognitive and attitudinal outcomes from their perceptions of classroom learning environment. In fact, a large number of studies conducted in numerous countries has provided consistent and strong support for the incremental predictive validity of students’ classroom perceptions in accounting for appreciable amounts of learning outcome variance, often beyond that attributable to student entry characteristics such as pretest performance and general ability.

Student Perceptions of Actual and Preferred Environment

An investigation of differences between students and teacher in their perceptions of the same actual classroom environment and of differences between the actual environment and that preferred by students or teachers was reported by Fisher and Frasert (1983a) using the ICEQ with a sample of 116 classes for comparisons of student actual with student preferred scores and a subsample of 56 of the teachers of these classes for contrasting teacher’ and students’ scores. Students preferred a more positive classroom environment than was actually present for all five ICEQ dimensions. Also, teachers perceived a more positive classroom environment than did their students in the same classrooms on five of the ICEQ’s dimensions. These results replicate patterns emerging in other studies in school classrooms in the USA (Moos 1979) The Netherlands (Wubbels, Brekelmans&Hooymers 1991), Thailand (Santiboon& Fisher, 2004), (Santiboon 2007), (Santiboon 2010), (Santiboon 2011), (Santiboon 2013), (Santiboon 2014) and Australia.
The contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualized Classroom Environment Questionnaire (ICEQ); My Class Inventory (ICEQ); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to (Moos 1974) Scheme for classifying human environments.

**Using the ICEQ Instrument for this Study**

The Individualized Classroom Environment Questionnaire (ICEQ) is designed to measure student or teacher perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information about: (1) the validity of the ICEQ; (2) differences between scores on different forms of the ICEQ; (3) relationships between student learning outcomes and perceptions of classroom individualization; and (4) relationships between student learning outcomes and actual/preferred congruence. A copy of the ICEQ is appended (Fraser, 1981).

The ICEQ assesses those dimensions which distinguish individualized classrooms from conventional ones. The initial development of the ICEQ (Rentoul & Fraser 1979) was guided by: the literature on individualized open and inquiry-based education; extensive interviewing of teachers and secondary school students; and reactions to draft versions sought from selected experts, teachers and junior high school students. The final published version of the ICEQ (Fraser 1980). Contains 50 items altogether, with an equal number of items belonging to each of the five scales. Each item is responded to on a five-point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items. Typical items are: 'The teacher considers students' feelings' (Personalization) and 'Different students use different books, equipment and materials' (Differentiation). The published version has a progressive copyright arrangement which gives permission to purchasers to make an unlimited number of copies of the questionnaires and response sheets.

**The Test Of Biology-Related Attitude (TOBRA)**

This study investigated associations between Actual and Preferred students’ perceptions of their biology laboratory environment classes at Grade 10 in Wat Sathong Municipal School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected to the Test Of Biology-Related Attitude (TOBRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among biology laboratory environment classes in Wat Sathong Municipal School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their biology laboratory environment classes. Furthermore, the TOBRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

This purposes of this study used the Individualized Classroom Environment Questionnaire (ICEQ) at determine students’ perceptions of the biology laboratory classroom situation. General description - The ICEQ is a useful tool for teachers to get feedback about their teaching methods, innovation and the most appropriate classroom situation that facilitates learning. There are several versions of the test available, Actual Classroom-Short Form, and Preferred Classroom-Short Form. Target Population - The test can be used by upper secondary education school students. Administration - The ICEQ is administered as a group test. A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

**Research Purposes**

1. To assess student’s perceptions of their biology laboratory environment classes at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.
2. To compare between student’s perception of their actual and preferred biology laboratory environment classes at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.
3. To associate student’s attitudes of their perceptions to their actual biology laboratory environment classes at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.

**Literature Review**

Fraser and Fisher (2002). Reported study on the relationships between students’ affective and cognitive outcomes and their perceptions of classroom psychosocial environment as measured by the Individualized Classroom Environment Questionnaire (ICEQ) and the Classroom Environment Scale (CES) were investigated for a sample of 1,083 junior high school students in 116 classrooms. Six different statistical analyses (simple correlation, multiple correlation, and canonical correlation analysis conducted separately for raw posttest scores and residual posttest scores adjusted for corresponding pretest and general ability) revealed sizable environment-outcome associations. Further analyses showed that the ICEQ and CES made appreciable, unique contributions to explaining outcome variance, and that the magnitudes of environment-outcome relationships were larger when the class was employed as the unit of analysis than when the student was used.

Fraser and Azmi (2003). Extensive research conducted in developed countries has established classroom learning environment as a thriving field of study. The present investigation makes a contribution to classroom environment research in that it involved the translation into Indonesian of scales previously available only in English, and the subsequent validation and use of these translated scales among Indonesian students. The new Indonesian instrument consists of nine seven-item scales based upon the Individualized Classroom Environment Questionnaire and the Classroom Environment Scale. Analyses of data collected from a sample of 373 Indonesian students from nine schools supported the new instrument’s internal consistency, discriminant validity, ability to differentiate between classrooms, and predictive validity (i.e. ability to predict student outcomes). Potential applications of the new instruments in Indonesian classrooms are suggested.

Lim (2006) Assessment of students’ perceptions of classroom environment and their learning styles provided a framework within which to study factors related to perceptions of students in learning. Two instruments, the Individualized Classroom Environment Questionnaire (ICEQ) and the Learning Style Inventory 1985 (LSI), were administered in Singapore to a stratified random sample of 1733 Secondary 4 students (equivalent to Grade 10) from nine secondary schools (good, average and below average schools). The study showed that school type (the category of schools that the students come from), had the most influence on the students’ perceptions of both actual and preferred classroom environment. Gender had an influence too, but mainly on perceptions of actual classroom environment. Learning styles of students had the least influence.

Igwebuike and Akpita (2012) reported of several studies on the relationship between science students’ perceptions of their classroom environments and their cognitive and affective achievements indicate strong association between the perceptions and the achievements. While this underscores the need for more effective relations in the classrooms, the issue of the effectiveness of some contemporary instructional strategies for teaching science in different classroom environments has not been addressed. This study, therefore, sought to find out if the constructivist instructional strategy can enhance cognitive and affective achievements of students in non-conducive environments. A total of 100 (57 boys, 43 girls) junior secondary two (grade 8) students participated in this experiment. Two instruments—the Cognitive Achievement Test and the Affective Achievement Test—were used in pre and post-test administration to measure the treatment effect on cognitive and affective achievements, respectively. Findings do not support the stand that the constructivist instructional strategy is more effective than the traditional (expository) teaching strategy for improving cognitive achievement. But with respect to affective achievement, the evidence supports the use of the constructivist strategy for instruction in non-conducive classroom environment. Implications of the study are discussed and recommendations given.

Wheldall, Beaman, and Mok (2013) Data from 1,467 high school students in New South Wales schools on the Individualized Classroom Environment Questionnaire (ICEQ) were analyzed using multilevel variance components models to derive intra-class correlations to determine the degree to which ICEQ scores may validly be said to measure aspects of classroom climate as against individual student attitude. The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all five ICEQ scales. Subsequent analyses showed that only small and non-significant proportions of variance were attributable to the school variable. In these terms, the ICEQ may be considered to be a relatively good measure of classroom climate.

Igwebuike and Akpita (2013). The purpose of this paper was to determine if there would be any difference in perceptions of psychosocial classroom environment between biology students (grade 12) and their teachers. Individualized Classroom Environment Questionnaire (Actual) was administered on the students (n = 400) and their teachers (n = 50). Analysis of data through t-test for independent samples indicated that the teachers and their students did not differ in their perceptions. Similarly, neither the male nor the female students differed with their teachers in their perceptions. Implications of the result were discussed.
Methodology

Research procedure
Using the ICEQ was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOBRA on the 15th week for associating biology laboratory classroom learning environments in biology classroom learning environment for upper secondary educational students at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.

Each scale of the ICEQ were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3, 8, 13, 18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.

Data Analyses
Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred ICEQ forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the ICEQ were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the ICEQ with students’ attitudes to associate were analyzed.

Sample
This study is improved and developed biology laboratory classroom learning environment for upper secondary educational students at Grade 10 in Wat Sathong Municipal School classes of their biology laboratory learning environments to actual and preferred student’s perceptions with sample size of 98 students in 2 classes at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.

Results

Validity and Reliability of Research Instruments
This section reports typical validation data for selected classroom environment scales. Table 1, 2, and 3 provide a summary of a limited amount of statistical information for the instrument (ICEQ), considered previously. Attention is restricted to the student actual form and to the use of the individual student as the unit of analysis. Table 2 provides information about each scale’s internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms (significance level and $\eta^2$ statistic from ANOVAs).

Validation of the ICEQ
Description of quantitative data of analyzing responses for Biology students student’s assessments is reported in Table 1.

Table 1.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the ICEQ

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>20.00</td>
<td>4.38</td>
<td>0.19</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>21.56</td>
<td>4.31</td>
<td>0.30</td>
<td>0.55</td>
</tr>
<tr>
<td>Participation</td>
<td>Actual</td>
<td>16.13</td>
<td>3.22</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>20.78</td>
<td>4.16</td>
<td>0.30</td>
<td>0.55</td>
</tr>
<tr>
<td>Independence</td>
<td>Actual</td>
<td>17.81</td>
<td>3.96</td>
<td>0.28</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>19.21</td>
<td>3.84</td>
<td>0.28</td>
<td>0.53</td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>18.69</td>
<td>3.74</td>
<td>0.32</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>19.62</td>
<td>3.93</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td>Differentiation</td>
<td>Actual</td>
<td>17.47</td>
<td>3.49</td>
<td>0.32</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>18.84</td>
<td>3.77</td>
<td>0.31</td>
<td>0.55</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five ICEQ scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each
scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the ICEQ. For the remaining five scales, namely; Personalization, Participation, Independence, Investigation, and Differentiation scales.

Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the ICEQ

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results ($\eta^2$)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>0.70</td>
<td>0.85</td>
<td>9.34</td>
<td>0.17</td>
<td>0.04*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.73</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>Actual</td>
<td>0.72</td>
<td>0.66</td>
<td>12.66</td>
<td>0.19</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.77</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>Actual</td>
<td>0.60</td>
<td>0.69</td>
<td>29.72</td>
<td>0.23</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.70</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>0.74</td>
<td>0.66</td>
<td>12.38</td>
<td>0.18</td>
<td>0.03*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.80</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td>Actual</td>
<td>0.62</td>
<td>0.84</td>
<td>56.08</td>
<td>0.26</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.74</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

***Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version ICEQ used in this study was determined by calculating Cronbach alpha coefficient for the 25 items of the ICEQ using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the ICEQ, which ranged from 0.60 to 0.74 when using the students’ actual climate scores and from 0.70 to 0.80 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the ICEQ, which suggests that each scale of the ICEQ was able to differentiate significantly ($p<0.001$) between students’ perceptions in my school and my dream school environmental climates in the same school. The $t$-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 9.34 to 56.38 for different scales, respectively.
Factor loading Analysis of the ICEQ
The Actual and Preferred Forms of the ICEQ were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 3.
Factor Loading for Items in the Actual Form of the ICEQ.

<table>
<thead>
<tr>
<th>Item</th>
<th>Pe</th>
<th>Pa</th>
<th>Id</th>
<th>Iv</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>0.63</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>0.55</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>0.51</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>0.44</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>0.44</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>0.70</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>0.69</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>0.59</td>
<td>0.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>0.52</td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>0.46</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>0.81</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>13</td>
<td>0.77</td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>0.60</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>3</td>
<td>0.43</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>8</td>
<td>0.33</td>
<td>0.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>19</td>
<td></td>
<td>0.64</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>14</td>
<td></td>
<td>0.56</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>4</td>
<td></td>
<td>0.44</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td></td>
<td>0.43</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>24</td>
<td></td>
<td>0.42</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Validation of the TOBRA
To measure biology students’ attitudes towards biology laboratory learning classes class, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997), (Kijkosol& Fisher, 2005), (Santiboon& Fisher, 2004), (Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014), (Sittikosol& Malone, 2008), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the Attitude Scale had a value of 0.79 which was considered satisfactory for further use in this study.

The Circumplex Nature of the ICEQ
To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 4. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.
Table 4.

Scale Intercorrelations for the ICEQ Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Pe</th>
<th>Pa</th>
<th>Id</th>
<th>Iv</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>0.56**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.72**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>Actual</td>
<td>0.54**</td>
<td>0.57**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.74***</td>
<td>0.47**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>Actual</td>
<td>0.55**</td>
<td>0.69**</td>
<td>0.51**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75**</td>
<td>0.42*</td>
<td>0.83***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>0.63**</td>
<td>0.45*</td>
<td>0.51**</td>
<td>0.63**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81***</td>
<td>0.37*</td>
<td>0.31*</td>
<td>0.56**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Comparisons between Student’s Perceptions of Their Actual and Preferred Forms in Biology Laboratory Learning Classes Classroom Environment

Table 1 and 2 are comparing differences between the students’ perceptions of their actual and preferred science classroom learning environment constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School environment classes show in Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Personalization, Participation, Independence, Investigation, and Differentiation scales than students’ actual perceptions.

The results of this study also indicate that using the ICEQ helps science educational management instructors to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the science educational management curriculum for students in the Biology laboratory learning classroom environment. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in biology laboratory classes (see in Figure 1).

![Graph](image)

*Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the ICEQ.*

Associations between Students’ Perceptions of Actual Science Classroom Learning Educational Constructivist Environments with the TOBRA

In this study, it was also considered important to investigate associations between biology students perceptions of their Biology laboratory learning classes classroom learning environment with their attitude toward science. The Cronbach alpha reliability of the selected Attitude Scale was 0.79, when using individual student as the unit
of analysis. This suggests that the scale is reliable for measuring students’ attitudes in biology laboratory classes in Wat Sathong Municipal School. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the Attitude Scale that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their Biology laboratory learning classes classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favorable attitude towards their Biology laboratory learning classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their Biology laboratory learning classroom environment on all scales of the Actual Form.

Table 5 is compared to investigate associations between science students’ perceptions of their Biology laboratory learning classroom environments with their attitude toward Biology laboratory learning classes. Using the ICEQ instrument in the higher education level, Wat Sathong Municipal School, Thailand, will help instructors to evaluate their learning environments in biology laboratory environment classes, in order to improve their education process. Furthermore, the information from the ICEQ could be useful as the guide to enhance the effectiveness of biology laboratory classes.

Table 5. Associations between ICEQ scale and attitude scale to biology laboratory learning classes in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From Simple Correlate. Attitude (r)</th>
<th>Std. Regress. Weight Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.18**</td>
<td>0.20**</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>0.19**</td>
<td>0.21**</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.22**</td>
<td>0.23**</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.17*</td>
<td>0.19*</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.20**</td>
<td>0.21**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.7158**</td>
<td>0.5104**</td>
</tr>
</tbody>
</table>

The effectiveness in biology laboratory learning classes is very important because the improving work is high cost and time consuming. Therefore, evaluation of the Biology laboratory learning classes teaching is important for improving and developing students’ learning achievement successfully.

Conclusions

The actual and preferred perceptions of biology students of their biology laboratory classroom environments were measured with the ICEQ. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their biology laboratory environment classes. In general, students’ perceptions of their preferred classroom biology laboratory environment classes in biology laboratory environment classes to be greater than what they actually perceive to be provided. The results of this study also indicate that using the ICEQ helps teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their biology laboratory environment classes, with regard to the ICEQ, it was found that all of five scales were positively associated with students’ attitude to biology laboratory environment classes. The multiple correlation R is significant for the ICEQ and shows that when the scales are considered together there are significant associations with the Attitude Scale. The R² values indicate that 44%, with actual form of the valiance in students’ attitudes to biology laboratory environment classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their adding, abstract, figures, tables, and reference and manuscript article of full paper lessons.
Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments Individualized Classroom Environment Questionnaire (ICEQ). This instrument provides the biology laboratory environment classes of students’ perceptions on actual and preferred biology laboratory environment classroom learning environments. The information from this instrument could be used for improvement and effectiveness teaching in biology laboratory environment classes. As described in the results section, Wat Sathong Municipal School students show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the ICEQ questionnaire. Overall, Wat Sathong Municipal School students show relatively favourable perceptions of their biology laboratory environment classes, with the lowest score occurring for the five scale. It seems that biology laboratory environment classes’ activities related to biology laboratory environment classes are operated rather as supplementary to theory classes rather than being independently important in their own right. Overall, this study replicated previous studies using the ICEQ, with the findings being consistent with the situation in Wat Sathong Municipal School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the biology laboratory environment classes, interestingly.

Acknowledgements

I am grateful to my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Rajabhat Maha Sarakham University. I am heartily thankful to my supervisors; Assist. Prof. Dr. Toansakul Santiboon and Dr. Panwilai Chomchid of Master of Science of Education Program, Faculty of Education, Rajabhat Maha Sarakham University, whose encouragement, guidance and support instruments and computing system for analysis of this research.

References


Motivating Learning Activities of Students of Science and Technology while Teaching Advanced Mathematics

Nguyen Chien Thang
Pedagogic Faculty of Mathematics, Vinh university
Number 182, Le Duan street, Vinh city, Nghe An province, Vietnam
E-mail: ncthang2009@gmail.com

Abstract

Advanced mathematics consists of mathematical knowledge that is taught in early years at university level such as Linear Algebra, Calculus and Advanced Geometry. They are difficult courses for most students of science and technology who are not in the major of mathematics. However, these courses are very helpful for students because they supply effective tools for them to study other courses, especially the specialized ones. Therefore, to help students learn actively while teaching advanced mathematics is an important task of lecturers. In this paper, we propose a number of main measures to motivate the learning activities of students while teaching this course.

Keywords: Motivate, Learning activities, Advanced mathematics, Science, Technology

Introduction

The method of constructing a theory of mathematics at university level is axiomatic method, including the basic concepts and axiomatic system, the new findings are derived by strictly logical deduction from axiomatic system and known results. The difficulty of students of science and technology in learning mathematics courses in general and advanced mathematics in particular is derived from high abstraction of mathematical concepts and that method of deduction.

In addition, the lecturers who teach these courses are often interested in imparting knowledge of the courses but seldom pay attention to active teaching methods. So, besides the interest of the relationship between theories and exercises in teaching the knowledge of advanced mathematics, lecturers should be aware of researching and applying the teaching methods to motivate the learning activities of students.

Materials and Methods

To motivate the learning activities of students while teaching advanced mathematics, we have made the following studies:
- Find out the role of Advanced Mathematics for the major in science and technology.
- Learn about the issues of motivating the learning activities of students at university level.
- Propose some feasible measures to motivate the learning activities of students at university level.

Results and Discussion

1. Advanced mathematics at university

Advanced Mathematics at university level includes basic problems of Linear Algebra, Calculus and Advanced Geometry. This subject serves to equip mathematical tools for students to study, acquire other subjects at university. Moreover, through learning this subject, they are training mathematically thinking - a type of thinking might be useful in their work and life in the future. In that sense, besides requiring how to teach students to master concepts, understand the theory insightfully, know how to use methods, basic results of the subjects in solving exercises, lecturers need to be interested in making chances for students to apply mathematical knowledge to practical profession in which they are enrolled. This application helps students understand theories more insightfully and express the significance of learning this subject to them, thereby creating their interest in learning.

2. The problem of motivating the learning activities of students

According to [1], the positiveness in learning is embodied in various activities: eagerly give opinions to build the lesson; actively presenting issues raised; or ask questions; not satisfy with the answers of everyone, including his/her own answer; hard thinking before the difficult problems; patiently solve the exercises in many different ways; …
The low to high levels of positiveness in learning:
- Imitate: try to act in the form of teachers and friends, ... (practical skills);
- Explore: independence of thinking when dealing with problems, identify various ways for an issue, ...
(skill level);
- Innovation: find new and unique ways to solve.

Measures to enhance the positive perception of students in the class include:
- Speak up theoretical and practical meaningfulness, importance of the research problem;
- Teaching contents must be new, new ones here are not too unfamiliar to students, new ones have to
contact and develop old ones. Knowledge must be realistic, closer to daily life, with daily thoughts, satisfy their
cognitive needs;
- Have to use various methods: problem posing, experiment, practice, comparison, work independently
and coordinate them with each other;
- Use the means of teaching that have good effect in stimulating students' interest;
- Use various forms of teaching organization: individuals, groups, the team, sightseeing, working in the
school garden, in laboratory, ...;
- Practice under other forms, apply knowledge into practice, in new situations;
- Stimulate positiveness through attitudes, the way of behaviour between teachers and students;
- Developing life experience of the student in learning ([9]).

3. Basic measures to motivate learning activities of students while teaching Advanced Mathematics

Based on the above analysis, we propose the following measures to motivate learning activities of
students while teaching Advanced Mathematics:

**Measure 1**: Appropriately apply the active teaching methods in teaching concepts, theorems of Advanced
Mathematics.

*Active teaching methods* are the teaching ones towards raising activeness and initiativeness of the
learner under the role of organization and orientation of teachers([3]).

When teaching the formation of concepts and theorems, teachers should employ an operational
perspective. Methods of arousing initial motivation:
- Stemming from the practical.
- Starting from a concrete example.
- Taking advantage of the results in flat and space (2, 3 - dimensional) to draw results in n –
dimensional.
- Derived from internal mathematics.

**Example 1**: Formation of the concept "Matrix inverses".

Step 1: Ask students to perform two matrix multiplication, with $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ và $B = \begin{pmatrix} -2 & 1 \\ 3 & 2 \end{pmatrix}$.

Step 2: Ask students to draw comments from the results obtained. Those are: Productions $AB$ or $BA$ are all
equal to the unit matrix of size 2.

Step 3: The lecturer confirms the student's comments and announces that $B$ is called the inverse of $A$, denoted
$A^{-1}$.

Step 4: Finally, the lecturer presents the definition of matrix inverse.

**Example 2**: Teaching the concept of "Vector space ".

Step 1: (May organize group activity) Ask students to list the properties of vector operation in plane and in
space (learned in high school).

Step 2: The lecturer reconfirms and writes in the order of the vector space axioms.

Step 3: The lecturer states the definition of general vector space and gives some examples for students to verify
whether they are vector spaces or not.

Note that it is not necessary to give too many examples about the concept or the theorem, but should
choose some examples that ensure both two aspects of identification and making them meaning (including
examples that satisfy or dissatisfy the connotation of the concept, the characteristics of the theorem).

**Measure 2**: Select the system of exercises carefully with varied forms, focus on the practice of calculating to
consolidate knowledge, limit proving, ensure gradually raise the difficulty level.

For students of science and technology, the lecturer should not choose a variety of exercises
demonstrated by strictly logical inference. For them, mathematics is just a tool, thus calculating exercises that
students directly manipulate formulas, theorems, processes, algorithms are most suitable. However, some proving exercises at moderate level will help them train the mathematical thinking capacity. This work corresponds with the principle of moderate efforts in teaching because exercises exceed the zone of proximal development of the learners will not promote their learning positiveness. The form of statement of the problem needs to be diversely to inspire students to solve it: Besides essay-type assignments, it is able to use multiple choice quiz.

To reinforce a theory, it is not necessary to assign too many application exercises. The best way is to choose some typical exercises and ask students to solve them in different ways to help them consolidate a lot of knowledge, simultaneously they can see that for a problem there are many plans for settlement and know to choose the best one.

Example 3: After having already learned the concept of determinant and its properties, teachers should reinforce the theory by asking students to calculate the determinant of a specific square matrix of size 3 in different ways, for instance, \( A = \begin{bmatrix} 2 & -1 & 3 \\ 0 & -2 & 1 \\ 5 & 2 & -3 \end{bmatrix} \) (Lecturers led students to calculate this determinant by following ways: Using Sarus rules, expanding using minors and cofactors, using elementary transformations).

Example 4: Building multiple choice test (multiple choice questions, completion question, two columns matching exercises, ...) for a topic of Advanced Mathematics. This type of exercises corresponds with chapter review and is done conveniently via PC and projector.

Measure 3: Enhancing the application of information technology in teaching Advanced Mathematics toward visually illustrating abstract mathematical concepts and supporting calculations.

The position and important role of computers in modern times has been confirmed. Informatics is almost a compulsory subject for students as soon as they entered universities. Therefore, the use of information technology in an active, appropriate way will contribute to improve the effectiveness of teaching in general, teaching Advanced Mathematics in particular, especially for students of science and technology. A software which is very effective in teaching this course is Maple: Along with traditional solutions, students should be guided to address in Maple. This method creates for students a new approach to mathematics - more lively and creative. This software can be applied in all the topics of Advanced Mathematics.

Example 5: With Maple software, students can perform most operations on vectors and matrices, finding transposition matrix, finding adjoint matrix, calculating determinants, calculating rank of matrices, find matrix inverse, solving systems of linear equations, finding basis of vector space, calculate the eigenvalues and eigenvectors and some advanced properties in Linear Algebra.

Considering the specific example: Find orthonormal basis of the vector space generated by a set of vectors with the GramSchmidt command. For instance, consider the problem of finding such orthonormal basis of the vector space generated by a set of vectors \( \{u_1,u_2,u_3,u_4\} \), where \( u_1 = (1,1,1,1) \), \( u_2 = (1,2,3,4) \), \( u_3 = (1,3,6,10) \), \( u_4 = (1,4,10,20) \). Here is the following solution:

Assign vectors by commands:

\[ u1 := \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \]

\[ u2 := \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix} \]

\[ u3 := \begin{bmatrix} 1 \\ 3 \\ 6 \\ 10 \end{bmatrix} \]
The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University

*******************************************************************************

\[ u^3 := \begin{bmatrix} 1 \\ 3 \\ 6 \\ 10 \end{bmatrix} \]

\[ u^4 := [1,4,10,20] ; \]

Then, find the orthonormal basis by the following command:

\[ \text{GramSchmidt}([u1,u2,u3,u4]) ; \]

\[ \begin{bmatrix} 1 \\ \frac{3}{2} \\ -1 \\ 1 \end{bmatrix}, \begin{bmatrix} -\frac{1}{2} \\ 1 \\ 1 \\ \frac{3}{2} \end{bmatrix}, \begin{bmatrix} \frac{1}{2} \\ -1 \\ -\frac{1}{2} \\ 1 \end{bmatrix}, \begin{bmatrix} \frac{1}{20} \\ \frac{1}{20} \\ \frac{3}{20} \\ \frac{1}{20} \end{bmatrix} \]

We know that the orthonormal basis has an important role in the orthogonal diagonalization issue. Theoretically we can always diagonalize a symmetric matrix but it is difficult for learners to do in practice, especially when the size of the matrix is big. However, thank to Maple, we can perform this task in a simple way.

**Example 6:** With Maple software, learners can perform calculations of limits, derivatives of a function of one variable, calculate differentiation of functions of several variables, vector functions and function matrices, find derivative of implicit functions, calculate the integral of a function of one variable, Taylor expansion, solve the ordinary differential equation, solve systems of ordinary differential equation, solving partial derivative equations, ....

Here is a typical example: Expanding a function as a Taylor series is an important problem in Calculus because it allows us to approximate any function (differentiable with high enough level) by a polynomial, with good enough accuracy in a point neighbourhood that we choose to expand. Then, instead of studying complex functions, it is easier for learners to study their polynomial approximations because polynomial functions are simple. Maple software is very good tool for this job. For example, we will expand the function \( f(x) = \sin 4x e^{3x} \) at the point \( x = 0 \) (also called the Maclaurin expansion). We do as follow:

If you want to expand with a certain degree, such as the degree 10, you type the command:

\[ \text{Order} := 10 ; \]

Assign the function by the command:

\[ f := \sin(4x) \cos(2x) ; \]

Taylor expansion of \( f \) by the command:

\[ \text{approx} := \text{series}(f,x=0) ; \]

Find the polynomial approximation of \( f \) by the command:

\[ \text{dathucxapxi} := \text{convert(approx,polynom)} ; \]
To see good approximation of Taylor polynomials at the neighbourhood of a point considering, we use Maple to plot graphs of the original expression and its polynomial approximation on the same coordinate system for comparing easily by the command:

\[
>\text{plot}\{f, x = -1..1, y = -1..1\};
\]

We should note that the more increasing the degree of the polynomial approximation is, the better the approximation is. Clearly, students will see the visual image and the meaning of the expansion theorem.

**Measure 4**: Create opportunities for students to exploit practical applications of Advanced Mathematics knowledge, especially in the field of their profession.

Practice is the criterion of truth, therefore, establishing links between mathematical knowledge and practice, especially practice of students occupations in the future, is necessary. Of course, not always with knowledge learned should contact to practice, this work should be carried out selectively with appropriate forms of organization. Lecturers can provide opportunities for students to exploit the applications of mathematics in two directions: Ask students to solve practical problems immediately after they completed theory (for those exercises that pose no complex task) or organize into groups to make a small project related to the knowledge of a chapter or topic.

Example 7: A beam of length \(l\) is beared on two single bearing points at both ends of the beam. Find the deflection of the beam with constant weight \(W\) per length unit and determine the maximum deflection.

The solution of the problem leads to solve a differential equation with initial conditions.

Example 8: From a iron rod of length 10 meters, one wants to form a U-shaped tank by folding the two ends with a section \(x\) in an angle \(\alpha\). Calculate \(x\) and \(\alpha\) so that the tank capacity is maximum.

Solving this problem leads to a system of equations of two derivatives and apply the theory of extreme values of a function of two variables to solve. The calculation becomes simpler with the Maple software.

**Conclusion**

Teaching Advanced Mathematics in the direction of motivating the learning activities of students of science and technology is a key task of lecturers at university. The measures that we have proposed completely correspond with the tasks mentioned above. To carry out these measures, it requires the lecturer to have a meticulous preparation from the phase of teaching concepts, theorems to the phase of selecting of exercises and using softwares.

**References**

Publishing House.
The Impact of Systemic Reform Efforts in Promoting Constructivist Approaches in Physics Classroom Learning Environments in Thakhonyang Pittayakom School

Salinee Sanwang1, Kamonphonkum1, Apichard Puhuadon2 and Toansakul Santiboon1*

1Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
2Science Learning Group Section, Thakhonyang Pittayakom School, Muang District, Maha Sarakham, Thailand 45000
(*author for correspondence, E-mail: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

This study is to describe on physics classroom learning environments for upper secondary educational students at Grade 12 in Thakhonyang Pittayakom School in Mahasarakham Province, Thailand with a sample size of 68 students. Students’ perceptions of their actual (assesses the class as it actually is) and preferred (asks the students what they would prefer their class to be like – the ideal situation) were compared. Associations between students’ perceptions of their attitudes toward their actual physics classroom learning environments were determined. The impact of systemic reform efforts in promoting constructivist approaches learning environment were obtained of the 30-item Constructivist Learning Environment Survey instrument (original modified from the CLES) (Taylor & Fraser, 1995) and students’ attitudes were assessed with a short version of the Test Of Physics-Related Attitude (TOPRA) (original modified from the Test Of Science-Related Attitude) (Fraser, 1981) that they were translated into Thai language for administrating research methodology. Statistically significant between students’ perceptions of their actual and preferred perceptions to their attitude toward their physics classroom learning environments were also found. The factors were analyzed to appear to be affecting student perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients for the scales were adequate (0.91-0.97), while confirmatory factor analyses provide support for the theoretical framework behind the questionnaire (0.65-0.95 omitted). The multiple correlations R² is significant for the CLES and considered associations with the Attitude scale, and value indicates that 55% of the variance in students’ attitude was also determined.

Keywords: Physics classroom, Learning, Environment, Secondary education

Introduction

Historical Background

The constructivist view of learning has made a major impact on science education, particularly during the past decade. The implications for a science curriculum centered on a constructivist philosophy were identified initially in a number of research studies which focused on students’ concept learning in science. The constructivist view of learning has had a most noticeable influence on curriculum thinking in science since (Treagust, Duit, & Fraser, 1996)[1].

The recent national reform movements in the United States are grounded in a constructivist approach to learning. That is, students should find personal relevance in their studies, share control over their learning, feel free to express concerns about their learning, view science as ever changing, and interact with each other to improve comprehension (Taylor, Dawson, & Fraser, 1995)[2], Taylor, Fisher, & Fraser, 1997)[3]. However, reform is often difficult to implement is large systems with inertia set by years of tradition and entrenched beliefs. At this point in time, the nature of how teachers view their students and how they believe that students learn is unknown within this district. However, it is known that the majority of teachers do not think that understanding how students learn is important (Dryden, 1996)[4]. Jakubowski and Tobin (1991) show that teachers who embrace a realist epistemology "emphasize technical interests and adopt strategies that controlled what students were to learn and how they were to engage".

A constructivist approach to learning is based on the idea that the learner constructs his or her own knowledge through negotiation of meaning. Tobin and Tippins (1993) suggested that constructivism has been used as a referent for building a classroom that maximizes student learning. In such a classroom, the teacher takes account of what students know, maximizes social interactions between learners so that they can negotiate meaning, and provides a variety of sensory experiences from which learning is built, they noted the following five assumptions shared by mathematics and science educators for reorganizing the curriculum and teaching to improve learning in school science and mathematics from a constructivist perspective.
In this study, the methodologies to assess the implementation of the reform initiative were used. First, actual and preferred administrations of the Constructivist Learning Environment Survey (CLES; Taylor, Dawson & Fraser, 1995[8]; Taylor, Fraser, & Fisher, 1997)[9] were given to upper secondary school science students at the grade level 12 of the educational system in Thailand. Second, physics laboratory classes were assessed to determine the nature of instruction, with a learning environment checklist being used by the students’ perceptions. The aim of this study was to investigate the extent to which this new physics laboratory learning environments at the upper secondary education level had influenced the constructivist nature. As students in grade 12 had not been exposed to the new curriculum it could be expected that those grades were not as constructivist in nature as grade 12 from the Basic Education Core Curriculum B.E. 2558 (A.D. 2015) will be used in 2016.

Science Constructivist Research on Classroom Learning Environment

Although most classroom environment research has focused on the assessment and improvement of learning and teaching, it has done so largely within the context of traditional epistemology underpinning the established classroom environment (Taylor, Fraser & Fisher, 1997)[8]. However, the traditional teacher-centered, didactic approach to teaching has been extensively criticized and there is a better understanding of the nature of knowledge development. Therefore, the Constructivist Learning Environment Survey (CLES) was developed with a psychological view of learning that focused on students as co-constructors of their own knowledge. Originally, the CLES was found to be and to contribute insightful understanding of classroom learning environment (Taylor, Fraser & Fisher, 1997)[8].

Taylor, Fraser & White (1994) found major socio-cultural constraints to the development of constructivist learning environment and developed a new version of the CLES based on critical constructivism, which combines key elements of the radical constructivist theory and the critical social. The new CLES is composed of the five scales of Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation, which recognize that the cognitive constructivist activity of the individual learner occurs within, and is constructed by, a socio-cultural context.

Using students’ perceptions to this study educational environments can be approached to studying science classroom environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if teachers are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991)[9].

Background to the Research Instruments

Several instruments have been developed to assess classroom environment. The Learning Environment Inventory(Fraser, Anderson, & Walberg, 1982)[10], the Classroom Environment Scale(Moos & Trickett, 1974)[11] and the Individualised Classroom Environment Questionnaire(Rentoul & Fraser, 1979)[12] have been used extensively to assess classroom environment at the secondary level. The My Class Inventory(Fisher & Fraser, 1991)[13]; Fraser, Anderson, & Walberg, 1982)[10] and the College and University Classroom Environment Inventory (Fraser & Tregaugst, 1986) were developed for use at the primary and tertiary levels, respectively. Because of the importance and uniqueness of laboratory settings in science education, the Science Laboratory Environment Inventory was developed to assess the environment of science laboratory classes (Fraser, Giddings, & McRobbie, 1995)[14].

The Constructive Learning Environment Survey (CLES)

Two forms of the CLES have been developed to gather students’ perceptions of science classrooms. These forms are named the Student Actual and Student Preferred (Taylor, Dawson, & Fraser, 1995)[14]. Although item wording is almost identical in the actual and preferred forms, words such as “I wish” are included in the preferred form to remind students that they are rating their preferred, or ideal classroom, rather than the actual classroom environment. For example, the statement, “In this class, I learn about the world outside of school” in the actual form of the CLES is changed in the preferred form to, “In this class, I wish that I learned about the world outside of school”. It was decided to investigate differences between students’ perceptions of their actual and preferred constructivist learning environments in this study. The CLES has 30 items with 5-response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation).

According to the constructivist view, meaningful learning is a cognitive process in which individuals
make sense of the world in relation to the knowledge which they already have constructed, and this sense-making process involves active negotiation and consensus building. The CLES developed to assist researchers and teachers to assess the degree to which a particular classroom’s environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice. The CLES has 30 items with 5-response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation).

The Test of Physics-Related Attitudes (TOPRA)

To investigate of associations between students’ perceptions of their physics laboratory classroom environment constructivist and their attitudes toward physics laboratory learning classes for upper secondary educational students. This study modified the Test of Physics-Related Attitudes (TOPRA) from the original of the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981[2]; Santiboon, 2011[3], 2013[4]) of Thai version was designed to measure eight distinct classroom-related attitudes among upper secondary educational students in ThakhonyangPittayakom School classes in Mahasarakham Province. The eight items are suitable for group administration and all can be administered within the duration of a learning and physics classroom constructivist. Furthermore, TOPRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Actual and Preferred Forms of Research Instrument Scales

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow.

Materials and Methods

Research Purpose

7. To assess and investigate of constructivist learning environment of student’s perceptions to their physics laboratory environment classes of the upper secondary educational students at Grade 12 in ThakhonyangPittayakom School, Mahasarakham Province.

8. To compare between students’ perceptions of their actual and preferred physics laboratory environment classes of the upper secondary educational students at Grade 12 in ThakhonyangPittayakom School, Mahasarakham Province.

9. To associate between students’ physics attitudes and their actual perceptions toward their physics laboratory environment classes for upper secondary educational students at Grade 12 in ThakhonyangPittayakom School, Mahasarakham Province.

Literature Reviews

Over the previous two decades or so, considerable interest has been shown internationally in the conceptualization, assessment and investigation of perceptions of psychosocial characteristics of the learning environment of classrooms at the elementary, secondary and higher education levels (Fraser, 1998; Fraser & Walberg, 1991). Use of student perceptions of classroom environment as predictor variables has established consistent relationships between the nature of the classroom environment and student cognitive and affective outcomes (McRobbie & Fraser, 1993)[17]. Furthermore, research involving a person-environment fit perspective has shown that students achieve better where there is greater congruence between the actual classroom environment and that preferred by students (Fraser & Fisher, 1983)[18].

Studies involving the use of classroom environment scales as criterion variables have revealed that classroom psychosocial climate varies between Catholic and government schools Researchers and teachers have found it useful to employ classroom climate dimensions as criteria of effectiveness in curriculum evaluation because they have differentiated revealingly between alternative curricula when student outcome measures have shown little sensitivity (Fraser, Williamson & Tobin, 1987)[20]. Research comparing students’ and teachers’ perceptions showed that, first, both students and teachers prefer a more positive classroom environment than they perceive as being actually present and, second, teachers tend to perceive the classroom environment more positively than do their students in the same classrooms (Fraser, 1994)[21] (Taylor, Fraser, & White 1994)[22] reported of their study on an instrument for assessing and investigating the development constructivist learning environments of items in revised CLES scales.
These criticisms were responded to in Korea’s new sixth National Science Curriculum which tried to reduce the amount of content knowledge and give an added emphasis to students’ problem solving in everyday contexts. This is particularly so in General Science which was introduced as a compulsory subject for all high school students and reflects the constructivist view was assessed. Students are expected to learn about and understand basic scientific concepts through student-centered activities and negotiation. The content is organized in a way that relates it to actual, concrete problems encountered by students in daily life. The intention is to facilitate the students’ understanding of science knowledge and the process of scientific inquiry. However, other physics subjects, such as Physics, Chemistry, Physics, and Earth Science, have remained academically content oriented in Korea (Heui-Baik Kim, 2006).[24]

Methodology

Steps on Assessing Students’ Perceptions with the CLES and TOPRA

Using the CLES was follows as for assessing students’ perception of their actual form on the 11th week, and preferred form on the 14th week and the TOPRA on the 15th week for associating physics laboratory environment in physics laboratory constructivist classes for upper secondary educational students at ThakhonyangPittayakom School, Mahasarakham Province.

Each scale of the CLES were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1, 2, 3, 4, 5, and 6; the second scale; Physics Uncertainty is composed the item of 7, 8, 9, 10, 11, and 12 ;the third scale;Critical Voiceis composed the item of 13, 14, 15, 16, 17, and 18 ;the fourth scale,Shared Controlis composed the item of 19, 20, 21, 22, 23; and 24; the fifth scale,Student Negotiationis composed the item of 25, 26, 27, 28, 29, and 30.

Data Analysis

Quantitative data were obtained using the two questionnaires (CLES and TOPRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual CLES scale to investigate whether students have significant different perceptions of their actual and preferred physics laboratory environment constructivist classes for upper secondary educational students at ThakhonyangPittayakom School.

Sample

This study is improved and developed physics laboratory constructivist learning environment classes for the upper secondary educational students in ThakhonyangPittayakom School classes of their physics learning classroom environments with actual and preferred student’s perceptions with sample size of 68 physics laboratory environment students in 2 classes at Grade level 12 in Mahasarakham Province, Thailand.
Results

Validity and Reliability of Research Instrument

B. Validation of the CLES

Description of quantitative data of analyzing responses for Master of Physics teacher student’s assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the CLES

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>Actual</td>
<td>22.50</td>
<td>3.75</td>
<td>0.28</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.13</td>
<td>4.19</td>
<td>0.35</td>
<td>0.60</td>
</tr>
<tr>
<td>Physics Uncertainty</td>
<td>Actual</td>
<td>22.59</td>
<td>3.76</td>
<td>0.46</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.13</td>
<td>4.19</td>
<td>0.35</td>
<td>0.60</td>
</tr>
<tr>
<td>Critical View</td>
<td>Actual</td>
<td>22.69</td>
<td>3.78</td>
<td>0.49</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.38</td>
<td>4.23</td>
<td>0.44</td>
<td>0.66</td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>23.00</td>
<td>3.83</td>
<td>0.34</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.00</td>
<td>4.33</td>
<td>0.46</td>
<td>0.67</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>Actual</td>
<td>23.44</td>
<td>3.90</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>24.78</td>
<td>4.13</td>
<td>0.57</td>
<td>0.75</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five CLES scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 6 and 30, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the CLES. For the remaining five scales, namely; Personal Relevance, Physics Uncertainty, Critical View, Shared Control, Student Negotiation scales.

Table 2. Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the CLES

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>Actual</td>
<td>0.91</td>
<td>0.93</td>
<td>14.19</td>
<td>0.28</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.96</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>Actual</td>
<td>0.93</td>
<td>0.92</td>
<td>5.10</td>
<td>0.19</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.96</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Actual</td>
<td>0.92</td>
<td>0.93</td>
<td>7.35</td>
<td>0.22</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.95</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical View</td>
<td>Actual</td>
<td>0.92</td>
<td>0.93</td>
<td>3.64</td>
<td>0.17</td>
<td>0.03*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.97</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>0.94</td>
<td>0.92</td>
<td>6.34</td>
<td>0.20</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.95</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version CLES used in this study was determined by calculating Cronbach alpha coefficient for the 30 items of the CLES using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the CLES, which ranged from 0.91 to 0.94 when using the students’ actual climate scores and from 0.92 to 0.96 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the CLES, which suggests that each scale of the CLES was able to differentiate significantly (p<0.05).
between students’ perceptions in my school and my dream school environmental climates in the same school classes. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.64 to 14.19 for different scales, respectively.

**B. Factor loading Analysis of the CLES**

The Actual and Preferred Forms of the CLES were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

**Table 3. Factor Loading for Items in the Actual and Preferred Forms of the CLES**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>0.76</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.72</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.72</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>0.68</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>0.68</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>0.67</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>0.90</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>0.90</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>0.89</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>0.89</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>0.75</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td></td>
<td></td>
<td>0.86</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td></td>
<td></td>
<td>0.86</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>17</td>
<td></td>
<td></td>
<td>0.83</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>13</td>
<td></td>
<td></td>
<td>0.77</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td>0.74</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td></td>
<td></td>
<td>0.49</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.71</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.69</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.55</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.65</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60</td>
<td>0.72</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% of variance</td>
<td></td>
<td>50.29</td>
<td>75.48</td>
<td>59.81</td>
<td>50.86</td>
<td>53.35</td>
<td>62.08</td>
<td>77.16</td>
<td>69.23</td>
<td>75.70</td>
<td>70.95</td>
<td>79.16</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td></td>
<td>3.01</td>
<td>4.52</td>
<td>3.58</td>
<td>3.05</td>
<td>3.20</td>
<td>4.63</td>
<td>4.15</td>
<td>4.54</td>
<td>4.25</td>
<td>4.35</td>
<td>4.15</td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 68 students*

**C. The Circumplex Nature of the CLES:**

To investigate the circumplex nature of the CLES correlations between the scales were calculated. The sample in Table is presented the results show that the correlations between a scale and the next scale.

The circumplex nature of the CLES, the result is presented in Table 4. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.
Table 4.
Scale Intercorelations for the CLES Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pr Actual</th>
<th>Pr Preferred</th>
<th>Uc Actual</th>
<th>Uc Preferred</th>
<th>Cv Actual</th>
<th>Cv Preferred</th>
<th>Sc Actual</th>
<th>Sc Preferred</th>
<th>Sn Actual</th>
<th>Sn Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr</td>
<td>0.66**</td>
<td>0.84**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uc</td>
<td></td>
<td></td>
<td>0.65**</td>
<td>0.86**</td>
<td>0.84**</td>
<td>0.86**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cv</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60**</td>
<td>0.85**</td>
<td>0.70**</td>
<td>0.81**</td>
<td>0.75**</td>
<td>0.81**</td>
</tr>
<tr>
<td>Sc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60**</td>
<td>0.85**</td>
<td>0.70**</td>
<td>0.81**</td>
</tr>
<tr>
<td>Sn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73**</td>
<td>0.73**</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

D. Validation of the TOBRA

To measure physics laboratory constructivist learning environment classes for upper secondary educational students at Grade 12 in ThakhonyangPittayakom School to their attitudes towards physics learning constructivist environment classes, the present study adapted the eight-item the Test Of Physics-Related Attitude (TOPRA) (Santiboon & Fisher, 2005[24]; Santiboon 2011[13], 2013[16], 2014[25]). Using internal consistency reliability the TOPRA had a value of 0.81 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of their Actual and Preferred Physics Laboratory Constructivist Learning Environment Classes

Table 1 and 2 are comparing differences between the students’ perceptions of their actual and preferred physics laboratory constructivists learning environment classes for upper secondary educational students at Grade 12 in ThakhonyangPittayakom School environment classes show in Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Personal Relevance, Physics Uncertainty, Critical View, Shared Control, and Student Negotiation scales than students’ actual perceptions.

![Graph showing mean scores](image)

Figure 1. Significant differences between physics students’ perceptions of their actual and preferred scores on the CLES.

The results of this study also indicate that using the CLES helps physics laboratory environment constructivists’ classes for the upper secondary educational students in ThakhonyangPittayakom School environment classes for physics teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into
consideration when planning and designing the physics laboratory constructivist environment classes for the upper secondary educational students in ThakhonyangPittayakom School environment constructivist’s classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the physics educational assessment and investigation of their classes.

Associations between Students’ Perceptions of Actual Physics Classroom Learning Constructivist’s Environments with the TOBRA

In this study, it was also considered important to investigate associations between physics laboratory learning constructivist environment classes for the upper secondary educational students in ThakhonyangPittayakom School environment classes of their physics classroom learning environments with their attitude toward physics classes. The Cronbach alpha reliability of the selected the TOBRA was 81, when using individual student as the unit of analysis. This suggests that the TOBRA is reliable for measuring students’ attitudes in physics classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOBRA that it’s reported in Table 5.

Table 5. Associations between CLES Scale and Attitude Scale to Physics Classroom Learning Assessing and investigating Constructivist Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regression Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>0.16*</td>
<td>0.17*</td>
<td></td>
</tr>
<tr>
<td>Physics Uncertainty</td>
<td>0.24*</td>
<td>0.23**</td>
<td></td>
</tr>
<tr>
<td>Critical View</td>
<td>0.18*</td>
<td>0.19*</td>
<td></td>
</tr>
<tr>
<td>Shared Control</td>
<td>0.15*</td>
<td>0.14*</td>
<td></td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>0.19**</td>
<td>0.18**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.7396**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.5471**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their physics educational assessing and investigating constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Physics Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their physics laboratory constructivist classes. In the other hand, the sample correlation values (r) are reported which shows statistically significant correlations between students’ attitudinal outcomes and assessing and investigating their physics laboratory learning environment constructivist’s classroom environment on all scales of the Actual Form.

Conclusions

The actual and preferred perceptions of 68 physics laboratory environment constructivist’s students for the upper secondary education in 2 classes in ThakhonyangPittayakom School of their physics laboratory environment constructivist’s classes were measured with the CLES. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their physics laboratory environment constructivist’s classes. In generally, students’ perceptions of their preferred physics laboratory environment constructivist’s classes were to greater than what they actually perceive to be provided. The results of this study also indicate that using the CLES helps
for assessing and investigating physics laboratory environment constructivist’s classes for the upper secondary educational students at Grade 12 in ThakhonyangPittayakom School of physics teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their physics classroom learning constructivist classes, with regard to the CLES, it was found that all of five scales were positively associated with students’ attitude to physics laboratory environment constructivist’s classes. The multiple correlation R is significant for the CLES and shows that when the scales are considered together there are significant associations with the TOBRA. The R² values indicate that 55%, with actual form of the valiance in students’ attitudes to their physics laboratory environment constructivist’s classes were attributable to their perceptions of their physics laboratory classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their physics laboratory environment constructivist’s lessons.

**Discussions and Implications**

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Physics teacher could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate Constructive Learning Environment Survey (CLES). This instrument provides the information of students’ perceptions on actual and preferred physics laboratory environment constructivist’s classes. The information from this instrument could be used for improvement and effectiveness teaching in physics subject to their laboratory classroom learning constructivist.

As described in the results section, upper secondary educational students at ThakhonyangPittayakom School classes show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the CLES questionnaire. Focusing on physics laboratory environment classes for upper secondary educational students in 4 classes in ThakhonyangPittayakom School classes show relatively favorable perceptions of their physics laboratory environment constructivist’s classes, with the higher score occurring for the whole prefer scales of the CLES. It seems that physics laboratory constructivist environment classes to improve and investigate developing constructivist lesson activities related to physics laboratory environment subject classes are operated rather as supplementary to theory classes rather than being independently important in their own right.

Overall, this study replicated previous studies using the CLES, with the findings being consistent with the situation in assessing and investigating physics laboratory constructivist environment constructivist’s classes in ThakhonyangPittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from this school environment. The present study produced several potentially fruitful results, but typically indicated directions for future classroom learning environment research in Thailand. Versions of the CLES are available to assess teachers’ perceptions of their own classroom environments and differences between teachers’ perceptions and those of their students could be a fruitful line of research. Previous learning environment research has indicated differences in the perceptions of students in the same classes and this also would be worth investigating, that also are needed to enhance our understanding of the results obtained from quantitative studies like this study, responsibility.

**Acknowledgements**

I am too greatest thankful of my supervisors; Assist. Prof. Dr. Toansakul Santiboon and Dr. Panwilai Chomchid of Master of Science of Education Program, Faculty of Education, Rajabhat Maha Sarakham University, whose encouragement, guidance and support instruments and computing system for analysis of this research. Too grateful of my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Rajabhat Maha Sarakham University.

**References**


Are my Students Collaborating Effectively in my Science Classroom Learning Environment Inventory at Grade 8th Level in Mittrapab School

Supawan Polrueang1, Kannika Polsan2, Toansakul Santiboon1,7 and Panwilai Chomchid1

1Departmen of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, 44000, Thailand
2Science Learning Group Science Mittrapab School

(*author for correspondence, E-mail address: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

Focusing on this research study is to despite international interest in research in the area of classroom environment to exploring how science teacher might apply ideas from the field of classroom environment in guiding practical improvements in lower secondary educational classes, to develop economical short forms of the actual and preferred questionnaires of the 25-Items My Class Inventory (MCI) instrument which is amenable to easy hand scoring was compared. When this instrument was administered to a small sample of 114 science lower secondary educational students at Grade level 8 in Mittrapab School in Mahasarakham Province was administered. Using statistically analysis supported the scale's internal consistency reliability, discriminant validity, and ability to differentiate between the perceptions of students in science classroom. Actual students’ perceptions of their classes to their attitudes with a short attitude version of the Test Of Science-Related Attitude (TOSRA) that they were translated into Thai language for administrating research methodology was associated. Statistically significant differences were found between the students’ perceptions of actual and preferred Classroom environment of their attitude toward their science classroom learning environment also were found. Students’ perceptions of their responses to their research instruments were differentiated. Cronbach’s alpha reliability coefficients for the scales were adequate (0.61-0.88), while confirmatory factor analyses provide support for the theoretical framework behind the questionnaire (0.41-0.92 omitted). The multiple correlations R² is significant for the MCI and considered associations with the TOSRA, and value indicates that 39% of the variance in students’ attitude was also determined.

Keyword: Mittrapab School, Perceptions, Science classroom, Learning

Introduction

Constructing the classroom learning environment more stimulating for students to improve their cognitive and affective outcomes is one of the major objectives of educators. The aspects of classroom learning environment such as satisfaction, friction, competitiveness, difficulty and cohesiveness are the most important variables which may be used for the prediction of the cognitive variables (e.g. stages of mental processing such as knowledge, comprehension, application, analysis, synthesis, & evaluation; and achievement) and evaluation of affective variables (e.g. self-esteem, attitudes, motivation, and satisfaction) (Wong, Young & Fraser, 1997).[1] Classroom learning environments include several characteristics which influence socio-psychological growth, intellectual development and academic achievement of students (LaRocque, 2008).[2] The classroom climate that is perceived as safe, friendly, warm, supportive and non-threatening has been reported to improve achievement, develop higher self-esteem, and promote more positive student attitudes toward their learning (Chionh & Fraser, 2009).[3] It has been also argued by Fraser & Fisher (1982) and LaRocque (2008) that making the aspects of classroom environment more congruent with the perceptions favoured by students may improve learning outcomes of students.

The classroom learning environment research has spanned more than three decades with significant contributions to the field of education. Reviews of research (Fraser, 1986; Fraser, 1998; Fraser & Walberg, 1991,[5], Haertel, Walberg & Haertel, 1981)[6] reported that most of the studies on classroom learning environments used the perceptual measures approach to investigate the nature of classroom learning environments. This approach involved the use of classroom environment instruments to measure teachers' and students’ perceptions of their classroom environments for investigating the nature of the classroom learning environment. These studies had developed many well-validated and robust classroom environment instruments for use in many countries in different classroom contexts (Fraser, 1998).[7]

Focusing on the early 2001, the Ministry of Education began developing new national curricula in an endeavor to model the system of education on child, or student-centered learning methods. The years from 2001 to 2009 showed some of the greatest improvements in education, experiments had also been tried with...
restructuring the administrative regions for education or partly decentralizing the responsibility of education to real change and many attempts to establish a clear form inappropriate or mismatched syllabus in the schools that it should be followed as the Thai policy government. The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Mitrapab Schoolat Grade 8 in Mahasarakham Province for demonstrating the reliability and validity of the My Class Inventory (MCI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Science-Related Attitude (TOSRA), the instruments need to be thoroughly analyzed psychometrically.

Science Education Classroom Learning Environment

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, current trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998).

Educational Classroom Learning Environments

Using students’ perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991)[8].

Science Education Learning Environment

In the past three decades, There are educational researchers (Walberg & Moos, 2011)[9] began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968)[10], Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos & Trickett 1984)[11]. The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979)[12], literature reviews (Fraser 1994; MacAuley, 1990; von Saudern, 1992)[13] and monographs sponsored by the American Educational Research Association’s Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994)[14].

Student Perceptions of Actual and Preferred Environments

An investigation of differences between students and teachers in their perceptions of the same actual classroom environment and of differences between the actual environment and that preferred by students or teachers was reported by Fisher and Fraser (1983) using the ICEQ with a sample of 116 classes for the comparisons of student actual with student preferred scores and a subsample of 56 of the teachers of these classes for contrasting teachers’ and students’ scores. Students preferred a more positive classroom environment than was actually present for all five ICEQ dimensions. Also, teachers perceived a more positive classroom environment than did their students in the same classrooms on four of the ICEQ’s dimensions. These results replicate patterns emerging in other studies in school classrooms in the USA (Moos 1979)[15], Israel (Hofstein & Lazarovitz, 1986)[16], The Netherlands (Wubbels, Brekelmans & Hooymayers 1991)[17] and Australia (Fraser & McRobbie 1995)[18], and in other settings such as hospital wards and work milieus (Moos 1974)[19].

Instrument for Assessing Classroom Environment

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher
Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974)[20] scheme for classifying human environments.

Selected Classroom Learning Environment Instrument for this Study
**My Class Inventory (MCI)**

The My Class Inventory (MCI) was the major instrument used in the present study (Abdul Majeed, Barry J. Fraser & Jill M. Aldridge, 2001)[21]. The initial development and validation of the Learning Environment Inventory (LEI) began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968)[22]. The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research).

The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O’Brien, 1985)[17]. Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study). The MCI differs in five important ways, in order to minimize fatigue among younger children, the MCI contains only five of the LEI's original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI's four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O'Brien (1985) developed a short 25-item version. Typical items are "Children are always fighting with each other" (Friction) and "Most children can do their school work without help" (Difficulty).

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>Extent of enjoyment of class work</td>
<td>The pupils enjoy their school work in my class.</td>
</tr>
<tr>
<td>Friction</td>
<td>Amount of tension and quarrelling among students</td>
<td>Many children in our class like to fight.</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Emphasis students competing with each other</td>
<td>Most children want their work to be better than their friend's work.</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Extent to which students find difficulty with the work of the class.</td>
<td>Most children can do their school work without help.</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Extent to which students know, help and are friendly towards each other</td>
<td>Some pupils in my class are not my friends.</td>
</tr>
</tbody>
</table>

To obtain a quick and easy assessment of their classroom environments, teachers can use the MCI. It satisfies two basic criteria (Fraser & Fisher, 1983a). First, the total number of items is small, thus providing economy in testing and scoring time. Because many teachers do not have ready access to computerized scoring methods, the MCI is suitable for easy hand scoring. Table 1 provides a scale description and sample item for the original form of the MCI.

**The Test Of Science-Related Attitude (TOSRA)**

This study investigated associations between Actual and Preferred students’ perceptions of their science learning environments classes in Mitraprab School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among science learning environments classes in Mitraprab School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their science learning environments classes. Furthermore, the TOSRA has
been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Actual and Preferred Forms of Scales**

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

**Materials and Methods**

**Research Objectives**

1. To assess student’s perceptions of their science learning environment classes at Grade 8 in Mittrapab School, Mahasarakham Province.
2. To compare between student’s perception of their actual and preferred science learning environment classes at Grade 8 in Mittrapab School, Mahasarakham Province.
3. To associate student’s attitudes of their perceptions to their actual science learning environment classes at Grade 8 in Mittrapab School, Mahasarakham Province.

**Research procedure**

Using the MCI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating science laboratory classroom learning environments in physics classroom learning environment for Lower secondary educational students at Grade 8 in Mittrapab School, Mahasarakham Province.

Each scale of the MCI were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3, 8, 18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.

**Data Analyses**

Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred MCI forms and the Attitude scale as specified in Fraser (1989)[19]. Factorial validity and adequacy of fit for the dimensionality of the MCI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the MCI with students’ attitudes to associate were analyzed.

**Sample**

This study is improved and developed students’ science classroom environment with actual and preferred student’s perceptions with a sample size 102 Lower secondary educational students at Grade level 8 in 4 classes in Mittrapab School, Mahasarakham Province, in the second semester in academic year 2014.
Results

Validity and Reliability of Research Instruments

A. Validation of the MCI

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 2.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>19.16</td>
<td>3.84</td>
<td>0.53</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.44</td>
<td>4.50</td>
<td>0.34</td>
<td>0.36</td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>17.88</td>
<td>3.58</td>
<td>0.49</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>19.56</td>
<td>3.90</td>
<td>0.58</td>
<td>0.32</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>17.56</td>
<td>3.55</td>
<td>0.49</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>19.56</td>
<td>3.91</td>
<td>0.52</td>
<td>0.30</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>19.90</td>
<td>3.93</td>
<td>0.41</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.33</td>
<td>4.48</td>
<td>0.49</td>
<td>0.46</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>22.44</td>
<td>4.49</td>
<td>0.49</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.95</td>
<td>4.57</td>
<td>0.47</td>
<td>0.35</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the five MCI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the MCI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.

Table 2: Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>0.73</td>
<td>0.69</td>
<td>4.24</td>
<td>0.16</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.63</td>
<td>0.69</td>
<td>10.33</td>
<td>0.22</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.74</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>0.63</td>
<td>0.62</td>
<td>6.98</td>
<td>0.19</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.71</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.65</td>
<td>0.61</td>
<td>11.50</td>
<td>0.24</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>0.77</td>
<td>0.60</td>
<td>4.47</td>
<td>0.17</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.87</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version MCI was determined by calculating Cronbach alpha coefficient for the 25 items using both actual and preferred environmental climates’ perceptions scores. Table 3 reports the internal consistency of the MCI, which ranged from 0.63 to 0.77 when using the students’ actual climate scores and from 0.71 to 0.94 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the MCI, which suggests that each scale of the MCI was able to differentiate significantly (p<0.05) between students’ perceptions in science environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 4.24 to 11.50 for different scales, respectively.
**B: The Circumplex Nature of the MCI:**

To investigate the circumflex nature of the MCI, correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale.

Table 3.
Scale Intercorelations for the MCI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cohesiveness</th>
<th>Friction</th>
<th>Difficulty</th>
<th>Satisfaction</th>
<th>Competitiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>0.46**</td>
<td>0.24*</td>
<td>0.39**</td>
<td>0.69**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.47**</td>
<td></td>
<td>0.68**</td>
<td>0.26*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td>0.59**</td>
<td>0.18*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.38**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

**C. Factor Loading Analysis of the MCI**

The Actual and Preferred Forms of the MCI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 4.
Factor Loadings for Items in the Actual Form of the MCI.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>16</td>
<td>0.72</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>0.95</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>0.69</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>0.85</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>21</td>
<td>0.72</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>0.95</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>22</td>
<td>0.85</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td>0.84</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>12</td>
<td>0.72</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.70</td>
<td>0.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>0.73</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.72</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>0.58</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.56</td>
<td>0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>0.55</td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>9</td>
<td>0.69</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>19</td>
<td>0.68</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td>0.65</td>
<td>0.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>24</td>
<td>0.64</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.53</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

%of variance

<table>
<thead>
<tr>
<th>Eigen value</th>
<th>Act.</th>
<th>76.92</th>
<th>33.81</th>
<th>33.35</th>
<th>32.92</th>
<th>55.91</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pref.</td>
<td>50.20</td>
<td>42.63</td>
<td>33.27</td>
<td>44.68</td>
<td>67.45</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 114 students
D. Validation of the TOPRA

To measure physics students’ attitudes towards science classroom learning environment in science learning group, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005; Santiboon & Fisher, 2005; Santiboon, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the TOSRA had a value of 0.80 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the MCI helps science classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the science classroom learning environment curriculum for the Mittrapab School students in physics classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in science classroom learning environments.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the MIC.

Associations between Students’ Perceptions of their Actual and Preferred Science Classroom Learning Environments toward their Attitude (TOSRA)

In this study, it was also considered important to investigate associations between students’ perceptions of their science classroom learning environments with their attitude toward science classroom learning environments subject. The Cranach alpha reliability of the selected TOPRA was 0.80, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in science classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOSRA that it’s reported in Table 6.

Table 6. Associations between MCI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regress Weigh Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>3.17*</td>
<td>0.18*</td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>3.22**</td>
<td>0.23**</td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>3.45***</td>
<td>0.43***</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>3.19**</td>
<td>0.20**</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>3.22**</td>
<td>0.24**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6258**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R²  
0.3916**

*Correlation is significant at the 0.05 level (2-tailed)  
**Correlation is significant at the 0.01 level (2-tailed)  
***Correlation is significant at the 0.001 level (2-tailed)

In Table 6, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science classroom learning environments on all scales. These
associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favorable attitude towards their science classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their science classroom learning environments on all scales of the Actual Form.

**Discussion and Implementations**

Table 6 is compared to investigate associations between physics students’ perceptions of their science classroom learning environments with their attitude toward science classes. Using the MCI instrument in the higher education level, Mittrapab School, Thailand, will help teachers to evaluate their learning environments in science classroom learning environments in order to improve their education process. Furthermore, the information from the MCI could be useful as the guide to enhance the effectiveness of science classes. The effectiveness in science classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of science classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 114 student of their science classroom learning environments were measured with the MCI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their science classroom learning environments. In general, students’ perceptions of their preferred science classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the MCI helps physics teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science classroom learning environments with regard to the MCI, it was found that all of five scales were positively associated with students’ attitude to science classroom learning environments. The multiple correlation \( R \) is significant for the MCI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The \( R^2 \) values indicate that 59%, with actual form of the valiance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights (\( \beta \)) show that in classes where the students perceived greater than all scales in their science classroom learning environments lessons.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (MCI).This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science classroom learning environments.

Overall, this study replicated previous studies using the MCI, with the findings being consistent with the situation in Mittrapab School Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the science classroom learning environments, interestingly.

**Acknowledgements**

I am heartily thankful to my supervisors; Assist. Prof. Dr. Toansakul Santiboon and Dr. Panwilai Chomchid of Master of Science of Education Program, Faculty of Education, Mittrapab School, whose encouragement, guidance and support instruments and computing system for analysis of this research. I am grateful to my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Mittrapab School.

**References**


Using the Individual Classroom Environments Questionnaire (ICEQ) to Associations Between Students’ Perceptions of their Chemistry Classes and their Attitudes Toward Chemistry

Supranee Aengsutha¹, Wandee Rakrai², Amorn Panitsiri¹ and Toansakul Santiboon¹,³

¹Department of Master of Science Education, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Department of Chemistry Program Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
³Department of Science, Mahawichanukool School Maha Sarakham, Thailand 44000

(¹author for correspondence, E-mail address: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

Using the international research instruments; the Individualized Classroom Environment Questionnaire (ICEQ) measure chemistry classroom learning environments for students’ individual outcomes? Researchers are to describe and answer for using data from 88 upper secondary school students at the Tenth-Grade level in 2 chemistry classes in Mahawichanukoon school on the Individualized Classroom Environment Questionnaire (ICEQ) were associated their students’ attitude with the Test Of Chemistry-Related Attitude (TOCRA) toward chemistry studies were analyzed. Using the compare mean difference, factor analysis, scaleinter-correlations, multilevel variance components models, and standardized regression coefficient to derive interaction class correlations to determine the degree to which ICEQ scores may validly be said to measure aspects of chemistry classroom learning environments as against individual student attitude. The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all five ICEQ scales. Subsequent analyses showed that significant proportions of variance were attributable to the school variable. In these terms, the ICEQ may be considered to be a relatively good measure of chemistry classroom environment. The multiple correlation R is significant for the Actual Form of the ICEQ and shows that when the five scales are considered together there is significant (p < 0.05) association with the TOCRA, the R² value indicates that 21.39% of the variance in students’ attitude to their chemistry class was attributable to their perceptions of their individual classroom learning environment in chemistry classes, interestingly.

Keywords: Associating, Chemistry classroom, Questionnaire, Individual (ICEQ), Perceptions

Introduction

Background of Science Educational System in Thailand

The Thai Education System is one of the Worst in S.E. Asia and is Worsening Every Year. In the Thai education system for more than three years and during this time learned quickly how bad the education system in Thailand. To be plagued by inadequate funding, huge class sizes (more than 50 students to a class), terrible teacher training, lazy students and a system that forces teachers to pass students even though they’ve actually failed - there doesn't seem to be much hope education in Thailand will improve any time soon. In a private bilingual school, so had many less problems than exist in government schools were compared? Even here though, the school falls under Ministry of Education bureaucracy, which is one of the most ridiculously inept in the world. Rules change every semester, new guidelines are handed down to teachers regarding course content, lesson plans, testing etc at the beginning of each new semester, then change again the following semester. Teachers are told to pass students, even though they've failed, and a blind eye is turned to serious problems like plagiarizing.

Every year, the Ministry of Education brings into effect another bright idea for improving education in Thailand. This year's bright idea is to force every Western teacher teaching in Thailand to take a Thai Culture course. Regardless that many teachers have been here for years and are well-versed in Thai culture, in order to get a teacher's license or renew one, they will be forced to take this course. Education in Thailand is provided mainly by the Thai government through the Ministry of Education from pre-school to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years' school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable.
Admission to an upper secondary school is through an entrance exam. On the completion of each level, students need to pass the NET (National Educational Test) to graduate. Children are required to attend six years of elementary school and at least the first three years of high school. Those who graduate from the sixth year of high school are candidates for two decisive tests: O-NET (Ordinary National Educational Test) and A-NET (Advanced National Educational Test). The school year is divided into two semesters. The first begins in the beginning of May and ends in October; the second begins in November and ends in March.

Most students attend formal educational institutions administered by the Ministry of Education and about half of these children enroll in learning childcare/development centers of the formal education system, mainly administered by the Department of Local Administration. The Office of Basic Education Commission (OBEC) prepares the basic core curriculum and disseminates it to all Educational Service Area (ESA) Offices for distribution to parents, guardians and teachers, so as to ensure that all key stakeholders combine efforts to provide school children with quality education. The 10-Year Plan and Policy for the Basic Educational Secondary Development (2006-2015) provides a blueprint for achieving universal student education for all Thai children. The 10-Year Plan and Policy gives priority to three main strategies, namely; (1) to support youth development; (2) to support parents and other stakeholders; and (3) to promote an environment that facilitates secondary educational learners.

**Selected the Classroom Learning Environment**

Research on selected the classroom learning environment during the past 35 years, the study of classroom environments has received increased attention by researchers, teachers, school administrators and administrators of school systems. The concept of environment, as applied to educational settings, refers to the atmosphere, ambience, tone, or climate that pervades the particular setting. Focused historically on researches in psychosocial dimensions, those aspects of the environment concerned with human behaviour in origin or outcome (Boy and Pine, 1988)[1]. Fraser (1998b)[2], Dorman (2002)[3], Goh and Khine (2002)[4] and Khine and Fisher (2003)[5]reviewed of classroom environment research have delineated at least 10 areas of classroom environment research including: associations between classroom environment and outcomes, evaluation of educational innovations, differences between students’ and teachers’ perceptions of classrooms, comparisons of actual and preferred environments, effect on classroom environment of antecedent variables, transition from primary to secondary school, school psychology, teacher education, educational productivity research, and using environment instruments to facilitate changes in classroom life, sincerely.

**Science Classroom Learning Environments for these Studies**

The Individualized Classroom Environment Questionnaire (ICEQ)

**The Individualized Classroom Environment Questionnaire (ICEQ)** is designed to measure student or teacher perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information about: (1) the validity of the ICEQ; (2) differences between scores on different forms of the ICEQ; (3) relationships between student learning outcomes and perceptions of classroom individualization; and (4) relationships between student learning outcomes and actual/preferred congruence. A copy of the ICEQ is appended.

**Context of Mahawichanukoon School**

Normally, almost all villages have an elementary school. Most sub-districts have a school for ages 6 through 14 and all districts have secondary schools for ages 12 through 17. Many have vocational colleges for students from age 15. The government is not able to cope with the entire number of students, thus the private sector, which is supervised by the government, provides a significant contribution. The level of education in the private sector is generally, but not always, higher than that of the government schools. Expensive, exclusive private and international schools provide for a high level of achievement and a large number of their students continue their education at universities abroad. Charitable organizations (missionary societies or diocesan), and other religious provide the backbone of non-government, low-fee, general education and some established universities, and their standard is relatively high. Cheaper, newer and individual private schools, are occasionally run for profit and government subsidies than for results, and are often indistinguishable from government schools in terms of quality of buildings, resources, teaching competency, and overcrowded classrooms. Their only real benefit is the prestige afforded to the parents for schooling their children in the private sector. In rural schools, absenteeism among both students and teachers is high due to family and farming commitments. Some schools close down during rice planting and harvesting seasons.

At elementary levels, students follow eight core subjects each semester: Thai language, mathematics, science, social science, health and physical education, arts and music, technology, and foreign languages. At age 16 (Matthayom 4), students are allowed to choose one or two elective courses. The science program (Wit-Kanit) and the mathematics-English language program (Sil-Kammuan) are among the most popular. Foreign language
In other words, Thailand stands right at the top of the poorest performing countries in the development of science classrooms (Sil-Phasa), and the social science program (sometimes called the general program) are also offered. Both elementary and secondary level has special programs for students called English Program and Gifted Program. In English Program students can learn almost every subject in English except for Thai and Social Studies. The Gifted Program is the Mathematics-Science program.

Focusing on Mahawichanu koon school is a rural or government school located in Wangnang Sub-district and Mueang District, MahaSakham, Thailand. It admits from lower to upper secondary students (Grade level at of 7-12) and has the largest yearly enrolment in MahaSakham. Founded in 1966 A.D. as a Baan Nonsumran, Mueng District, MahaSakham for being supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. Mahawichanu koon School offers among the development, enhancement, and improvement entry rates for local Thai schools. The school has 4 buildings, 12 classrooms, 4 laboratory classes. This school composes with 222 students, 35 senior professional teachers; a schooling administrator is Kasama Bunbanjong, Amorn Panitsiri is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

**Important Problems in Science Secondary Educational Classroom Learning Environment in this study**

Thailand has formulated a policy and framework for action on education for all in the 1992 National Education Scheme in compliance with the World Declaration on Education for All adopted by all UNESCO Member States during the World Conference on Education for All in March, 1990 at Jomtien, Chonburi, Thailand. The scheme aims at guiding all related agencies to implement their activities. The World Declaration will have reached one-decade old in 2000 since its adoption. An assessment on education for all will be conducted to follow up the progress of the management of education for all in UNESCO Member States. UN agencies, namely, UNESCO, UNICEF, UNDP, UNFPA, and the World Bank, have jointly published a Guideline for the Assessment as well as provided technical assistance to Member States.

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the transition to lower and upper secondary education levels was approximately 90 % and it tends to be on a continual increase. The provision of pre-primary education was obviously extended as the number of school age children having obtained this level of education was relatively higher from 1990 to 68.64 %. The approaches of the provision of this level of education are offered through the Community Child Care Centers, Child Care attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary education is 91.32 % with equal opportunity in terms of gender. These are some of the successful models of education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to undertake the national activities in providing education for all.

This study will be made possible by the assistance of agencies relating to basic education for all, both central and regional offices under the Ministry of Education as well as other relevant agencies outside the Ministry of Education. Additionally, UNESCO has also rendered its technical and financial support to the Ministry while UNICEF has assisted in translating the report into English. The Thai Ministry of Education, as the focal point of the Assessment of EFA 2000, would like to express its sincere appreciation to all concerned and hope that this report would be of benefited to widen circles of readers.

Unfortunately that isn’t the kind of good news for Asia that Thailand can share. The PISA tests of all know that Thai students’ performance in international standardized tests is generally below average. That’s not a surprise given such appalling scores they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor. However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is on school students, the international test that is the most relevant and highly regarded for measuring performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA 2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above 15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan, Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such as Chile, Turkey and Romania.

In an article published in the Bangkok Post on July 7, 2014, TC’s Thomas Corcoran outlines his views on the challenges in the teaching and learning of science in Thai secondary schools. Corcoran directs the College’s
participation in the Consortium for Policy Research in Education (CPRE), the oldest federally funded education policy center in the United States, of which TC President Susan Fuhrman is the founding director. “The biggest problem that students face is time,” says Corcoran, a curriculum expert who has played a major role in TC’s work in Jordan. “The problem is, basically, at Thailand’s lower-secondary level. Only 120 minutes a week are allocated to science. That’s about half of what most of the rest of the world provides for that age group. A typical schedule would include 240 to 250 minutes a week for science.” Corcoran led a project evaluation of the Inquiry Based Science and Technology Education Program (IN-STEP), a public-private science education initiative designed to improve teaching and learning in science in Thai lower secondary schools (Corcoran, 2014)[6].

Thailand has tried to do quite a lot of things in the past decade setting up the NIETS to organize O-NET was among them, but evidently the initiatives haven’t yielded good results. Thailand’s PISA scores over the past nine years have shown no discernable progress whatsoever. A lot of money has been put into the Thai education system: 20% of overall national budget or 4% of GDP. That rate of spending puts Thailand among the top spenders on education-more than what Singapore and Japan spend relative to size, although other top performers such as Hong Kong and South Korea, and neighboring countries such as Malaysia and Vietnam, also spend around 4-5% of their GDP on education. Yet, as this situation has seen, Thailand’s results leave much to be desired.

Focusing on this research study, Chemistry classroom environment dimensions have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of school. This study will be established associations between teacher personality and classroom environment, and will report differences in the chemistry classroom environment perceptions of Mahasarakham students, the individual cultural differences in student perceptions of teacher-student interaction and their classroom learning environments.

This study wills also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample Chemistrystudents in 12 classes and a school environment instrument to 35 teachers of these classes, only weak associations between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

Research purposes

1. To explore between students’ perception of their actual Chemistry Classroom learning environment and their attitude toward chemistry class in Mahawichanukoon school at level 11.
2. To associate between actual student perception and their attitudes in chemistry classes in Mahawichanukoon School at level 11.

Previous research

Lim (2006)[7] assessed of students’ perceptions of classroom environment and their learning styles provided a framework within which to study factors related to perceptions of students in learning. Two instruments, the Individualized Classroom Environment Questionnaire (ICEQ) and the Learning Style Inventory 1985 (LSI), were administered in Singapore to a stratified random sample of 1733 Secondary 4 students (equivalent to Grade 10) from nine secondary schools (good, average and below average schools). The study showed that school type (the category of schools that the students come from), had the most influence on the students’ perceptions of both actual and preferred classroom environment. Gender had an influence too, but mainly on perceptions of actual classroom environment. Learning styles of students had the least influence.

Fraser, (1981)[8] used the Individualized Classroom Environment Questionnaire (ICEQ), Constructivist Learning Environment Survey (CLES), Test of Mathematics-Related Attitudes (TOMRA), and concept map tests were administered to two groups of fifth-grade students as pretests and posttests over an academic year were assessed. To enrich the data collected from those questionnaires, three case studies (one for the experimental group and two for the control group) were undertaken based on observations and interviews of selected students. Relative to non-students, students experienced more favorable changes in terms of mathematics concept development, attitudes to mathematics, and perceived classroom environments on several dimensions of the CLES (e.g., Personal Relevance, Shared Control) and the ICEQ (e.g., Participation and Differentiation). Qualitative information based on classroom observations and student interviews reinforced and enriched the patterns of results obtained from the concept test and questionnaires.

Fraser and Azmi (2003)[9] studied in extensive research conducted in developed countries has established classroom learning environment as a thriving field of study. The present investigation makes a contribution to
classroom environment research in that it involved the translation into Indonesian of scales previously available only in English, and the subsequent validation and use of these translated scales among Indonesian students. The new Indonesian instrument consists of nine seven-item scales based upon the Individualized Classroom Environment Questionnaire and the Classroom Environment Scale. Analyses of data collected from a sample of 373 Indonesian students from nine schools supported the new instrument’s internal consistency, discriminant validity, ability to differentiate between classrooms, and predictive validity (i.e. ability to predict student outcomes). Potential applications of the new instruments in Indonesian classrooms are suggested.

Materials and Methods

Research Procedures
Using the ICEQ was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating chemistry laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 11 in Mahawichanukoon School, MahaSarakham, and Province. Each scale of the ICEQ were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1,2,3,4 and 5; the second scale, Participation is composed the item of 6,7,8,9 and 10; the third scale, Independence is composed the item of 11,12,13,14 and 15; the fourth scale, Investigation is composed the item of 16,17,18,19 and 20; the fifth scale, Differentiation is composed the item of 21,22,23,24 and 25.

Research Instrument
The Individual Classroom Environments Questionnaire (ICEQ)
Basically, the Individualized Classroom Environment Questionnaire (ICEQ) is designed to measure student perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information, such as the validity of the ICEQ; differences between scores on different forms of the ICEQ; relationships between student learning outcomes and perceptions of classroom individualization; and relationships between student learning outcomes and actual/preferred congruence. A copy of the ICEQ is appended.

The ICEQ assesses those dimensions which distinguish individualized classrooms from conventional ones. The initial development of the ICEQ was guided by: the literature on individualized, open and inquiry-based education; extensive interviewing of teachers and secondary school students; and reactions to draft versions sought from selected experts, teachers and junior high school students. The final published version of the ICEQ (Fraser, 1990) contains 50 items altogether, with an equal number of items belonging to each of the five scales. Each item is responded to on a five point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items. Typical items are “The teacher considers students’ feelings” (Personalization) and “Different students use different books, equipment and materials” (Differentiation). The copyright arrangement gives permission to purchasers to make an unlimited number of copies of the questionnaires and response sheets. (Fraser, 1998)

The Test of Chemistry-Related Attitude (TOCRA)
This study investigated associations between Actual students’ perceptions of their chemistry laboratory environment classes in Mahawichanukoon School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) and Santiboon (2014) was modified, adapted, and selected to the Test Of Chemistry-Related Attitude (TOCRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in Mahawichanukoon School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their chemistry laboratory environment classes. Furthermore, the TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Sample
This study is explored and described based on the developing students’ chemistry laboratory classroom environment with actual and preferred student’s perceptions with a sample size 166 upper secondary educational students at Grade level 10 in 4 classes in Mahawichanukoon School, MahaSarakham Province, in the first semester in academic year 2015.

Data Analysis
Assuming the scales of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred ICEQ forms and the
Attitude scale as specified in Santiboon (2014)[12]. Factorial validity and adequacy of fit for the dimensionality of the ICEQ were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the ICEQ with students’ attitudes to associate were analyzed.

Results

Validity and Reliability of Research Instruments

Validation of the ICEQ

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard deviation</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>16.36</td>
<td>3.27</td>
<td>15.16</td>
<td>3.89</td>
<td>0.84</td>
<td>0.85</td>
<td>6.53***</td>
</tr>
<tr>
<td>Participation</td>
<td>16.98</td>
<td>3.40</td>
<td>17.43</td>
<td>4.16</td>
<td>0.84</td>
<td>0.85</td>
<td>2.54**</td>
</tr>
<tr>
<td>Independence</td>
<td>16.83</td>
<td>3.37</td>
<td>20.58</td>
<td>4.54</td>
<td>0.87</td>
<td>0.84</td>
<td>3.58***</td>
</tr>
<tr>
<td>Investigation</td>
<td>16.02</td>
<td>3.20</td>
<td>13.44</td>
<td>3.67</td>
<td>0.82</td>
<td>0.86</td>
<td>2.01*</td>
</tr>
<tr>
<td>Differentiation</td>
<td>16.31</td>
<td>3.26</td>
<td>19.30</td>
<td>4.39</td>
<td>0.88</td>
<td>0.84</td>
<td>3.17**</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five ICEQ scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the ICEQ. For the remaining five scales, namely; Personalization, Participation, Independence, Investigation, and Differentiation scales.

The internal consistency reliability of the version ICEQ used in this study was determined by calculating Cronbach alpha coefficient for the 25 items of the ICEQ using both actual and preferred environmental climates’ perceptions scores. And reports the internal consistency of the ICEQ, which ranged from 0.82 to 0.88. This characteristic was explored using a series of one-way analyses of variance on the scales of the ICEQ, which suggests that each scale of the ICEQ was able to differentiate significantly (p<0.001) between students’ perceptions in my school and my dream school environmental climates in the same school.

The Circumplex Nature of the ICEQ

To investigate the circumplex nature of the ICEQ correlations between the scales were calculated. The sample in Table 2 is presented the results show that the correlations between a scale and the next scale.

Table 2.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.91**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.73**</td>
<td>0.89**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.79**</td>
<td>0.91**</td>
<td>0.81**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>0.48**</td>
<td>0.70**</td>
<td>0.80**</td>
<td>0.08**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)
As expected, the results show that the correlation between a scale and the scale next it generally is high, and becomes higher for scales further away from that scale. This is illustrated using the five scales in Table 2. In generally, the circumflex nature of the ICEQ has been confirmed.

**Validation of the TOSRA**

To measure students’ attitudes towards chemistry classes, the present study adapted the tenth-item Attitude Scale (Santiboon, 2014)[12], which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981)[8]. Using internal consistency reliability the TOCRA had a value of 0.84 which was considered satisfactory for further use in this study.

**Factor loading Analysis of the ICEQ**

The Actual Form of the ICEQ were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

<table>
<thead>
<tr>
<th>Item</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.848</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.838</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.803</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.798</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.780</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>0.800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>0.612</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>0.607</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>0.577</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>0.489</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.904</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.776</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.633</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.544</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.470</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.891</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.863</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.860</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.810</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.762</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.862</td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.807</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.833</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.531</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.437</td>
</tr>
<tr>
<td>% of variance</td>
<td>60.46</td>
<td>61.71</td>
<td>67.16</td>
<td>60.52</td>
<td>69.38</td>
</tr>
<tr>
<td>Eigen value</td>
<td>3.02</td>
<td>3.09</td>
<td>3.36</td>
<td>3.03</td>
<td>3.47</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 42 students

**Associations between Students’ Perceptions of their Actual Chemistry Laboratory Classroom Learning Environments toward their Attitude (TOCRA)**

In this study, it was also considered important to investigate associations between students’ perceptions of their physics laboratory classroom learning environments with their attitude toward physics laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOCRA was 0.81, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in physics laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOCRA that it’s reported in Table 4.
Table 4. Associations between ICEQ scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Simple Correlate Attitude (r)</th>
<th>Std. Regress Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.13*</td>
<td>0.18*</td>
</tr>
<tr>
<td>Participation</td>
<td>0.77*</td>
<td>1.45*</td>
</tr>
<tr>
<td>Independence</td>
<td>0.15*</td>
<td>0.24*</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.95*</td>
<td>1.24*</td>
</tr>
<tr>
<td>Differentiation</td>
<td>0.46**</td>
<td>0.72**</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments Individualized Classroom Environment Questionnaire (ICEQ). This instrument provides the Chemistry laboratory environment classes of students’ perceptions on actual Chemistry laboratory environment classroom learning environments. The information from this instrument could be used for improvement and effectiveness teaching in physic laboratory environment classes.

As described in the results section, Mahawichanukoon School’s students show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the ICEQ questionnaire. Overall, Mahawichanukoon School’s students show relatively favorable perceptions of their Chemistry laboratory environment classes, with the lowest score occurring for the Differentiation scale. It seems that chemistry laboratory environment classes’ activities related to chemistry laboratory environment classes are operated rather as supplementary to theory classes rather than being independently important in their own right. Overall, this study replicated previous studies using the ICEQ, with the findings being consistent with the situation in Mahawichanukoon School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the Chemistry laboratory environment classes, interestingly.

Acknowledgments

Firstly, I would like to thank the 22 chemistry students in Mahawichanukoon School at the Grade level 11 who were part of the study. Thank you to the Kasama Bunbanjong, and Amorn Panitsirir who allowed students to complete the questionnaire. Secondary, I would like to my fellow Master of Science students; Chatchai Natakhom, Jeeraporn Saraboon, Wipaporn Panpom, and Noppadone Manolai to advise some problem point for fixing up commendation from my supervisor and co-supervisor. Thirdly, I must thank you my supervisor; Wandee Rakrai and my co-supervisor; they understood and never pushed me to build up of my research that it was going on work, completely. Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout the this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Improving Students’ Learning Achievements in Chemistry Classroom Learning Environments of the Grade 12th Level Upper Secondary

Sopida Senanorit1, Kittima Promruksa2, Wiriyaporn Montripoea3 and Toansakul Santiboon1,*

1Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
2Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
3Science Learning Group Section, Chaingyeun Pittayakom School, Muang Distric, Maha Sarakham, Thailand, 44000

(*author for correspondence. E-mail: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

This study on the relationship between students perceptions of the learning environment of chemistry classroom and their attitudes as well as self-activity towards chemistry, the chemistry outcomes were investigated with the My Class Inventory (MCI); the psychological international research instrument. It examines data from 90 grade 12th students in upper secondary schools to identify how students’ perceptions of the learning environment variables and the extent to which these predict the chemistry outcomes were associated of their attitude with the Test Of Chemistry-Related Attitude (TOCRA) toward chemistry studies were analyzed. Using the compare mean difference, factor analysis, scale inter correlations, multilevel variance components models, and standardized regression coefficient to drive interaction class correlations to determine degree to which MCI scores may validly be revealed to measure aspects of chemistry classroom learning environments as against student attitude. The results indicated that the variable accounted for large and noteworthy proportions of overall variance in all five MCI scales were assessed. It has showed significant proportions of variance were attributable to school variable were analyzed. In terms of the MCI may be considered to be a relative better than measuring chemistry classroom environments. The simple and multiple correlation R2 value indicates that 34% of the variance in students’ attitude to chemistry classes were attributable to their perception of their classroom learning environment in chemistry classes, amazingly.

Keyword: Learning environment, Students, Perceptions, My Class Inventory (MCI), Chemistry classroom

Introduction

Background of Science Educational System in Thailand

Education in Thailand is provided mainly by the Thai government through the Ministry of Education from preschool to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable (Ministry of Education, 2010).

The school structure is divided into four key stages: the first three years in elementary school, the first primary level or Prathom 1–3, are for age groups 7–9 (Grade 1-3); the second primary level or Prathom 4 through 6 are for age groups 10–12 (Grade 4-6); the third lower secondary level or Matthayom 1–3, is for age groups 13–15 (Grade 7-9). The upper secondary level of schooling consists of Matthayom 4–6 for age groups 16–18 (Grade 10-12), and is divided into academic and vocational streams. There are academic upper secondary schools, vocational upper secondary schools and comprehensive schools offering academic and vocational tracks. Students who choose the academic stream usually intend to enter a university. Vocational schools offer programs that prepare students for employment or further studies.

The Institute for the Promotion of Teaching Science and Technology (IPST)

There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as; curricula, teaching/learning process, media and materials then publicize them to all relevant
organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner's development. To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations (IPST, 2011).

Science Classroom Learning Environments
During the past 35 years, the study of classroom environments has received increased attention by researchers, teachers, school administrators and administrators of school systems. The concept of environment, as applied to educational settings, refers to the atmosphere, ambience, tone, or climate that pervades the particular setting. Research on classroom environments has focused historically on its psychosocial dimensions, those aspects of the environment concerned with human behaviour in origin or outcome (Boy and Pine, 1988). Reviews of classroom environment research by Fraser (1998), Dorman (2002), Goh and Khine (2002) and Khine and Fisher (2003) have delineated at least 10 areas of classroom environment research including: associations between classroom environment and outcomes, evaluation of educational innovations, differences between students’ and teachers’ perceptions of classrooms, comparisons of actual and preferred environments, effect on classroom environment of antecedent variables (for example, gender, year level, school type, subject), transition from primary to secondary school, school psychology, teacher education, educational productivity research, and using environment instruments to facilitate changes in classroom life.

Important Developments with Learning Environment Instruments

Personal Forms of Scales
Fraser and Tobin (1991) pointed out that there was potentially a major problem with nearly all existing classroom instruments when they are used to identify differences between subgroups within a classroom (e.g., males and females) or in the construction of case studies of individual students. The problems are that items are worded in such a way that they elicit an individual student's perceptions of the class as a whole, as distinct from a student's perceptions of his/her own role within the classroom. For example, items in the traditional class form might seek students’ opinions about whether 'the work of the class is difficult' or whether 'the teacher is friendly towards the class'. In contrast, a personal form of the same items would seek opinions about whether 'I find the work of the class difficult' or whether 'the teacher is friendly towards me'. Confounding could have arisen in past studies which employed the class form because, for example, males could find a class less difficult than females, yet males and females still could agree when asked for their opinions about the class as a whole. The distinction between personal and class forms is consistent with Stern, Stein and Bloom's (1956) terms of 'private' beta press, the idiosyncratic view that each person has of the environment, and 'consensual' beta press, the shared view that members of a group hold of the environment.

Instruments for Assessing Classroom Environment
Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos's (1974) scheme for classifying human environments. Moos's three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur) and System Maintenance and System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Selected the Classroom Learning Environments for this Study

My Class Inventory (MCI)
The LEI has been simplified to form the MCI for use among children aged 8-12 years (Fisher & Fraser 1981; Fraser, Anderson & Walberg 1982; Fraser & O'Brien 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be very useful with students in the junior high school, especially those who might experience reading difficulties with other instruments. The MCI differs from the LEI in four important ways. First, in order to minimise fatigue among younger children, the MCI contains only five of the LEI's original 15 scales. Second, item wording has been simplified to enhance readability. Third, the LEI's four-point response format has been reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring
Basic subject areas, namely buildings, resources, teaching competency, and overcrowded classrooms. Their only real solution and management supporting the public education system, provides a significant contribution. The level of education in the private universities, and especially in the higher education levels, is generally higher than that of the government schools. Expensive, exclusive private and international schools provide for a high level of achievement and a large number of their students continue their education at universities abroad. Charitable organizations (missionary societies or diocesan, and other religions provide the backbone of non-government, low-fee, general education and some established universities, and their standard is relatively high. Cheaper, newer and individual private schools, are occasionally run more for profit and government subsidies than for results, and are often indistinguishable from government schools in terms of quality of buildings, resources, teaching competency, and overcrowded classrooms. Their only real benefit is the prestige afforded to the parents for schooling their children in the private sector. In rural schools, absenteeism among both students and teachers is high due to family and farming commitments. Some schools close down during rice planting and harvesting seasons.

At elementary levels, students follow eight core subjects each semester: Thai language, mathematics, science, social science, health and physical education, arts and music, technology, and foreign languages. At age 16 (Matthayom 4), students are allowed to choose one or two elective courses. The science program (Wit-Kanit) and the mathematics-English language program (Sil-Kamnuan) are among the most popular. Foreign language programs (Sil-Phasa), and the social science program (sometimes called the general program) are also offered. Both elementary and secondary level has special programs for students called English Program and Gifted Program. In English Program students can learn almost every subject in English except for Thai and Social studies.

Important Problems in Science Secondary Educational Classroom Learning Environment in this study

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the transition to lower and upper secondary education levels was approximately 90% and it tends to be on a continual increase. The provision of pre-primary education was obviously extended as the number of school age children having obtained this level of education was relatively higher from 1990 to 68.64%. The approaches of the provision of this level of education are offered through the Community Child Care Centers, Child Care attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary education is 91.32% with equal opportunity in terms of gender. These are some of the successful models of education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to undertake the national activities in providing education for all. In addition to such concerted efforts, Section 43 of the 1997 Constitution stipulates that all Thai citizens shall enjoy their right to education which will be provided by the government to all citizens at least twelve years of basic education with quality and free of charge. The 1999 National Education Act also legislates that compulsory education shall be extended from six to nine years and shall be completely undertaken within the year 2002. These policies reflect the models of education administration and management supporting the...
provision of education for all in compliance with the goals. About 10% of the out-of-school youth, particularly the disadvantaged, require special needs to enable them to maintain in the formal education system. Both public and private agencies, have undertaken several projects to enable this group to access to formal education system. Consequently, some duplications and inequitable distribution of services were seen. Therefore, the assessment of EFA 2000 will help identify problems and solutions to ensure that the current education reform will yield maximum impacts in improving efficiency of education for all.

This study will be made possible by the assistance of agencies relating to basic education for all, both central and regional offices under the Ministry of Education as well as other relevant agencies outside the Ministry of Education. Additionally, UNESCO has also rendered its technical and financial support to the Ministry while UNICEF has assisted in translating the report into English. The Thai Ministry of Education, as the focal point of the Assessment of EFA 2000, would like to express its sincere appreciation to all concerned and hope that this report would be of benefited to wider circles of readers.

Unfortunately that isn’t the kind of good news for Asia that Thailand can share. The PISA tests of all know that Thai students don’t belong in the same class as the world-class East Asian. Of course Thailand has a few of our own some stellar students who win medals at the math and science Olympiads but their scholastic achievements are at odds with the general performance of their peers in the Thai education system. Thai students’ performance in international standardized tests is generally below average. That’s not a surprise given such appalling scores they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor. However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is on school students, the international test that is the most relevant and highly regarded for measuring performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA 2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above 15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan, Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such as Chile, Turkey and Romania.

In an article published in the Bangkok Post on July 7, 2014. TC’s Thomas Corcoran outlines his views on the challenges in the teaching and learning of science in Thai secondary schools. Corcoran directs the College’s participation in the Consortium for Policy Research in Education (CPRE), the oldest federally funded education policy center in the United States, of which TC President Susan Fuhrman is the founding director. “The biggest problem that students face is time,” says Corcoran, a curriculum expert who has played a major role in TC’s work in Jordan. “The problem is, basically, at Thailand’s lower-secondary level. Only 120 minutes a week are allocated to science. That's about half of what most of the rest of the world provides for that age group. A typical schedule would include 240 to 250 minutes a week for science.” Corcoran led a project evaluation of the Inquiry Based Science and Technology Education Program (IN-STEP), a public-private science education initiative designed to improve teaching and learning in science in Thai lower secondary schools (Corcoran, 2014).

What has Thailand done to improve the quality of education in the past decade? Thailand has tried to do quite a lot of things in the past decade setting up the NIETS to organize O-NET was among them, but evidently the initiatives haven’t yielded good results. Thailand’s PISA scores over the past nine years have shown no discernable progress whatsoever. A lot of money has been put into the Thai education system: 20% of overall national budget or 4% of GDP. That rate of spending puts Thailand among the top spenders on education—more than what Singapore and Japan spend relative to size, although other top performers such as Hong Kong and South Korea, and neighboring countries such as Malaysia and Vietnam, also spend around 4-5% of their GDP on education. Yet, as this situation has seen, Thailand’s results leave much to be desired.

Focusing on this research study, chemistry classroom environment dimensions have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of school. This study will be established associations between teacher personality and classroom environment, and will report differences in the chemistry classroom environment perceptions of ChaingyeunPittayakom School students, the individual cultural differences in student perceptions of teacher-student interaction and their classroom learning environments.

This study will also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample chemistry students in 7 classes and a school environment instrument to 118 teachers of these classes, only weak associations between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be
transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importantly, this study is going to seek for answering many problems on education in secondary school classes.

**Research Objectives**
1. To explore the science classroom learning environment instruments for using these research instruments in learning classroom research in the secondary education in Thailand.
2. To describe and investigate of actual students’ perception in chemistry classroom learning environment for using the ICEQ in school at level 11.
3. To analyze of reliability and validity of the MCI and the TOCRA research instrument will use in ChaingyeunPittayakom School at Grade level 11.
4. To associate between students’ perception of their actual individual chemistry classroom learning environment and their chemistry attitudes.

**Literature Reviews**
The My Class Inventory (MCI) was the major instrument used in the present study (Abdul Majeed, Barry J. Fraser & Jill M. Aldridge, 2001). The initial development and validation of the Learning Environment Inventory (LEI) began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research). The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O’Brien, 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study). The MCI differs in five important ways, Firstly, in order to minimize fatigue among younger children, the MCI contains only five of the LEI’s original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI’s four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O’Brien (1985) developed a short 25-item version. Typical items are "Children are always fighting with each other" (Friction) and "Most children can do their school work without help" (Difficulty).

Although the long forms of classroom environment instruments have been used successfully for a variety of purposes, some researchers and teachers have reported that they would like instruments to take less time to administer and score. Consequently, a short form of the MCI was developed to satisfy three main criteria. First, the total number of items in each instrument was reduced to approximately 25 to provide greater economy in testing and scoring time. Second, the short forms were designed to be amenable to easy hand scoring. Third, although long forms of instruments might be needed to provide adequate reliability for the assessment of the perceptions of individual students, short forms are likely to have adequate reliability for the many applications which involve averaging the perceptions of students within a class to obtain class means. The development of the short form was based largely on the results of several item analyses performed on data obtained by administering the long forms of each instrument to a large sample. The short form of the MCI each consist of 25 items divided equally among the five scales comprising the long form. Because the long form of the CES consisted of 90 items, this was reduced to a short version with 24 items divided equally among six of the original nine scales.

**Materials and Methods**

**Research Procedures**
Using the MCI was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating chemistry laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 12 in ChaingyeunPittayakom School, Mahasarakham Province.

Each scale of the MCI were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3,8,18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.
Data Analyses
The scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred MCI forms and the Attitude scale as specified in Santiboon (2014). Factorial validity and adequacy of fit for the dimensionality of the MCI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the MCI with students’ attitudes to associate were analyzed.

Sample
This study is explored and described based on the developing students’ chemistry laboratory classroom environment with actual and preferred student’s perceptions with a sample size 108 upper secondary educational students at Grade level 12 in 3 classes in ChaingyeunPittayakom School, Mahasarakham Province, in the first semester in academic year 2015.

Research Instrument
My Class Inventory (MCI)
The My Class Inventory (MCI) was the major instrument used in the present study (Abdul Majeed, Barry J. Fraser & Jill M. Aldridge, 2001). The initial development and validation of the Learning Environment Inventory (LEI) began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research). The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O'Brien, 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study). The MCI differs in five important ways, Firstly, in order to minimize fatigue among younger children, the MCI contains only five of the LEI’s original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI’s four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O’Brien (1985) developed a short 25-item version. Typical items are "Children are always fighting with each other” (Friction) and "Most children can do their school work without help” (Difficulty).

To obtain a quick and easy assessment of their classroom environments, teachers can use the MCI. It satisfies two basic criteria (Fraser & Fisher, 1983a). First, the total number of items is small, thus providing economy in testing and scoring time. Second, because many teachers do not have ready access to computerized scoring methods, the MCI is suitable for easy hand scoring.

The Test of Chemistry-Related Attitude (TOSRA)
This study investigated associations between Actual students’ perceptions of their chemistry laboratory environment classes in Chiang Yean Pittayakom School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) and Santiboon (2014) was modified, adapted, and selected to the Test Of Chemistry-Related Attitude (TOSRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in ChaingyeunPittayakom School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their chemistry laboratory environment classes. Furthermore, the TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Results
Validity and Reliability of Research Instruments
This section reports typical validation data for selected classroom environment scales. Table 1, 2and 3 provide a summary of a limited amount of statistical information for the instrument (MCI) considered previously. Attention is restricted to the student actual form and to the use of the individual student as the unit of analysis. Table 2 provides information about each scale’s internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms (significance level and eta² statistic from ANOVAs).
The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University

Validation of the MCI
Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

Table 1.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual Form of the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>20.66</td>
<td>4.33</td>
<td>0.13</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.66</td>
<td>4.43</td>
<td>0.11</td>
<td>0.36</td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>19.21</td>
<td>4.44</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.22</td>
<td>4.49</td>
<td>0.11</td>
<td>0.32</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>19.71</td>
<td>4.59</td>
<td>0.14</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.93</td>
<td>4.64</td>
<td>0.10</td>
<td>0.30</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>18.53</td>
<td>4.31</td>
<td>0.22</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>21.75</td>
<td>4.38</td>
<td>0.20</td>
<td>0.46</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>20.34</td>
<td>4.48</td>
<td>0.13</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.54</td>
<td>4.55</td>
<td>0.12</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Factor loading Analysis of the ICEQ
The Actual and Preferred Forms of the MCI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.
Table 3.
Factor Loading for Items in the Actual Form of the ICEQ.

<table>
<thead>
<tr>
<th>Item</th>
<th>SC</th>
<th>TS</th>
<th>IV</th>
<th>IN</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q6</td>
<td>Q16</td>
<td>0.88</td>
<td></td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>Q21</td>
<td>Q1</td>
<td>0.76</td>
<td></td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>Q16</td>
<td>Q6</td>
<td>0.73</td>
<td></td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>Q1</td>
<td>Q11</td>
<td>0.64</td>
<td></td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td>Q11</td>
<td>Q21</td>
<td>0.54</td>
<td></td>
<td></td>
<td>0.67</td>
</tr>
<tr>
<td>Q17</td>
<td>Q2</td>
<td>0.68</td>
<td></td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td>Q7</td>
<td>Q22</td>
<td>0.67</td>
<td></td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>Q12</td>
<td>Q17</td>
<td>0.62</td>
<td></td>
<td></td>
<td>0.68</td>
</tr>
<tr>
<td>Q22</td>
<td>Q12</td>
<td>0.61</td>
<td></td>
<td></td>
<td>0.47</td>
</tr>
<tr>
<td>Q2</td>
<td>Q7</td>
<td>0.56</td>
<td></td>
<td></td>
<td>0.32</td>
</tr>
<tr>
<td>Q23</td>
<td>Q23</td>
<td>0.83</td>
<td></td>
<td></td>
<td>0.80</td>
</tr>
<tr>
<td>Q8</td>
<td>Q13</td>
<td>0.78</td>
<td></td>
<td></td>
<td>0.71</td>
</tr>
<tr>
<td>Q13</td>
<td>Q18</td>
<td>0.70</td>
<td></td>
<td></td>
<td>0.53</td>
</tr>
<tr>
<td>Q18</td>
<td>Q13</td>
<td>0.46</td>
<td></td>
<td></td>
<td>0.44</td>
</tr>
<tr>
<td>Q3</td>
<td>Q8</td>
<td>0.42</td>
<td></td>
<td></td>
<td>0.41</td>
</tr>
<tr>
<td>Q24</td>
<td>Q9</td>
<td>0.75</td>
<td></td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>Q14</td>
<td>Q19</td>
<td>0.75</td>
<td></td>
<td></td>
<td>0.67</td>
</tr>
<tr>
<td>Q19</td>
<td>Q14</td>
<td>0.61</td>
<td></td>
<td></td>
<td>0.63</td>
</tr>
<tr>
<td>Q9</td>
<td>Q24</td>
<td>0.03</td>
<td></td>
<td></td>
<td>0.58</td>
</tr>
<tr>
<td>Q4</td>
<td>Q4</td>
<td>0.22</td>
<td></td>
<td></td>
<td>0.48</td>
</tr>
<tr>
<td>Q10</td>
<td>Q20</td>
<td>0.90</td>
<td></td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>Q5</td>
<td>Q10</td>
<td>0.89</td>
<td></td>
<td></td>
<td>0.74</td>
</tr>
<tr>
<td>Q15</td>
<td>Q25</td>
<td>0.79</td>
<td></td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>Q25</td>
<td>Q15</td>
<td>0.73</td>
<td></td>
<td></td>
<td>0.69</td>
</tr>
<tr>
<td>Q20</td>
<td>Q5</td>
<td>0.46</td>
<td></td>
<td></td>
<td>0.68</td>
</tr>
<tr>
<td>%of</td>
<td>Act.</td>
<td>51.45</td>
<td>39.92</td>
<td>43.24</td>
<td>30.79</td>
</tr>
<tr>
<td>varian</td>
<td>Pref.</td>
<td>60.83</td>
<td>37.71</td>
<td>35.78</td>
<td>40.54</td>
</tr>
<tr>
<td>ce</td>
<td>Eigen</td>
<td>Act.</td>
<td>2.57</td>
<td>2.00</td>
<td>2.16</td>
</tr>
<tr>
<td></td>
<td>value</td>
<td>Act.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pref.</td>
<td>3.04</td>
<td>1.89</td>
<td>1.79</td>
<td>2.03</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 108 students.
The Circumplex Nature of the MCI

To investigate the circumplex nature of the MCI correlations between the scales were calculated. The sample in Table 2 is presented the results show that the correlations between a scale and the next scale.

Table 2.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>FR</th>
<th>DI</th>
<th>SA</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.58**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>0.58**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>0.41*</td>
<td>0.51**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>0.41*</td>
<td>0.61**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.60**</td>
<td>0.63**</td>
<td>0.47**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>0.35*</td>
<td>0.53**</td>
<td>0.51**</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>0.61**</td>
<td>0.21**</td>
<td>0.27*</td>
<td>0.27*</td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>0.76**</td>
<td>0.51**</td>
<td>0.32*</td>
<td>0.45*</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Table 4.

Associations between MCI Scale and Attitude Scale to Chemistry Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlate</th>
<th>Std. Regress Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Attitude (r)</td>
<td>Attitude (β)</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>3.48</td>
<td>0.19*</td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>3.17</td>
<td>0.15*</td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>4.04</td>
<td>0.14**</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>4.09</td>
<td>0.16*</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>4.04</td>
<td>0.13**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.8852**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.6625**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Discussions and Implication

The strongest tradition in chemistry classroom environment of this study has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their performances. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics. This study involves tabulation of 40 past studies in science education shows that associations between outcome measures and classroom environment perceptions have been replicated for a variety of cognitive and affective outcome measures, a variety of classroom environment instruments and a variety of samples.

This research study has been conducted on educational environments; less has been done to help teachers to improve the environments of their own classrooms or schools. This result reports how feedback information based on student perceptions can be employed as a basis for reflection upon, discussion of, and systematic attempts to improve classroom and school environments. The proposed methods have been applied successfully in studies upper secondary levels. The attempt at improving classroom environments described below made use of the short 25-item version of the MCI discussed previously. The class involved in the study consisted of 7 grade 12 males and females of mixed ability studying science at a government school in Thailand. The procedure
followed by the teacher of this class incorporated the following five steps, such as; Assessment, Feedback, Reflection and discussion, Intervention, and Reassessment, These results summarised show that some change in actual environment occurred during the time of the intervention. When tests of statistical significance were performed, it was found that differences were significant \((p<0.05)\) only for between students' attitudinal outcomes and their chemistry laboratory classroom learning environments on all scales. These findings are noteworthy because two of the dimensions on which appreciable changes were recorded were those on which the teacher had attempted to promote change. Although the second administration of the environment scales marked the end of this teacher's attempt at changing a classroom, it might have been thought of as simply the beginning of another cycle. This study evidences confirmation of the research studies at the four past decades, for example; using the MCI, associations with students' cognitive and affective outcomes have been established for a sample of approximately 80 senior high school chemistry classes in (Fraser & McRobbie, 2005; McRobbie & Fraser, 2005), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 2007) and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser, 2006). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (2005a) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the QTI, associations between student outcomes and perceived patterns of teacher-student interaction were reported for samples of 489 senior high school biology students in Australia (Fisher, Henderson & Fraser, 2005), 3,994 high school science and mathematics students in Australia (Fisher, Fraser & Rickards, 2007), 1,512 primary school mathematics students in Singapore (Goh, Young & Fraser, 2005), and 2256 lower secondary science dream school project students in Thailand (Santiboon, 2013).

Acknowledgment

Firstly, I would like to thank the 90 chemistry students in ChiangyuenPittayakomschool at the Grade level 12 who were part of the study. Thank you to the Mr. ChongratTanamalaphong, andMiss KittimaProraksawho allowed students to complete the questionnaire. Secondary, I would like to my fellow Master of Science studentsto advise some problem point for fixing up commendation from my supervisor and co-supervisor. Thirdly, I must thank you my supervisor; Dr.WandeeRukrai, my co-supervisor; they understood and never pushed me to build up of my research that it was going on work, completely. Finally, my greatest thanks go to Assist. Prof. Dr. ToansakulSantiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References

Students’ Outcomes in Physics Classroom Learning Environments Inventory in Chiangyuen Pittayakom School At Grade Level 10

Orawan Sasrisao1, Kamon Ponkham2, Suchat Jaidee3 and Toansakul Santiboon1,*

1Department of Master of Science Education, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
2Department of Physics Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
3Science Learning Group Section, Chiangyuen Pittayakom School, Maha Sarakham, Thailand

(*author for correspondence, E-mail: Toansakul35@yahoo.com.au Fax: +66 43 713 206)

Abstract

This aims of study are to investigate on physics classroom learning environments, student’s perceptions of their actual and preferred classes were assessed, and associations between students’ perceptions to their attitudes were associated with a sample size of 108 upper secondary educational physics students in 3 classes at Grade 10 in, Chiangyuen Pittayakom School, Mahasarakham Province in Thailand. Student’ perceptions of their actual (assesses the class as it actually is) and preferred (asks the students what they would prefer their class to be like – the ideal situation) were assessed and compared with the international classroom learning environment instrument perceptions were obtained of the 25-item My Class Inventory (original modified from the MCI) (Fisher & Fraser, 1981). To associate on students’ attitudes with a short version of the Test of Physics-Related Attitude (original modified from the Test Of Physics-Related Attitude) (Fraser, 1981) that they were translated into Thai language for administrating research methodology. Statistically Significant differences were found between the students’ perceptions of actual and preferred physics classroom learning environment also were found. Cronbach’s alpha reliability coefficients for the scales were adequate (0.65-0.89), while confirmatory factor analyses provided support for the theoretical framework behind the questionnaire (0.42-0.83 omitted). The multiple correlation R² is significant for the MCI and considered associations with the Attitude scale, and value indicates that 52% of the variance in students ‘attitude were also determined. Based on findings, suggestions for improving the physics classroom learning environments with student’s perceptions are provided, interestingly.

Keywords: My Class Inventory (MCI), Students, Physics classroom, Learning

Introduction

Normally, educational psychology-related studies have consistently demonstrated that a positive classroom environment coupled with useful interventions to increase student social-emotional skills are related to increased student academic performance and students’ sense of ‘connectivity to school’. Learning environments should be, in part, tailored to the sociocultural among and ethnic differences elementary students. Certain elementary school classrooms are more conducive to higher achievement with some student populations and not with others. In short, a wide array of research supports the indirect relationship between academic achievement and counselors’ efforts to facilitate students’ personal-social development as well as positive learning environments. Instrumentation was the My Class Inventory-SF for teachers (Fraser & Fisher, 1983) for a psychometric review of this instrument) for use with elementary school teachers. The 30-item measure is (a) readily understandable, (b) brief (no more than 8 minutes to complete), and (c) simple to administer and hand score.

Focusing on the early 2001, the Ministry of Education began developing new national curricula in an endeavor to model the system of education on child, or student-centered learning methods. The years from 2001 to 2009 showed some of the greatest improvements in education, experiments had also been tried with restructuring the administrative regions for education or partly decentralizing the responsibility of education to real change and many attempts to establish a clear form inappropriate or mismatched syllabuses in the schools that it should be followed as the Thai policy government. The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Chiangyuen Pittayakom School at Grade 10 in...
Mahasarakham Province for demonstrating the reliability and validity of the My Class Inventory (MCI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Physics-Related Attitude (TOPRA), the instruments need to be thoroughly analyzed psychometrically.

1. Science Classroom Learning Environment
The research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, current trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998)[10].

2. Studying Educational Environment Approaches
Using students' perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data. students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin, 1991)[5].

3. Historical Science Education Learning Environment
In the past three decades, There are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968)[6]. Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos, 1979[7]; Moos & Trickett, 1984[8]). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser, 1986[9]; Fraser & Walberg, 1991[10]; Moos, 1979[7]), literature reviews (Fraser 1994[11]; MacAuley, 1995[12]; von Saldern, 1995[13]) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fishner, 1994)[11].

4. Differences between Student Perceptions of Actual and Preferred Environment
An investigation of differences between students and teachers in their perceptions of the same actual classroom environment and of differences between the actual environment and that preferred by students or teachers was reported by Fisher and Fraser (1983)[14] using the ICEQ with a sample of 116 classes for the comparisons of student actual with student preferred scores and a subsample of 56 of the teachers of these classes for contrasting teachers' and students' scores. Students preferred a more positive classroom environment than did their students in the same classrooms on four of the five ICEQ dimensions. Also, teachers perceived a more positive classroom environment than did their students in the same classrooms on four of the ICEQ’s dimensions. These results replicate patterns emerging in other studies in school classrooms in the USA (Moos, 1979)[7], Israel (Hofstein & Lazarowitz, 1986), The Netherlands (Wubbels, Brekelmans & Hooymers, 1991)[15] and Australia (Fraser & McRobbie, 1995)[16], and in other settings such as hospital wards and work milieus (Moos, 1979)[7].

5. Instrument for Assessing Classroom Environment
Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCED); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1979)[7] scheme for classifying human environments.
6. Selected Classroom Learning Environment Instrument for this Study

6.1 My Class Inventory (MCI)

The My Class Inventory (MCI) was the major instrument used in the present study. The initial development and validation of the Learning Environment Inventory (LEI) began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research).

The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8–12 years (Fisher & Fraser, 1983; Fraser, Anderson & Walberg, 1982; Fraser & O’Brien, 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study).

The MCI differs in five important ways. Firstly, in order to minimize fatigue among younger children, the MCI contains only five of the LEI’s original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI’s four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O’Brien (1985) developed a short 25-item version. Typical items are "Children are always fighting with each other" (Friction) and "Most children can do their school work without help" (Difficulty).

To obtain a quick and easy assessment of their classroom environments, teachers can use the MCI. It satisfies two basic criteria (Fraser & Fisher, 1983a). First, the total number of items is small, thus providing economy in testing and scoring time. Second, because many teachers do not have ready access to computerized scoring methods, the MCI is suitable for easy hand scoring. Table 1 provides a scale description and sample item for the original form of the MCI.

Table 1

<table>
<thead>
<tr>
<th>Scale Description for the Individual Dimensions in the MCI</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Satisfaction</strong></td>
<td>The pupils enjoy their school work in my class.</td>
</tr>
<tr>
<td><strong>Friction</strong></td>
<td>Many children in our class like to fight.</td>
</tr>
<tr>
<td><strong>Competitiveness</strong></td>
<td>Most children want their work to be better than their friend’s work.</td>
</tr>
<tr>
<td><strong>Difficulty</strong></td>
<td>Most children can do their school work without help.</td>
</tr>
<tr>
<td><strong>Cohesiveness</strong></td>
<td>Some pupils in my class are not my friends.</td>
</tr>
</tbody>
</table>

Because the MCI provides the lowest reading level of all existing classroom environment instruments, it was the natural choice for the present study which involved students for whom English was not the first language. Nevertheless, the original form of the MCI (which was developed more than 20 years ago) still has some important shortcomings that needed to be taken into consideration in the present study.

6.2 The Test Of Physics-Related Attitude (TOPRA)

This study investigated associations between Actual and Preferred students’ perceptions of their physics environment classes in Chiangyuen Pittayakom School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected to the Test Of Physics-Related Attitude (TOPRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among physics environment classes in Chiangyuen Pittayakom School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their physics laboratory environment classes. Furthermore, the TOPRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

7. Actual and Preferred Forms of Scales

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of 'preferred' or
ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow’.

8. Context of ChiangyuenPittayakom School

Normally, almost all villages have an elementary school. Most sub-districts have a school for ages 6 through 14 and all districts have secondary schools for ages 12 through 17. Many have vocational colleges for students from age 15. The government is not able to cope with the entire number of students, thus the private sector, which is supervised by the government, provides a significant contribution. The level of education in the private sector is generally, but not always, higher than that of the government schools. Expensive, exclusive private and international schools provide for a high level of achievement and a large number of their students continue their education at universities abroad. Charitable organisations (missionary societies or diocesan), and other religions provide the backbone of non-government, low-fee, general education and some established universities, and their standard is relatively high. Cheaper, newer and individual private schools, are occasionally run more for profit and government subsidies than for results, and are often indistinguishable from government schools in terms of quality of buildings, resources, teaching competency, and overcrowded classrooms. Their only real benefit is the prestige afforded to the parents for schooling their children in the private sector. In rural schools, absenteeism among both students and teachers is high due to family and farming commitments. Some schools close down during rice planting and harvesting seasons.

At elementary levels, students follow eight core subjects each semester: Thai language, mathematics, science, social science, health and physical education, arts and music, technology, and foreign languages. At age 16 (Matthayom 4), students are allowed to choose one or two elective courses. The science program (Wit-Kanit) and the mathematics-English language program (Sil-Kammuan) are among the most popular. Foreign language programs (Sil-Phasa), and the social science program (sometimes called the general program) are also offered. Both elementary and secondary level has special programs for students called English Program and Gifted Program. In English Program students can learn almost every subject in English except for Thai and Social Studies. The Gifted Program is the Mathematics-Science program.

Focused on ChiangyuenPittayakom School is a rural or government school located in downtown ChiangyuenSubdistrictChiangyuen district Mahasakham,Thailand. It admits from lower to upper secondary students (Grade level at of 7-12) and has the largest yearly enrolment in Chiangyuen district in MahasarakhamProvince (the country. Founded in 1973 as Phoong village supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. ChiangyuenPittayakom School has among the development, enhancement, and improvement entry rates for local Thai schools. The school has 4 buildings, 53classrooms, onelaboratory classes. This school composes with 1,174students, 118senior professional teachers, a school admininistrator is Mr. ChongratTanamalaphong Mr. ChongratTanamalaphong, Mr. SuchatJaidees the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

Methodology

Research Objectives

1. To assess student’s perceptions of their physics environment classes at Grade 10 in ChiangyuenPittayakom School, Mahasarakham Province.

2. To compare between students’ perceptions of their actual and preferred physics classroom learning environments at Grade 10 in ChiangyuenPittayakom School, Mahasarakham Province.

3. To associate student’s attitudes of their perceptions to their actual physics classroom learning environments at Grade 10 in ChiangyuenPittayakom School, Mahasarakham Province.

Research procedure

Using the MCI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOPRA on the 15th week for associating physics classroom learning environments in physics classroom learning environment for upper secondary educational students at Grade 10 in ChiangyuenPittayakom School, Mahasarakham Province.
Each scale of the MCI were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3,8,18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.

**Data Analyses**

The scaling items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred MCI forms and the Attitude scale as specified in Fraser (1991)[19]. Factorial validity and adequacy of fit for the dimensionality of the MCI were assessed through principal component analyses. The multiple correlations were significant of students' perceptions of their school climate for the Actual Form of the MCI with students' attitudes to associate were analyzed.

**Sample**

This study is improved and developed students’ physics laboratory classroom environment with actual and preferred student’s perceptions with a sample size 108 upper secondary educational students at Grade level 10 in 3 classes in ChiangyuenPittayakomSchool, Mahasarakhm Province, in the second semester in academic year 2014.

**Results**

**Validity and Reliability of Research Instruments**

A. **Validation of the MCI**

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 2.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>21.36</td>
<td>4.15</td>
<td>0.40</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.88</td>
<td>4.45</td>
<td>0.45</td>
<td>0.20</td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>17.30</td>
<td>3.46</td>
<td>0.66</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>17.67</td>
<td>3.53</td>
<td>0.51</td>
<td>0.26</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>16.58</td>
<td>3.32</td>
<td>0.590</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>17.09</td>
<td>3.42</td>
<td>0.58</td>
<td>0.34</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>17.36</td>
<td>3.47</td>
<td>0.51</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>17.70</td>
<td>3.54</td>
<td>0.36</td>
<td>0.13</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>22.00</td>
<td>4.40</td>
<td>0.30</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.67</td>
<td>4.53</td>
<td>0.46</td>
<td>0.21</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the five MCI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the MCI. For the remaining five scales, namely; **Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness** scales.

The internal consistency reliability of the version MCI used in this study was determined by calculating Cronbach alpha coefficient for the 25 items of the MCI using both actual and preferred environmental climates’ perceptions scores. Table 3 reports the internal consistency of the MCI, which ranged from 0.62 to 0.80 when using the students’ actual climate scores and from 0.67 to 0.87 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the MCI, which suggests that each scale of the MCI was able to differentiate significantly (p<0.001) between students’ perceptions in physics laboratory environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.55 to 11.50 for different scales, respectively.
### Table 3

Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the MCI

| Scale       | Form     | Cronbach’s alpha reliability | Discriminant validity | t-test | ANOVA Results (eta²) | Significant
|-------------|----------|------------------------------|-----------------------|-------|----------------------|-------------
| Cohesiveness| Actual   | 0.84                         | 0.75                  | 12.68 | 0.17                 | 0.03*       |
|             | Preferred| 0.89                         | 0.60                  |       |                      |             |
| Friction    | Actual   | 0.77                         | 0.77                  | 16.90 | 0.21                 | 0.00***     |
|             | Preferred| 0.82                         | 0.62                  |       |                      |             |
| Difficulty  | Actual   | 0.72                         | 0.78                  | 46.38 | 0.27                 | 0.00***     |
|             | Preferred| 0.59                         | 0.68                  |       |                      |             |
| Satisfaction| Actual   | 0.63                         | 0.80                  | 36.39 | 0.24                 | 0.00***     |
|             | Preferred| 0.16                         | 0.78                  |       |                      |             |
| Competitiveness| Actual | 0.87                         | 0.74                  | 12.29 | 0.16                 | 0.04*       |
|             | Preferred| 0.83                         | 0.82                  |       |                      |             |

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

### B: The Circumplex Nature of the MCI

To investigate the circumplex nature of the MCI, correlations between the scales were calculated. The sample in Table is presented the results show that the correlations between a scale and the next scale.

Table 4. Scale Intercorrelations for the MCI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>CO</th>
<th>FR</th>
<th>DI</th>
<th>SA</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>0.46**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.31**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.28**</td>
<td>0.83***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.29**</td>
<td>0.69***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>0.38**</td>
<td>0.66***</td>
<td>0.72***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.20*</td>
<td>0.40*</td>
<td>0.31**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.66***</td>
<td>0.24**</td>
<td>0.12*</td>
<td>0.18*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76***</td>
<td>0.16*</td>
<td>0.26**</td>
<td>0.19*</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)
C. Factor Loading Analysis of the MCI

The Actual and Preferred Forms of the MCI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 5.
Factor Loading for Items in the Actual Form of the MCI.

<table>
<thead>
<tr>
<th>Item</th>
<th>SC Pref.</th>
<th>SC Act.</th>
<th>TS Pref.</th>
<th>TS Act.</th>
<th>IV Pref.</th>
<th>IV Act.</th>
<th>IN Pref.</th>
<th>IN Act.</th>
<th>TO Pref.</th>
<th>TO Act.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>16</td>
<td>0.78</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>0.75</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.70</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>0.69</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>11</td>
<td>0.23</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>0.87</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.84</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>0.74</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>22</td>
<td>0.74</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>12</td>
<td>0.69</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td>0.66</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0.64</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>0.49</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.44</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>0.31</td>
<td>0.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td></td>
<td>0.84</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td></td>
<td>0.83</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>9</td>
<td></td>
<td>0.79</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td></td>
<td>0.74</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td></td>
<td>0.58</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td>0.61</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>0.57</td>
<td>0.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>0.53</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance

<table>
<thead>
<tr>
<th>Item</th>
<th>SC Pref.</th>
<th>SC Act.</th>
<th>TS Pref.</th>
<th>TS Act.</th>
<th>IV Pref.</th>
<th>IV Act.</th>
<th>IN Pref.</th>
<th>IN Act.</th>
<th>TO Pref.</th>
<th>TO Act.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>16</td>
<td>0.78</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>0.75</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.70</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>0.69</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>11</td>
<td>0.23</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>0.87</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.84</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>0.74</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>22</td>
<td>0.74</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>12</td>
<td>0.69</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td>0.66</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0.64</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>0.49</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.44</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>0.31</td>
<td>0.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td></td>
<td>0.84</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td></td>
<td>0.83</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>9</td>
<td></td>
<td>0.79</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td></td>
<td>0.74</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td></td>
<td>0.58</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td>0.61</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>0.57</td>
<td>0.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>0.53</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than .3 omitted. The sample consisted of 108 students

D. Validation of the TOPRA

To measure students’ attitudes towards physics laboratory classroom learning environment subject, the present study adapted the eight-item Attitude Scale (Kijkosol & Fisher, 2005[20], Santiboon & Fisher, 2005[21], Santiboon, 2014[22]), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981[2]). Using internal consistency reliability the TOPRA had a value of 0.81 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the MCI helps physics laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the physics laboratory classroom learning environment curriculum for the ChiangyuenPittayakom School students in physics classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in physics laboratory classroom learning environments.
Associations between Students’ Perceptions of their Actual Physics Laboratory Classroom Learning Environments toward their Attitude (TOPRA)

In this study, it was also considered important to investigate associations between students’ perceptions of their physics laboratory classroom learning environments with their attitude toward physics laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOPRA was 0.81, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in physics laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOPRA that it’s reported in Table 6.

Table 6. Associations between MCI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regress Weigh Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>0.15</td>
<td>0.19*</td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>0.24</td>
<td>0.15*</td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>0.40</td>
<td>0.14**</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0.32</td>
<td>0.16*</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>0.30</td>
<td>0.13**</td>
<td></td>
</tr>
</tbody>
</table>

Multiple Correlation (R) 0.7201**  
R² 0.5175**

*Correlation is significant at the 0.05 level (2-tailed)  
**Correlation is significant at the 0.01 level (2-tailed)  
***Correlation is significant at the 0.001 level (2-tailed)

In Table 6, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their physics laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students
perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their physics laboratory classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students' attitudinal outcomes and their physics laboratory classroom learning environments on all scales of the Actual Form.

Discussion and Implementations

Table 6 is compared to investigate associations between physics students’ perceptions of their physics laboratory classroom learning environments with their attitude toward physics classes. Using the MCI instrument in the higher education level, Chiangyuen Pittayakom, Thailand, will help teachers to evaluate their learning environments in physics laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the MCI could be useful as the guide to enhance the effectiveness of physics laboratory classes. The effectiveness in physics laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of physics laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 108 student of their physics laboratory classroom learning environments were measured with the MCI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their physics laboratory classroom learning environments. In general, students’ perceptions of their preferred physics laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the MCI helps physics teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students. An investigation of the association between students’ perceptions of learning environments with their attitudes to their physics laboratory classroom learning environments with regard to the MCI, it was found that all of five scales were positively associated with students’ attitude to physics laboratory classroom learning environments. The multiple correlation $R$ is significant for the MCI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 56%, with actual form of the variance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights ($\beta$) show that in classes where the students perceived greater than all scales in their physics laboratory classroom learning environments lessons.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (MCI). This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in physics laboratory classroom learning environments.

Overall, this study replicated previous studies using the MCI, with the findings being consistent with the situation in Chiangyuen Pittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the physics laboratory classroom learning environments, interestingly.

Acknowledgements

I am heartily thankful to my supervisors; Assist. Prof. Dr. Toansakul Santiboon and Dr. Panwilai Chomchid of Master of Science of Education Program, Faculty of Education, Chiangyuen Pittayakom, whose encouragement, guidance and support instruments and computing system for analysis of this research. I am grateful to my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Chiangyuen Pittayakom School.

References


An Instrument for Monitoring the Development of Constructivist of Constructivist Science Learning Classroom Environments for Enhancing Students’ Achievements at Eight-Grade Level in Burapha Pittayakhan Municipal School

Utumporn Anamart¹, Toansakul Santiboon¹, ², Praphaporn Sinsaeng³ and Panwilai Chomchid⁴

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
²Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
³Science Learning Group Section, Burapha Pittayakhan Municipal School, Maha Sarakham, Thailand
⁴( author for correspondence, E-mail: toansakul35@yahoo.com.au; Fax: +6643 713 206)

Abstract

To adapt the international research on science classroom learning environment; the Constructivist Learning Classroom Environment Survey (CLES) enhance science classroom learning environments for students’ outcomes. Researchers were to describe and answer for using data from 64 lower secondary school students at the seventh and eighth-Grade levels in 2 science classes in BuraphaPittayakhan Municipal School. Students’ perceptions of their actual CLES were associated their students’ attitude with the Test Of Science-Related Attitude (TOSRA) toward science studies were analyzed. Using the compare mean difference, factor analysis, scaleinter-correlations, multilevel variance components models, and standardized regression coefficient to derive interaction class correlations to determine the degree to which CLES scores may validly be said to measure aspects of chemistry classroom learning environments as against enhancing student attitude. The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all five CLES scales. Subsequent analyses showed that significant proportions of variance were attributable to the science classes’ variable. Meanwhile, the CLES may be considered to be a relatively better than enhancement of science classroom environments. The multiple correlation R is significant for the actual of the CLES and showed that all the five scales were considered together indicated that was significant (p< 0.05) association with the TOSRA, the R² value indicates that 38% of the variance in students’ attitude to their science classes were attributable to their perceptions of their enhancing science classroom learning environment in science classes, surprisingly.

Keywords: Actual form, Associations, Student, Perceptions, Science classroom, Learning

Introduction

Background of Science Educational System in Thailand

Education in Thailand is provided mainly by the Thai government through the Ministry of Education from preschool to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years’ school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable. The school structure is divided into four key stages: the first three years in elementary school, the first primary level or Prathom 1–3, are for age groups 7–9 (Grade 1-3); the second primary level or Prathom 4 through 6 are for age groups 10–12 (Grade 4-6); the third lower secondary level or Matthayom 1–3, is for age groups 13–15 (Grade 7-9). The upper secondary level of schooling consists of Matthayom 4–6 for age groups 16–18 (Grade 10-12), and is divided into academic and vocational streams. There are academic upper secondary schools, vocational upper secondary schools and comprehensive schools offering academic and vocational tracks. Students who choose the academic stream usually intend to enter a university. Vocational schools offer programs that prepare students for employment or further studies.

Admission to an upper secondary school is through an entrance exam. On the completion of each level, students need to pass the NET (National Educational Test) to graduate. Children are required to attend six years of elementary school and at least the first three years of high school. Those who graduate from the sixth year of high school are candidates for two decisive tests: O-NET (Ordinary National Educational Test) and A-NET
An assessment of the quality of secondary school education has indicated that only 40% of 3 secondary learners received adequate preparation for readiness in learning before attending university. Although Thailand has a very high percentage of youth learners attending child development centers, if such centers are not supported properly through strengthening capacity and management, the quality of secondary development and young children’s preparation for primary and secondary schooling can be seriously affected. Most students attend formal educational institutions administered by the Ministry of Education and about half of these children enroll in learning childcare/development centers of the formal education system, mainly administered by the Department of Local Administration. The Office of Basic Education Commission (OBE) prepares the basic core curriculum and disseminates it to all Educational Service Area (ESA) Offices for distribution to parents, guardians and teachers, so as to ensure that all key stakeholders combine efforts to provide school children with quality education. The 10-Year Plan and Policy for the Basic Educational Secondary Development (2006-2015) provides a blueprint for achieving universal student education for all Thai children. The 10-Year Plan and Policy gives priority to three main strategies, namely; (1) to support youth development; (2) to support parents and other stakeholders; and (3) to promote an environment that facilitates secondary educational learners.

**The Institute for the Promotion of Teaching Science and Technology (IPST)**

There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as; curricula, teaching/learning process, media and materials then publicize them to all relevant organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner’s development, To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations.

**International Classroom Learning Environment**

Using students’ and teachers’ perceptions to study educational environments can be contrasted with the external observer's direct observation and systematic coding of classroom communication and events. introduced the term *alpha press* to describe the environment as assessed by a detached observer and the term *beta press* to describe the environment as perceived by milieu inhabitants. Another approach to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, case study or interpretive research. Defining the classroom or school environment in terms of the shared perceptions of the students and teachers has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data which the observer could miss or consider unimportant. Students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if teachers are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this chapter, discussion focuses on the merits of combining quantitative and qualitative methods when studying educational environments (Fraser & Tobin 1991) [1].

**Field of Classroom Environment**

Over the previous two decades or so, considerable interest has been shown internationally in the conceptualisation, assessment, and investigation of perceptions of psychosocial characteristics of the learning environment of classrooms at the elementary, secondary, and higher education levels (Fraser, 1986, 1989, 1994; Fraser & Walberg, 1991) [3]. Classroom environment instruments have been used as sources of both predictor and criterion variables in a variety of research studies. Use of student perceptions of classroom environment as predictor variables in several different countries has established consistent relationships between the nature of the classroom environment and various student cognitive and affective outcomes (Fraser, 1986; Haertel, Walberg & Haertel, 1981; McRobbie and Fraser, 1993). For example, Fraser and Fisher's (1982) study involving 116 Australian science classes established sizeable associations between several inquiry skills and science-related attitudes and classroom environment dimensions measured by the *Classroom Environment Scale* and the *Individualized Classroom Environment Questionnaire*. Furthermore, research involving a person-environment fit perspective has shown that students achieve better where there is greater congruence between the actual classroom environment and that preferred by students (Fraser & Fisher, 1983) [2].

Studies involving the use of classroom environment scales as criterion variables have revealed that classroom psychosocial climate varies between Catholic and government schools (Dorman, Fraser and McRobbie, 1994) [4] and between coeducational and single-sex schools (Trickett, Trickett, Castro & Schaffner, 1982) [12].

---

Both researchers and teachers have found it useful to employ classroom climate dimensions as process criteria of effectiveness in curriculum evaluation because they have differentiated revealingly between alternative curricula when student outcome measures have shown little sensitivity (Fraser, 1981; Fraser, Williamson & Tobin, 1987). Research in the USA, Australia (Fraser, 1982) [6], The Netherlands (Wubbels, Brekelmans & Hooymayers, 1991) [13], and Israel compared students' and teachers' perceptions and found that, first, both students and teachers preferred a more positive classroom environment than they perceived as being actually present and, second, teachers tended to perceive the classroom environment more positively than did their students in the same classrooms. In promising small-scale practical applications, teachers have used assessments of their students' perceptions of their actual and preferred classroom environment as a basis for identification and discussion of actual-preferred discrepancies, followed by a systematic attempt to improve classrooms (Fraser & Fisher, 1986) [9].

Some of the exciting recent lines of classroom environment research which are still in progress involve: investigating the links between and the joint influence of classroom, school, family, and other environments on students' outcomes incorporating classroom environment as one factor in a multi-factor model of educational productivity evaluating and investigating teacher-student interpersonal relationships in the classroom exploring ways in which classroom environment instruments can be used to advantage by school psychologists incorporating learning environment ideas into teacher education investigating changes in classroom environment during the transition from elementary to high school and incorporating the evaluation of classroom environment in teacher assessment schemes.

**Critical Constructivist Framework**

The original version of the CLES was based on a theory of constructivism that underpins recent research in science and mathematics education that is concerned with developing teaching approaches that facilitate students' conceptual development. This conceptual change research highlights: (1) the key role of students' prior knowledge in their development of new conceptual understandings, especially the problematic role of students' alternative conceptions; and (2) the reflective process of interpersonal negotiation of meaning within the consensual domain of the classroom community.

However, our research on teachers' development of constructivist pedagogies has shown how readily traditional teacher-centred classroom environments can assimilate conceptual change perspectives and remain largely unchanged (Taylor, 1992, 1993, 1994) [11]. We have found that the rationality of traditional teacher-centred classrooms is dominated by two cultural myths: (1) an objectivist view of the nature of scientific and mathematical knowledge; and (2) a complementary technical controlling interest that views the curriculum as a product to be delivered. If classroom learning environments are to feature negotiation and meaning-making, then teachers need to be empowered to deconstruct these repressive myths.

**Instruments for Assessing Classroom Environment**

Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos's (1974) scheme for classifying human environments. Moos's three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur) and System Maintenance and System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

**Context of BuraphaPittayakhan Municipal School**

Normally, almost all villages have an elementary school. Most sub-districts have a school for ages 6 through 14 and all districts have secondary schools for ages 12 through 17. Many have vocational colleges for students from age 15. The government is not able to cope with the entire number of students, thus the private sector, which is supervised by the government, provides a significant contribution. The level of education in the private sector is generally, but not always, higher than that of the government schools. Expensive, exclusive private and international schools provide for a high level of achievement and a large number of their students continue their education at universities abroad. Charitable organisations (missionary societies or diocesan), and other religions provide the backbone of non-government, low-fee, general education and some established universities, and
their standard is relatively high. Cheaper, newer and individual private schools, are occasionally run more for profit and government subsidies than for results, and are often indistinguishable from government schools in terms of quality of buildings, resources, teaching competency, and overcrowded classrooms. Their only real benefit is the prestige afforded to the parents for schooling their children in the private sector. In rural schools, absenteeism among both students and teachers is high due to family and farming commitments. Some schools close down during rice planting and harvesting seasons.

Focused on BuraphaPittayakhan Municipal Schools is a rural or government school located in downtown Ta-lad of SubdistrictMasakhmatThailand. It admits from lower to upper secondary students Grade level at 7-8 and has the largest yearly enrolment in Maeung district in MahaSarakhamf Province the country. Founded in 1995 as a MahaSarakhamf supported the household families who live in this local area, the school have long been regarded as one of the attracting students from their social community and daily life. BuraphaPittayakhan Municipal School has among the development, enhancement, and improvement entry rates for local Thai schools. The school has 5 buildings, 39 classrooms, 2 laboratory classes. This school composes with 882 students, 63 senior professional teachers; a schooling administrator is Dr. SompongMarttean, PrapapornSinsaengi is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

**Important Problems in Science Secondary Educational Classroom Learning Environment in this study**

Thailand has formulated a policy and framework for action on education for all in the 1992 National Education Scheme in compliance with the World Declaration on Education for All adopted by all UNESCO Member States during the World Conference on Education for All in March, 1990 at Jomtien, Chonburi, Thailand. The scheme aims at guiding all related agencies to implement their activities. The World Declaration will have reached one decade old in 2000 since its adoption. An assessment on education for all will be conducted to follow up the progress of the management of education for all in UNESCO Member States. UN agencies, namely, UNESCO, UNICEF, UNDP, UNFPA, and the World Bank, have jointly published a Guideline for the Assessment as well as provided technical assistance to Member States.

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the transition to lower and upper secondary education levels was approximately 90% and it tends to be on a continual increase. The provision of pre-primary education was obviously extended as the number of school age children having obtained this level of education was relatively higher from 1990 to 68.64%. The approaches of the provision of this level of education are offered through the Community Child Care Centers, Child Care attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary education is 91.32% with equal opportunity in terms of gender. These are some of the successful models of education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to undertake the national activities in providing education for all.

In addition to such concerted efforts, Section 43 of the 1997 Constitution stipulates that all Thai citizens shall enjoy their right to education which will be provided by the government to all citizens at least twelve years of basic education with quality and free of charge. The 1999 National Education Act also legislates that compulsory education shall be extended from six to nine years and shall be completely undertaken within the year 2002. These policies reflect the models of education administration and management supporting the provision of education for all in compliance with the goals. About 10% of the out-of-school youth, particularly the disadvantaged, requires special needs to enable them to maintain in the formal education system. Both public and private agencies, have undertaken several projects to enable this group to access to formal education system. Consequently, some duplications and inequitable distribution of services were seen. Therefore, the assessment of EFA 2000 will help identify problems and solutions to ensure that the current education reform will yield maximum impacts in improving efficiency of education for all.

This study will be made possible by the assistance of agencies relating to basic education for all, both central and regional offices under the Ministry of Education as well as other relevant agencies outside the Ministry of Education. Additionally, UNESCO has also rendered its technical and financial support to the Ministry while UNICEF has assisted in translating the report into English. The Thai Ministry of Education, as the focal point of the Assessment of EFA 2000, would like to express its sincere appreciation to all concerned and hope that this report would be of benefited to wider circles of readers.

Unfortunately that isn’t the kind of good news for Asia that Thailand can share. The PISA tests of all know that Thai students don’t belong in the same class as the world-class East Asian. Of course Thailand has a few of our own some stellar students who win medals at the math and science Olympiads but their scholastic achievements are at odds with the general performance of their peers in the Thai education system. Thai students’ performance
in international standardized tests is generally below average. That’s not a surprise given such appalling scores they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor. However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is on school students, the international test that is the most relevant and highly regarded for measuring performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA 2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above 15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan, Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such as Chile, Turkey and Romania.

What has Thailand done to improve the quality of education in the past decade? Thailand has tried to do quite a lot of things in the past decade setting up the NIETS to organize O-NET was among them, but evidently the initiatives haven’t yielded good results. Thailand’s PISA scores over the past nine years have shown no discernable progress whatsoever. A lot of money has been put into the Thai education system: 20% of overall national budget or 4% of GDP. That rate of spending puts Thailand among the top spenders on education—more than what Singapore and Japan spend relative to size, although other top performers such as Hong Kong and South Korea, and neighboring countries such as Malaysia and Vietnam, also spend around 4-5% of their GDP on education. Yet, as this situation has been seen, Thailand’s results leave much to be desired.

Focusing on this research study, science classroom environment dimensions have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of school. This study will be established associations between teacher personality and classroom environment, and will report differences in the science classroom environment perceptions of Burapha Pittayakhan Municipal School students, the individual cultural differences in student perceptions of teacher-student interaction and their classroom learning environments.

This study will also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample science students in 2 classes and a school environment instrument to 1 teachers of these classes, only weak associations between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

Research purposes

1. To explore the science classroom learning environment instruments for using these research instruments in learning classroom research in the secondary education in Thailand.
2. To describe and investigate of actual students’ perception in science Classroom learning environment for using the CLES in Burapha Pittayakhan Municipal School at level 7-8.
3. To analyze of reliability and validity of the CLES and the TOCRA research instrument will use in Burapha Pittayakhan Municipal School at level 7-8.
4. To associate between students’ perception of their actual individual science classroom learning environment and their science attitudes.

Research Methodology

Research Procedures

Using the CLES was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating science laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 7-8 in Burapha Pittayakhan Municipal School, Mahasarakham Province.

Each scale of the CLES were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1, 2, 3, 4, 5, and 6; the second scale; Biology Uncertainty is composed the item of 7, 8, 9, 10, 11, and 12; the third scale; Critical Voices is composed the item of 13, 14, 15, 16, 17, and 18; the fourth scale, Shared Control is composed the item of 19, 20, 21, 22, 23; and 24; the fifth scale, Student Negotiation is composed the item of 25, 26, 27, 28, 29, and 30.

Data Analyses
The revised CLES has a 5-point Likert-type frequency response scale which comprises the categories: *almost always* (5 points), *often* (4), *sometimes* (3) *seldom* (2), and *almost never* (1). Therefore, the maximum possible mean score of each 8-item scale was 40 and the minimum possible scale mean score was 8. This response scale was designed to enable students to indicate their perceptions of the frequency of occurrence of a range of salient phenomena.

**Sample**

This study was explored and described based on the developing students’ science laboratory classroom environment with actual and preferred student’s perceptions with a sample size 64 upper secondary educational students at Grade level 7-8 in 2 classes in BuraphaPittayakhan Municipal School, Mahasarakham Province, in the first semester in academic year 2015.

**Research Instrument**

*The Constructive Learning Environment Survey (CLES)*

The purposes of this study were to validate an instrument to explore students’ preferences toward the assessing and investigating constructivist learning environments for biology classroom environments at the upper secondary educational classes. The instrument was customized and modified from the Constructivist Learning Environment Survey (CLES) questionnaire. Taylor, Fraser, & White (1994) reported of their study on an instrument for assessing and investigating the development constructivist learning environments of items in revised CLES scales. The five scales of the revised CLES were refined and reduced to seven items each. It included five components of constructivist learning: *Personal Relevance, Biology Uncertainty, Shared Control, Critical Voice* and *Student Negotiation*, the allocation of the 30 items is to the 5 scales.

*The Test of Science-Related Attitude (TOCRA)*

For purposes of establishing the concurrent validity of the five CLES scales, this study included a sixth scale to assess students’ attitudes towards their mathematics class. We expected that favourable perceptions of the classroom learning environment would be related to favourable attitudes towards the class. The Attitude scale comprised items that asked students about their anticipation of the class, their sense of the worthwhileness of the class, and the impact of the class on their interest, enjoyment and understanding. The attitude scale was based partly on items in the *Test of Science Related Attitudes* (TOSRA; Fraser, 1981)[2].

**Results**

*Validity and Reliability of Research Instruments*

*Validation of the CLES*

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
<th>Cronbach's alpha reliability</th>
<th>Discriminant validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>22.37</td>
<td>3.72</td>
<td>0.15</td>
<td>0.66</td>
<td>0.84</td>
<td>0.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Biology Uncertainty</td>
<td>18.96</td>
<td>3.16</td>
<td>0.12</td>
<td>0.57</td>
<td>0.91</td>
<td>0.72</td>
<td>0.00</td>
</tr>
<tr>
<td>Critical View</td>
<td>18.68</td>
<td>3.11</td>
<td>0.13</td>
<td>0.57</td>
<td>0.84</td>
<td>0.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Shared Control</td>
<td>18.75</td>
<td>3.12</td>
<td>1.58</td>
<td>0.51</td>
<td>0.88</td>
<td>0.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>23.21</td>
<td>3.86</td>
<td>0.98</td>
<td>0.58</td>
<td>0.82</td>
<td>0.72</td>
<td>0.00</td>
</tr>
</tbody>
</table>

*The Circumplex Nature of the ICEQ*

To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.
Table 2.
Scale Interco relations for the ICEQ Using the Actual and Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Personal Relevance</th>
<th>Biology Uncertainty</th>
<th>Critical View</th>
<th>Shared Control</th>
<th>Student Negotiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>0.76**</td>
<td>0.58**</td>
<td>0.67**</td>
<td>0.73**</td>
<td></td>
</tr>
<tr>
<td>Biology Uncertainty</td>
<td></td>
<td>0.89**</td>
<td>0.81**</td>
<td>0.63**</td>
<td></td>
</tr>
<tr>
<td>Critical View</td>
<td></td>
<td></td>
<td>0.83**</td>
<td>0.43**</td>
<td></td>
</tr>
<tr>
<td>Shared Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.54**</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Factor loading Analysis of the CLES

The Actual Form of the CLES was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the CLES. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

Table 3.
Factor Loading for Items in the Actual Form of the CLES.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>0.88</td>
<td>0.90</td>
<td>0.89</td>
<td>0.77</td>
<td>0.65</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.85</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.74</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0.72</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>0.66</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>0.89</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>0.89</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>0.87</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>0.83</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>0.78</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>0.75</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>15</td>
<td>0.93</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>0.85</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>0.80</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.79</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>13</td>
<td>0.63</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>0.46</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>22</td>
<td>0.88</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>0.87</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>20</td>
<td>0.82</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>19</td>
<td>0.77</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>23</td>
<td>0.72</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>24</td>
<td>0.66</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>27</td>
<td>0.88</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>0.86</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>29</td>
<td>0.70</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>26</td>
<td>0.68</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>30</td>
<td>0.66</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>25</td>
<td>0.64</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance | Act. | 57.80 | 70.63 | 58.15 | 62.82 | 55.08 |
|---------------|------|-------|-------|-------|-------|-------|

Eigenvalue | Act. | 3.46 | 4.23 | 3.48 | 3.77 | 3.30 |

*Loading smaller than .30 omitted. The sample consisted of 88 students
Table 4. Associations between ICEQ scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regression Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>0.26***</td>
<td>0.26***</td>
</tr>
<tr>
<td>Biology Uncertainty</td>
<td>0.26**</td>
<td>0.28***</td>
</tr>
<tr>
<td>Critical View</td>
<td>0.36***</td>
<td>0.36***</td>
</tr>
<tr>
<td>Shared Control</td>
<td>0.31***</td>
<td>0.32***</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>0.32***</td>
<td>0.33***</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6130**</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.3758**</td>
<td></td>
</tr>
</tbody>
</table>

The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between students’ perceptions on each scale of the CLES and their attitudes towards physics laboratory classes when the effect of relationships between the scales is controlled.

The multiple correlation $R$ is significant for Actual Forms of the ICEQ and shows that when the scales are considered together there is a significant ($p<0.01$) association with the TOPRA. The $R^2$ value indicates that 39% of the variance in teacher’s attitude to their school administration environment was attributable to their perceptions of their physics teachers. The beta weights (β) show that in physics laboratory environments where the teachers perceived management a more favorable attitude towards their physics laboratory environments.

Conclusions and Discussion

This research study presents an analysis of the results of a trial of the revised Constructivist Learning Environment Survey (CLES) that was conducted in a single high school mathematics classroom during 2015. Researches had chosen that particular classroom because we wanted to assess the efficacy of the CLES in generating a plausible account of a classroom learning environment that was characterised by the presence, rather than absence, of key attributes that were compatible with the critical constructivist perspective underpinning the five CLES scales.

What might have been considered, from a purely psychometric perspective, to be a relatively straightforward task of generating statistical data and refining the CLES scales by abandoning or modifying problematic items became, instead, an intriguing inquiry into the complex nature of a changing classroom learning environment. During this process, we found ourselves supplementing psychometric warrants (e.g., reliability) associated with traditional learning environment questionnaires. Researchers were able to do this by adopting an interpretive research framework within which we studied in detail the complex array of perceptions held by the teacher and students. The statistical analyses, especially problematic results (such as negative item-scale correlation coefficients) became starting points, rather than end points, of our investigation. Researchers ought to generate plausible explanations for anomalies that were apparent in both quantitative and qualitative analyses.

The richness of our investigation was enhanced by the establishment of a dialogical relationship between the teacher-researcher and one of the participant-researchers. The teacher-researcher was able to express his own critical voice about the significance of both the data that were generated in the study and the participant-researchers’ interpretations. His voice appears in two ways throughout the paper. The first is his influence (by means of continuous negotiations during the study) on the participant-researchers’ interpretations that are presented in the discussion of the results. The second, which is in a more explicit form, is by means of the Explanatory Teacher Notes which are appended to, and provide alternative interpretations of, the participant-researchers' analyses.

One of the outcomes of the study was our realization of the difficulty faced by teachers who wish to transform their classroom learning environments in accordance with a constructivist philosophy. The process of change might not be a simple transition from this research results. Researchers suggest that this problem might be minimised by careful design of items and by careful design of prompts that constrain students’ thinking within an appropriate experiential context.

Another important outcome of the study was our realization of the difficulty facing learning environment researchers who wish to promote the adoption by teachers of the role of teacher-researcher for the purpose of
undertaking pedagogical change of a constructivist nature. The CLES comprises five scales that, for many teachers, could represent five radical transformations of their current learning environments. Researchers are sufficiently realistic that we would not wish teachers to undertake more than one or two of these transformations at any one time. In that case, it would not be appropriate to make use of all five scales when monitoring students’ learning environment perceptions. There is no point in monitoring the absence of attributes of state B, especially if anomalous and misleading results are likely to be generated.

A similar problem is likely to occur if CLES scales are used too early in the monitoring of transformations to classroom learning environments (e.g., in the manner of a pretest). In the absence of desired attributes, students’ responses to CLES items might be inconsistent. For example, when considering the immediate relevance of the Teaching and Learning Project to the world outside of school over-reported perceptions of relevance as a result of transcending their immediate experiential contexts and referring to imagined future careers. Researchers therefore caution researchers to take care when adopting research designs that involve the use of the CLES to obtain measures of change in students’ perceptions.

Finally, the trial of the CLES scales made us aware of a major problem associated with the use of positively-worded items. We believe that some negatively-worded items yielded inconsistent responses from students partly because of the conceptual complexity that occurs when students consider the item in relation to negatively-worded categories (i.e., seldom, almost never) of the frequency response scale. Of course, this problem is exacerbated by the use of conceptually asymmetric items which, when reverse-scored, are assumed to contribute to a particular scale.

Acknowledgment

Firstly, I would like to thank the 64 science students in BuraphaPitakayan Municipal School who were part of the study. Thank you to Dr. Sompong Marttan, Sukanya Chaemmo, and Praphaporn Sinsaeng who allowed students to complete the questionnaire.

Secondary, I would like to thank my fellow Master of Science students, Piyarat Tamtard to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Using the ICEQ to Assessment Students’ Perceptions of their Attitude toward Chemistry in Roi-Et Wittayalai School at the Tenth-Grade Level

Chatchai Netakham¹, Tanawat Somtua², Wiriyaporn Montripoe³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
³Science Learning Group Section, Roi-Et Wittayalai School, Muang District, Rot-Et, Thailand 45000

(*) author for correspondence. E-mail: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

The aims of this study were investigated data analyses which provide information of the Individualized Classroom Environment Questionnaire (ICEQ) composes with Personalization, Participation, Independence, Investigation, and Differentiation scales was used, relationships between student’s science attitudes and actual perceptions of chemistry classroom individualization were associated. The sample size data from 188 upper secondary school students in Roi-Et Wittayalai School on the ICEQ were analyzed using multilevel variance components models to derive intra-class correlations to determine the degree to which ICEQ scores may validly be said to measure aspects of classroom climate as against individual student’s attitude with the Test Of Chemistry-Related Attitude (TOCRA). The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all five ICEQ scales. Subsequent analyses showed that statistically significant proportions of variance were attributable to the school variable. Suggestions that the ICEQ may be considered to be a relatively good measure of chemistry classroom environment are provided. The multiple correlation R was significant for the Actual Form of the ICEQ and showed that when the five scales are considered together there was significant (ρ < 0.05) association with the TOCRA, the R² value indicates that 34% of the variance in students’ attitude to their physics class was attributable to their perceptions of their individual classroom learning environment in physics classes. In these terms, the ICEQ may be considered to be a relatively good measure of classroom climate.

Keywords: Actual form, Associations, Student, Perception, Chemistry classroom, Learning

Introduction

Background of Science Educational System in Thailand

Education in Thailand is provided mainly by the Thai government through the Ministry of Education from preschool to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years’ school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable (Ministry of Education, 2010). [1]

The school structure is divided into four key stages: the first three years in elementary school, the first primary level or Prathom 1–3, are for age groups 7–9 (Grade 1-3); the second primary level or Prathom 4 through 6 are for age groups 10–12 (Grade 4-6); the third lower secondary level or Matthayom 1–3, is for age groups 13–15 (Grade 7-9). The upper secondary level of schooling consists of Matthayom 4–6 for age groups 16–18 (Grade 10-12), and is divided into academic and vocational streams. There are academic upper secondary schools, vocational upper secondary schools and comprehensive schools offering academic and vocational tracks. Students who choose the academic stream usually intend to enter a university. Vocational schools offer programs that prepare students for employment or further studies.

An assessment of the quality of secondary school education has indicated that only 40% of 3 secondary learners received adequate preparation for readiness in learning before attending university. Although Thailand has a very high percentage of youth learners attending child development centers, if such centers are not supported properly through strengthening capacity and management, the quality of secondary development and young children’s preparation for primary and secondary schooling can be seriously affected. Most students attend formal educational institutions administered by the Ministry of Education and about half of these children enroll
in learning childcare/development centers of the formal education system, mainly administered by the Department of Local Administration. The Office of Basic Education Commission (OBEC) prepares the basic core curriculum and disseminates it to all Educational Service Area (ESA) Offices for distribution to parents, guardians and teachers, so as to ensure that all key stakeholders combine efforts to provide school children with quality education. The 10-Year Plan and Policy for the Basic Educational Secondary Development (2006-2015) provides a blueprint for achieving universal student education for all Thai children. The 10-Year Plan and Policy gives priority to three main strategies, namely: (1) to support youth development; (2) to support parents and other stakeholders; and (3) to promote an environment that facilitates secondary educational learners.

**The Institute for the Promotion of Teaching Science and Technology (IPST)**

There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as; curricula, teaching/learning process, media and materials then publicize them to all relevant organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner’s development, To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations (IPST, 2011)\(^2\).

**An Important for Student's Learning Managements and Outcomes**

On 27 May 2015, the Ministry of Public Health released Thai student IQ survey results. They indicate that the IQ of Grade 1, students have dropped from 94 in 2011 to 93. The international standard is 100. It is highly possible that Thailand’s education system is harming student IQ’s. While the IQ of pre-school students is acceptable, IQ drops as primary schooling commences, suggesting a need for changes at schools. The IQ of students in rural areas is considerably lower, at just 89. This difference persists at university. While studies have found the IQ of Bangkok university students averages 115, the IQ of provincial university students is 5-8 points lower (Maxwell and Kamnuansilpa, 2015)\(^3\). Alarming, the low IQ levels in the recent survey confirm continuing high levels of intellectual disability: IQ levels lower than 70, also termed "mildly impaired or delayed". The average global percentage of such students is 2%. However, a previous 2011 survey found that 6.5% of Thai students scored in this range. The recent results suggest intellectual disability in some rural areas could now be up to 10% (Maxwell and Kamnuansilpa, 2015)\(^3\).

**international science classroom learning environment**

Four past decade years ago, Herbert Walberg and Rudolf Moos began seminal independent programs of research which form the starting points for the work reviewed in this chapter. Walberg developed the widely-used *Learning Environment Inventory* (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968)\(^4\). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the *Classroom Environment Scale* (CES) (Moos 1979\(^5\)); Moos &Trickett, 1987(\(^6\)). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Walberg, 1979\(^7\)), literature reviews (Fraser, 1994\(^8\)), MacAuley, 1990\(^9\); von Saldern, 1992\(^10\)) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the study of learning environments (Fisher, 1994\(^8\)).

**Science Classroom Learning Environments**

During the past 35 years, the study of classroom environments has received increased attention by researchers, teachers, school administrators and administrators of school systems. The concept of environment, as applied to educational settings, refers to the atmosphere, ambience, tone, or climate that pervades the particular setting. Research on classroom environments has focused historically on its psychosocial dimensions, those aspects of the environment concerned with human behaviour in origin or outcome (Boy and Pine, 1988\(^11\)). Reviews of classroom environment research by Fraser (1998b\(^12\)), Dorman (2002\(^13\)), Goh and Khine (2002\(^14\)) and Khine and Fisher (2003\(^15\)) have delineated at least 10 areas of classroom environment research including: associations between classroom environment and outcomes, evaluation of educational innovations, differences between students’ and teachers’ perceptions of classrooms, comparisons of actual and preferred environments, effect on classroom environment of antecedent variables (for example, gender, year level, school type, subject); transition from primary to secondary school, school psychology, teacher education, educational productivity research, and using environment instruments to facilitate changes in classroom life.

**Instruments for Assessing Science Classroom Environment**

Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: *Learning Environment Inventory* (LEI); *Classroom Environment Scale* (CES);
Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos's (1974) scheme for classifying human environments. Moos's three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur) and System Maintenance and System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Selected the Classroom Learning Environments for this Study

The Individualized Classroom Environment Questionnaire (ICEQ)

The Individualized Classroom Environment Questionnaire (ICEQ) is designed to measure student or teacher perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information about: (1) the validity of the ICEQ; (2) differences between scores on different forms of the ICEQ; (3) relationships between student learning outcomes and perceptions of classroom individualization; and (4) relationships between student learning outcomes and actual/preferred congruence. A copy of the ICEQ is appended.

Context of Roi-Et Wittayalai School

Focused on Roi-Et Wittayalai School is a rural or government school located in Roi-Et city on Tapharak road, Muang District, Roi-Et, Thailand. It admits from 36 lower secondary classes to 54 upper secondary classes and 4,256 students at Grade level at of 7-12 and has the largest yearly enrolment in the Roi-Et Province. Founded in 1803 as a Wat That Thong supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. Roi-Et Wittayalai School has among the development, enhancement, and improvement entry rates for local Thai schools. The school has 6 buildings and 9 Hall rooms. This school composes with 236 professional teachers, a schooling administrator is Dr. Preeda Sammana, and Mrs. Wiriyaporn Montripee and is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

Quick Win on Science Secondary Educational Classroom Learning Environment

Thailand has formulated a policy and framework for action on education for all in the 1992 National Education Scheme in compliance with the World Declaration on Education for All adopted by all UNESCO Member States during the World Conference on Education for All in March, 1990 at Jomtien, Chonburi, Thailand. The scheme aims at guiding all related agencies to implement their activities. The World Declaration will have reached one-decade old in 2000 since its adoption. An assessment on education for all will be conducted to follow up the progress of the management of education for all in UNESCO Member States. UN agencies, namely, UNESCO, UNICEF, UNDP, UNFPA, and the World Bank, have jointly published a Guideline for the Assessment as well as provided technical assistance to Member States.

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the transition to lower and upper secondary education levels was approximately 90% and it tends to be on a continual increase. The provision of pre-primary education was obviously extended as the number of school age children having obtained this level of education was relatively higher from 1990 to 68.64%. The approaches of the provision of this level of education are offered through the Community Child Care Centers, Child Care attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary education is 91.32% with equal opportunity in terms of gender. These are some of the successful models of education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to undertake the national activities in providing education for all.

In addition to such concerted efforts, Section 43 of the 1997 Constitution stipulates that all Thai citizens shall enjoy their right to education which will be provided by the government to all citizens at least twelve years of basic education with quality and free of charge. The 1999 National Education Act also legislates that compulsory education shall be extended from six to nine years and shall be completely undertaken within the
year 2002. These policies reflect the models of education administration and management supporting the provision of education for all in compliance with the goals. About 10% of the out-of-school youth, particularly the disadvantaged, require special needs to enable them to maintain in the formal education system. Both public and private agencies, have undertaken several projects to enable this group to access to formal education system. Consequently, some duplications and inequitable distribution of services were seen. Therefore, the assessment of EFA 2000 will help identify problems and solutions to ensure that the current education reform will yield maximum impacts in improving efficiency of education for all. This study will be made possible by the assistance of agencies relating to basic education for all, both central and regional offices under the Ministry of Education as well as other relevant agencies outside the Ministry of Education. Additionally, UNESCO has also rendered its technical and financial support to the Ministry while UNICEF has assisted in translating the report into English. The Thai Ministry of Education, as the focal point of the Assessment of EFA 2000, would like to express its sincere appreciation to all concerned and hope that this report would be of benefited to wider circles of readers.

Unfortunately that isn’t the kind of good news for Asia that Thailand can share. The PISA tests of all know that Thai students don’t belong in the same class as the world-class East Asian. Of course Thailand has a few of our own some stellar students who win medals at the math and science Olympiads but their scholastic achievements are at odds with the general performance of their peers in the Thai education system. Thai students’ performance in international standardized tests is generally below average. That’s not a surprise given such appalling scores they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor. However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is on school students, the international test that is the most relevant and highly regarded for measuring performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA 2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above 15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan, Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such as Chile, Turkey and Romania.

What has Thailand done to improve the quality of education in the past decade? Thailand has tried to do quite a lot of things in the past decade setting up the NIETS to organize O-NET was among them, but evidently the initiatives haven’t yielded good results. Thailand’s PISA scores over the past nine years have shown no discernable progress whatsoever. A lot of money has been put into the Thai education system: 20% of overall national budget or 4% of GDP. That rate of spending puts Thailand among the top spenders on education—more than what Singapore and Japan spend relative to size, although other top performers such as Hong Kong and South Korea, and neighboring countries such as Malaysia and Vietnam, also spend around 4-5% of their GDP on education. Yet, as this situation has seen, Thailand’s results leave much to be desired.

This study wills also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample chemistry students in 4 classes and a school environment together by investigating links between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

**Research Purposes**

1. To explore the science classroom learning environment instruments for using these research instruments in learning classroom research in the secondary education in Thailand.
2. To describe and investigate of actual students’ perception in Chemistry Classroom learning environment for using the ICEQ in Roi-Et Wittayalai school at level 10.
3. To analyze of reliability and validity of the ICEQ and the TOCRA research instrument will use in Roi-Et Wittayalai school at level 10.
4. To associate between students’ perception of their actual individual chemistry classroom learning environment and their chemistry attitudes.

**Literature Reviews**

Fraser used the Individualized Classroom Environment Questionnaire (ICEQ), Constructivist Learning Environment Survey (CLES), Test of Mathematics-Related Attitudes (TOMRA), and concept map tests were administered to two groups of fifth-grade students as pretests and posttests over an academic year were assessed.
To enrich the data collected from those questionnaires, three case studies (one for the experimental group and two for the control group) were undertaken based on observations and interviews of selected students. Relative to non-students, students experienced more favorable changes in terms of mathematics concept development, attitudes to mathematics, and perceived classroom environments on several dimensions of the CLES (e.g., Personal Relevance, Shared Control) and the ICEQ (e.g., Participation and Differentiation). Qualitative information based on classroom observations and student interviews reinforced and enriched the patterns of results obtained from the concept test and questionnaires.

Fraser and Azmistudied in extensive research conducted in developed countries has established classroom learning environment as a thriving field of study. The present investigation makes a contribution to classroom environment research in that it involved the translation into Indonesian of scales previously available only in English, and the subsequent validation and use of these translated scales among Indonesian students. The new Indonesian instrument consists of nine seven-item scales based upon the Individualized Classroom Environment Questionnaire and the Classroom Environment Scale. Analyses of data collected from a sample of 373 Indonesian students from nine schools supported the new instrument's internal consistency, discriminant validity, ability to differentiate between classrooms, and predictive validity (i.e. ability to predict student outcomes). Potential applications of the new instruments in Indonesian classrooms are suggested.

Materials and Methods

Research Procedures

Using the ICEQ was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating chemistry laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 10 in Roi-Et Wittayalai School. Each scale of the ICEQ were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1,2,3,4 and 5; the second scale, Participation composed the item of 6,7,8,9 and 10; the third scale, Independence composed the item of 11,12,13,14 and 15; the fourth scale, Investigation composed the item of 16,17,18,19 and 20; the fifth scale, Differentiation composed the item of 21,22,23,24 and 25.

Research Instruments

The Individual classroom Environments Questionnaire (ICEQ)

Basically, the Individualized Classroom Environment Questionnaire (ICEQ) is designed to measure student perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information, such as the validity of the ICEQ; differences between scores on different forms of the ICEQ; relationships between student learning outcomes and perceptions of classroom individualization; and relationships between student learning outcomes and actual/preferred congruence. A copy of the ICEQ is appended

The ICEQ assesses those dimensions which distinguish individualized classrooms from conventional ones. The initial development of the ICEQ was guided by: the literature on individualized, open and inquiry-based education; extensive interviewing of teachers and secondary school students; and reactions to draft versions sought from selected experts, teachers and junior high school students. The final published version of the ICEQ (Fraser, 1990[16]) contains 50 items altogether, with an equal number of items belonging to each of the five scales. Each item is responded to on a five point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items. Typical items are “The teacher considers students’ feelings” (Personalization) and “Different students use different books, equipment and materials” (Differentiation). The copyright arrangement gives permission to purchasers to make an unlimited number of copies of the questionnaires and response sheets.(Fraser, 1998b[12])

The Test of Chemistry-Related Attitude (TOCRA)

This study investigated associations between Actual students’ perceptions of their chemistry laboratory environment classes in Roi-Et Wittayalai School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981[17]) and Santiboon (2014[18]) was modified, adapted, and selected to the Test Of Chemistry-Related Attitude (TOCRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in Roi-Et Wittayalai School students. The eight items are suitable for group administration and all can be administered with the duration of Actual and Preferred Students’ Perceptions of their chemistry laboratory environment classes. Furthermore, the TOSRA has been carefully developed and
extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Sample**
This study was explored and described based on the developing students’ chemistry laboratory classroom environment with actual and preferred student’s perceptions with a sample size 166 upper secondary educational students at Grade level 10 in 4 classes in Roi-Et Wittayalai School, Roi-Et Province, in the first semester in academic year 2015.

**Data Analysis**
Assuming the scales of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred ICEQ forms and the Attitude scale as specified in Santiboon (2014[18]). Factorial validity and adequacy of fit for the dimensionality of the ICEQ were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the ICEQ with students’ attitudes to associate were analyzed.

**Results**

**Validity and Reliability of Research Instruments**
The existence of a sizable positive association of the class means of students’ actual scores would support the concurrent validity, of the ICEQ’s actual form. Two different statistics were calculated to describe, these associations using Actual form together with the corresponding sample of 4 classes of 168 chemistry students, The results of these two types of analysis generally indicate the presence of quite sizable associations between student perceptions of actual chemistry classroom environment, and therefore support the validity of the actual forms of the ICEQ.

**Validation of the ICEQ**
Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

### Table 1: Scale Mean Scores, Means, Variance, and Standard Deviations for Actual Form of the ICEQ

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard deviation</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>23.90</td>
<td>4.69</td>
<td>0.15</td>
<td>1.10</td>
<td>0.74</td>
<td>0.71</td>
<td>4.82***</td>
</tr>
<tr>
<td>Participation</td>
<td>24.04</td>
<td>4.81</td>
<td>0.12</td>
<td>1.25</td>
<td>0.67</td>
<td>0.72</td>
<td>2.97*</td>
</tr>
<tr>
<td>Independence</td>
<td>23.70</td>
<td>4.74</td>
<td>0.13</td>
<td>1.17</td>
<td>0.72</td>
<td>0.71</td>
<td>4.53***</td>
</tr>
<tr>
<td>Investigation</td>
<td>23.82</td>
<td>4.76</td>
<td>1.58</td>
<td>1.26</td>
<td>0.73</td>
<td>0.71</td>
<td>4.74***</td>
</tr>
<tr>
<td>Differentiation</td>
<td>24.19</td>
<td>4.84</td>
<td>0.98</td>
<td>0.95</td>
<td>0.70</td>
<td>0.72</td>
<td>5.47***</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

The strongest tradition in past classroom environment research has involved investigation of the predictability of students' cognitive and effective learning outcomes from their perceptions of psychosocial characteristics of their classrooms. Moreover, numerous research programs involve many thousands of students from various.

**The Circumplex Nature of the ICEQ**
To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.
Table 2. Scale Intercorrelations for the ICEQ Using the Actual and Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.41**</td>
<td>0.34**</td>
<td>0.32**</td>
<td>0.17*</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.13*</td>
<td>0.50**</td>
<td>0.38**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.23*</td>
<td>0.19*</td>
<td>0.25*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Factor Loading Analysis of the ICEQ

The Actual Form of the ICEQ were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 3. Factor Loading for Items in the Actual Form of the ICEQ.

<table>
<thead>
<tr>
<th>Item</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>0.43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td>0.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td>0.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td>0.47</td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 88 students

The Actual Form of the ICEQ was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the ICEQ. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

Associations between Student Attitudes and Chemistry Classroom Environments

The strongest tradition in past classroom environment research has involved investigation of associations between students’ cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics.

In this study, it was also considered important to investigate associations between students’ perceptions of their physics classroom learning environments with their attitudes toward physics. The selection of an evaluation and assessment instrument suitable for confirming the third research purposes was required. The internal consistency
of the selected TOCRA was 0.77, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in physics classes.

Two main methods of data analysis were used to investigate this environment attitude relationship. These involved: simple correlation analyses of relationships between students’ perceptions of actual physics laboratory classroom environments with their attitude toward physics; and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOCRA. The summary of the result of this analyse is reported in Table 4.

The simple correlation values \( r \) are reported in Table 4 which show significant correlations \( p<0.01 \) between students’ attitudinal outcomes and physics laboratory classes on all of five scales. These associations are positive for the all of scales of Personalization, Participation, Independence, Investigation and Differentiation scales. That is, in physics laboratory class environment where the teachers perceived a more favorable attitude towards their physics laboratory environment.

Table 4. Associations between ICEQ scale and attitude scale to information communication technology class in term of simple and multiple correlations \( r \) and standardized regression coefficient \( \beta \)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlate</th>
<th>Std. Regress Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Attitude ( r )</td>
<td>Attitude ( \beta )</td>
</tr>
<tr>
<td>Personalization</td>
<td>0.11*</td>
<td>0.18*</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.16*</td>
<td>0.23*</td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.17*</td>
<td>0.31*</td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>0.23*</td>
<td>0.32*</td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td>0.34**</td>
<td>0.48**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation ( R )</td>
<td>0.5803**</td>
<td>0.3368**</td>
<td></td>
</tr>
</tbody>
</table>

The second type of analysis consisted of the more conservative standardized regression coefficient \( \beta \) which measures the association between students’ perceptions on each scale of the ICEQ and their attitudes towards physics laboratory classes when the effect of relationships between the scales is controlled. The multiple correlation \( R \) is significant for Actual Forms of the ICEQ and shows that when the scales are considered together there is a significant \( p<0.01 \) association with the TOCRA. The \( R^2 \) value indicates that 34% of the variance in teacher’s attitude to their school administration environment was attributable to their perceptions of their physics teachers. The beta weights \( \beta \) show that in physics laboratory environments where the teachers perceived management a more favorable attitude towards their physics laboratory environments.

Conclusions and Discussion

The results of this study have described the development and validation of short forms of the Individualized Classroom Environment Questionnaire (ICEQ). In addition to a short form of each instrument measuring perceptions of actual environment, a short form of the ICEQ and CES measuring preferred environment was also developed. The short form of each instrument contains 25 items, provides a rapid and economical assessment of student perceptions of psychosocial characteristics of classroom learning environment, and can be used to provide reliable information about class mean perceptions (rather than individual student perceptions). Support for the validity of the short forms of the ICEQ was obtained by using the class mean as the unit of analysis in a variety of analyses based on samples of less than 100 science classes. In particular, for each scale in each of the short forms developed, it was found that the correlation actual form was very large, and that the internal consistency reliability and discriminant validity were satisfactory.

Other analyses performed for the actual form of the short version of each instrument attested to each short scale’s ability to differentiate between the perceptions of students in different classrooms, and to its predictive validity (i.e., its ability to predict cognitive and affective outcomes). The ICEQ is likely to be used by researchers, curriculum evaluators, and teachers to replicate, consolidate, and extend the traditions of past research which involved use of the form of these scales and which were discussed in greater detail earlier in this article. Further studies of the predictive validity of the short forms of association between learning outcomes and environment perceptions) could be pursued for a variety of student ages and cultures and using various
cognitive, affective, and psychomotor outcome criteria. Similarly, there is scope for employing classroom environment characteristics as criterion variables in studies into factors influencing the classroom environment. In particular, curriculum evaluators and teachers have not used classroom environment criteria nearly as much as they might have when evaluating educational innovations, new curricula, or teaching approaches. Similarly, the short forms could be used in research analogous to prior studies which have investigated various factors (e.g., class size, grade level, subject matter, type of school) which affect the classroom environment. This article also identified several promising new research directions which are based on the use of both actual and preferred forms of classroom environment scales. These include investigations of differences between student and teacher perceptions of actual and preferred environment, person environment fit studies of whether students achieve cognitive and affective aims better when in their preferred environment, and practical attempts by teachers to make use of environment assessments in facilitating improvements in their classrooms. It is hoped that the existence of the economical and reliable short forms of the classroom environment instruments described in this article will assist researchers and teachers wishing to follow some of these promising directions.

This study evidences confirmation of the research studies at the four past decades, for example; using the ICEQ, associations with students' cognitive and affective outcomes have been established for a sample of approximately 68 senior high school chemistry classes in 489 senior high school biology students in Australia and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser 1996[19]). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (1995b[20]) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the QTI, associations between student outcomes and perceived patterns of teacher-student interaction were reported for samples of 489 senior high school biology students in Australia 3,994 high school science and mathematics students in Australia 1,512 primary school mathematics students in Singapore and 2,256 lower secondary science dream school project students in Thailand (Sanitiboon, 2013[21]).

Acknowledgments

Firstly, I would like to thank the 168 students in Roi- Et Wittayalai School at the Grade level 10 who were part of the study Dr. PreedaSammana, the schooling administer and Mrs. WiriyapornMontripoeand is the teacher trainer, who allowed students to complete the questionnaire.

Second, I must thank you my supervisor; Dr. TanawatSomtuaand Dr. PanwilaiChomchid; my co-supervisor, they understood and never pushed me to build up of my research that it was going on work, completely.

Finally, my greatest thanks go to Assist. Prof. Dr. ToansakulSantiboon, as my extra editor and reviewer, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Research for Development, the Participation of the Community and Elevate to Management Cultural Tourism Model in Chiang Khan Municipality, Chiang Khan District, Loei Province

Thongsai Yowa

Major subject Educational Management for Local Development, Faculty of Education, Rajabhat Maha Sarakham University, Thailand
E-mail: numnim.dorn@hotmail.com

Abstract

This research aimed to 1) to study the current condition of participation in the management of cultural communities in Chiang Khan municipal district. 2) to study the potential for cultural tourism resources of the community in Chiang Khan Municipality. 3) develop the one model of community participation in the management of cultural tourism. 4) compare among the communities where had there were successes and failures in cultural tourist management. For the research methodology, it was conducted and based on both of participatory action research and research and development techniques. The research was divided into 3 Phase, with 4 research steps 1) study on basic data 2) design and development of instruments and 3) trial in the instruments and 4) evaluate the study. The research instruments employed here were structural interviewing questionnaire, guideline for In-depth Interview and guideline for Focus group discussion. Respectively, the collected data was quantitatively and qualitatively analyzed with Statistical Package Computer Program and technique of content analysis.

The results, were as follows:
1. Receiving news and information about the management of cultural tourism of the samples were found. Ever get information about the management of cultural tourism of 53 people, representing 58.87 percent. Source Information received, mostly from media people (relatives, neighbors, community leaders, public officials) of 64 people, representing 71.12 percent. Participation in social activities were mainly village meeting of village headmen of 75 people, representing 83.33 percent. The level of perception is moderate 67 percent from 74.44.
2. Overview of the participation of the local population sample in management cultural tourism in Chiang Khan wa moderated and considerate.
3. According to the study on potential of management of cultural tourism found the result found that assessment of cultural tourism was in the moderate level.

Keywords: Research for Development, Participation, Changing in Cultural Tourism

Introduction

Thailand's national cultural heritage as their own heritage for a long time. There are many valuable Thai things such as ethnic groups, language, and food. And a country also has a culture which is one of the richest of tourism resources in the world. Due to the diversity of the natural ecosystem and cultural tourism resource Immensely valuable to the develop sustainable tourism as well (Aranya Thanawan, 2556). Tourism was raised as an important phenomenon in Thailand. especially cultural tourism. This tourism-related cultural factors are in all aspects of tourism, culture is used as a guide in the development of the local tourism industry. and presenting the cultural heritage of the community to tourists. For implying royalty, life is pretty good. And has been inherited from the past to the present. The concept of the local culture is unique thing in the social local. Culture exists because human learning from the past to the present and continuously. develop new and creative things. By these resources they will play an important part in the development of tourism in the local area. Each community will have its own resources, cultural wealth and identity. This has been used to advertise the tourism of the area immensely. That culture become a product for sale to tourists to signify. (Nuttapon Meekeaw, 2554).

Loei province is located in northern of the Northeast. Surrounded by the mountainous terrain. The weather and nature makes this province "The city of Mountain Mist and Coldest Place in Siam "Loei province has a high potential for tourism. Due to cultural and natural attractions. Loei maintain traditions has been popular in tourists at the top level of the country. (Sudarath Sutchaya, 2549: 5)

Cheang Khan is, a small town along the Mekong River in Loei province and is seen as the next location. of influx of visitors. It is becoming more famous attractions of Thailand. with an element of tourism facilities. With its nature charm history, culture, and easy lifestyle in becomes big trend for tourists who seek peaceful life. You
can maintain Khan Way of living Tradition and culture, with a unique, distinctive and clear. The old wooden building has preserved very well, including lifestyle on the culture and nature (Lomlumpei, 2553: 41). The people open their houses to welcome visitors and to increase the number of tourists. Khan began making several problems. The old urban street change lifestyle communities arising from tourism is considered an urgent problem that must be protected for the future. But the progress of technology and the impact on communities and culture caused by tourism development within the community is likely to expand even more serious. If people still lack of common sense to solve problems and cooperation from the parties community does not have a good plan. The system will not go in the same direction.

Research Objectives
1. To study the current condition of participation in the management of cultural communities in the municipal district in Chiang Khan sub district, Loei Province.
2. To study the potential for cultural tourism resources of the community in the Municipality Chiang Khan sub district, Loei Province.
3. Develop the one model of community participation in the management of cultural tourism.
4. Compare among the communities which had their successes and failures in cultural tourism management.

Research questions
1. What is the overall current state of the involvement of the community in determining the activity or major cultural tourism in the Municipality Chiang Khan and how to do so?
2. What are the potential for cultural tourism resources to the Chiang Khan community?
3. What are ways and means of form the participation of the community to improve the management of sustainable cultural tourism in the Chiang Khan Municipality.

Research concept
The researchers summarized and synthesized a framework for research that links various issues. The integration consists of a variable is the context of the community in the Chiang Khan Municipality. 1. The variables include cultural tourism potential of the area to the management and organizational activities 2. The participation of communities in tourism management. participation in decision, making, participation practice, participation beneficiaries and participate rates.

Materials and Methods

Phase 1
Phase 1 was used to collect 2 types of information.
1. In-depth Interview for the interviews, conditions, problems and needs of the communities involved. Which are a form of structured interviews (Structured Interview) the nature of the questions are open-ended questions (Open-ended question) consists of two parts.
   The first basic information such as gender, age, marital status, education, occupation and income. The information awareness about cultural tourism.
   The second participation of information in the management of cultural tourism by dividing the issue into five areas: 1) a joint planning. 2) a joint action plan. 3) a joint use of four 4) a joint monitoring and evaluation. 5) a joint maintenance.
2. Questionnaire was closed questions (Close-ended question) and open-ended questions (Open-ended question) to store data. Questionnaire is divided into three parts.
   The first basic information of respondents, including gender, age, marital status, education, occupation and income.
   The second management information about the potential of cultural communities in the Municipality of Khan. Which includes three issues: 1) the potential to attract tourism 2) the potential to support the tourism 3) Management. (Environmental Research Institute, 2557).
   The third potential tourism resources Local Municipality Khan province, which includes seven point. 1) potential tourism resources. 2) the tourist. 3) the wisdom. 4) culture and tradition. 5) tourism policy. 6) the facility. and 7) the organization in the community.
   The fourth recommendation with regard to the development of cultural tourism in the Municipality Chiang Khan.
Research Methodology

The research methodology was used in this research was R & D (Research and Development) with a participatory action research participants. (Participatory Action Research: PAR).

Research Scope

In this study, the researchers divided the study into three stages: stage four.

- Phase 1
  - Research (Research: R1) to study and analyze information to develop (Analysis: A).

- Phase 2
  - Development (Development: D1) to design and develop tools for research (Design and Development: D & D).

- Phase 3
  - Research (Research: R2) of the trial or Dr. tool to use. (Implementation: I)
  - Development (Development: D2) Evaluation and Improvement (Evaluation: E).

Population and sample group

Population

1. Local populations, including people living in nine communities and municipalities Chiang Khan.
2. Visitors include tourists who travel to Thailand in Chiang Khan district in Loei Province during the period for which the data was collected for study in phase one.
3. Government agencies, including agencies that are involved with the development of tourism in the Municipality Khan as Khan Taos. Khan etc. Tourism School.
4. The private sector, including operators of tourism such as tour operators, accommodations, restaurants in the tourist areas in the Chiang Khan municipality.

Sample group

The sample used in this study consisted of.

1) Local population and purposive sampling defining features of population samples by population and feature information on the subject to be studied from all nine communities and select 10 people from each community, so this will be totally 90 people.
2) 400 Thai visitors selected by accidental sampling.
3) The government agency selected by purposive sampling including the mayor of the Municipality of Chiang Khan sub district, 8 chief executives of Chiang Khan sub district, scholars, tourists, 2 bachelor's degree teachers, 3 policemen, this sample group will be totally 32 people.
4) 16 local private sectors selected by purposive

Content Phase 1 research

(Research: R1) To study the and analyze information to develop (Analysis: A).

Objective

Phase 1, To study and analyze basic data management Cultural Tourism Initiative in Chiang Khan municipality Chiang Khan district in Loei in the following issues.

1. study the involvement of communities in the management of cultural tourism. divided into five areas: 1) the joint planning, 2) a joint action plan. 3) a joint use, 4) a joint monitoring and evaluation. 5) a joint maintenance in the cultural community in the Chiang Khan Municipality.
2. study the ability to manage cultural communities in the Chiang Khan include contextual information, residential communities, and way of life of the traditional arts and crafts and tradition
3. study educational resources, a major tourist area in Chiang Khan district in Loei, including facilities services and the ability to access internal tourism resources.
4. study potential Analysis, SWOT Analysis, management cultural tourism in the Chiang Khan Municipality, analyze strengths, weaknesses, opportunities and threats. The management of cultural tourism in the Chiang Khan Municipality.

Research areas

The research will be conducted in Chiang Khan district, Loei province.

Research period

Phase 1 will start from January 2558 - May 2558.
Results

1. Analysis of community participation in the management of cultural communities in the Chiang Khan Municipality.
   1.1 General Information
      Overview of the resident were 58 women (64.44%) as aged between 20-30 years, for 45 people, 36% of them were students and 40% of them educated in higher secondary education level. 42 People were vocational (46.66%) who have average income less than 5000 Bath/Month.

1.2 Recognition of information on managing cultural tourism.
   The information awareness about the cultural tourism of the sample found that 53 people (58.87%) received news about the exploration. 64% of the people received source information of the media people (relatives, neighbors, community leaders, public officials) 71.12% attend social events.

2. The participation of the local population in the management of cultural tourism in the Chiang Khan Municipality
   There were participation of people in Chiang Khan district in Loei Province in the management of cultural tourism in the medium level (= 3.28) when the criterion is found. The participation of citizens is moderate. Sort order: No. 1 joint monitoring and evaluation (= 3.47), No. 2, a joint action plan (= 3.28), No. 3 The Joint Planning (= 3.20), No. 4 joint utilization (= 3.16), No. 5 joint maintenance (= 3.02).

   The analysis of in-depth interviews from a sample of three groups of tourists. agencies and private sectors had the potential for cultural tourism community in the municipality of Chiang Khan. The result will be summarized in the issue as follows:

   The potential for cultural tourism community in the municipality of Chiang Khan. consisting of three issues, the residents were from public sector, private sector and the samples found that potential tourists attraction in Chiang Khan district overall was moderate. with an average value (= 2.65) when the criterion can sort the No. 1 potential in culture and tradition with an average (= 3.60) in a sequence of two potential travel policy with a mean (= 3.55) in a sequence of three potential tourism resources, with an average (= 3.34) were moderate number four potential wisdom, the mean (= 3.12) were moderate number five potential things, Facilities with a mean (= 3.04) in moderate 6th potential tourists, with an average (= 2.77) level 7 on the organization of the community average (= 2.48) at a low level.

3. The analysis the current situation of cultural tourism in Municipalities in the Chiang Khan district, The analysis of strengths, weaknesses, opportunities and threats. The management of cultural tourism in the Chiang Khan Municipality, the result found that:
  Strengths
   1) The strong points of Chiang Khan district are natural attractions, cherish in forest resources, historical building and architecture, religious places such as temples. The 100 year old houses are also its strength, and also the food, language, culture, ways of life and traditions.
   2) The transportation to Chiang Khan is very convenient, the tourists cold access to the district by land by air.

   Weakness
   1) Lack of good management the tourism management still lack of practice and well rules which effected to community's image.
   2) The facilities did not meet tourists needs. The facilities such as restaurants, toilets and convenient stores still not enough for the tourists.
   3) lack of signage to attract tourist.
   4) Lack of specialists who can provide information to the tourists in the area.
   5) Lack of efficiency marketing management.
   6) Lack of agency coordination in the field of tourism between communities and authorities, public and private and given understanding on the cooperation of the community. The agency should have a clear responsibility in tourism.
   7) Lack of knowledge and understanding of the local tourism administration. Some people still do not know what a tourist attraction in their local. History, however, has they also lack a sense of responsibility in being a good host to visitors.
   8) Lack of communities strengthened. The cooperation in compliance with the requirements of the old wooden houses built in the area along the river. In order to promote the image 100 year old community house.

   Opportunities
   1) Administration and Related Agencies. should begin to focus on tourism of the area. The policy promotion and development of tourism in the area.
2) Promote tourism cooperation with neighboring countries by making an agreement to gain opportunity to promote tourism to grow faster.

3) The variety of tourism activities in the area such as providing more various kind of activities to attract more tourists.

Threats
1) The volatility of the economy, such as the volatility of oil prices. Affect the travel of tourists.
2) Political situation which effect to the safety of the country and will make frighten tourists not to come to Chiang Khan district.
3) Seasonal conditions for example, in rainy season, there will be a lot of car accident.
4) The advantage of serving tourists: Some operators are also opportunistic exploitation of tourists by rising prices for goods and services to tourists.

Conclusions and Discussion

1. Analysis of community participation in the management of cultural tourism.

1.1 Knowledge about the cultural tourism of the sample found that overall knowledge and understanding of the local population is high, according to the study of the involvement of the community in the ecotourism market case study: Community market Bang Bang Phli, Samut Prakan. The results showed that Citizens and entrepreneurs have a better understanding about the management of cultural tourism the most.

1.2 Overview of the involvement of communities in the management of cultural tourism in the Municipality Khan include joint planning. The joint action plan Sharing benefits the Joint Monitoring and Evaluation And the Joint Maintenance Results from the study showed that Nat moderately in line with forecasts for traditional Confederation (2554) studied the development of cultural tourism. Chiang Khan district in Loei, the researchers found. that the participation of citizens in the development of cultural tourism as a whole is moderate when considering aspects of the disengagement plan. The joint action plan, the joint use, the joint monitoring and evaluation and the Joint Maintenance Results from the study showed that all aspects of the involvement of local populations are moderate in line with Wipada Moonstone (2557) studied the involvement of citizens in the management of eco-tourism Umphang, Tak results found he participation of citizens in managing all aspects of ecotourism are moderate.

2. The results of the exploration potential of communities in the Chiang Khan municipality.

2.1 Analysis of data
Most people in the community, farmers and trade folklore traditions and ways of life, like the East in general based on the Heats 14 and 12 of the festivals and traditions that have practical merit. The current situation in tourism has returned to prominence again. Chiang Khan became popular because of this tour. In line with the concept of international law regarding cultural tourism. The playground and undergrowth Ze Ze Ya Nant Thar Depot's (2550) has said that cultural heritage the testimony of historical development. It plays an important role in contemporary life. Must build understanding and awareness of the importance of their cultural heritage with its well-balanced and deploy the status quo.

2.2 Current situation of the cultural tourism in the Municipality Khan SWOT Analysis of tourism in the current situation.
Strengths of tourism in the current situation the unique attraction of visitors using a simple life. A tourist looks at a wide range the travel is quite convenient
Weakness : The order of attractions such as shops, restaurants, a nonstandard rates. Rather waste adversely affect the landscape of tourism.
Opportunities : government to pay more attention to conservation, community development, old wooden houses ancient city. Contribute to the development of tourism facilities, coupled with conservation tourism.
Threats issues oil prices, seasonal problem and the problem of the political opposition and natural disasters which impact to traveling.

2.3 Analysis of the potential of cultural tourism in the Chiang Khan Municipality.
The study found that potential as a source of cultural tourism in the Chiang Khan Municipality is important and interesting to attract tourists who visit the town. The history the ethnic group with cultural practices, tradition rituals, beliefs, language, lifestyle belongings local natural resources and various professional groups These are unique to the culture of the community. That as a learning local history and culture should be valuable to learn. It is a space that is conducive to cultural management in line with Surachai win Boon (2550) discussed the potential. Management and Cultural Tourism Choosing a home-stay tourism. Education for life Cultural heritage and environment to achieve these sustainable potential. It is primarily a lifestyle, conservation and promotion of heritage to the children anyway.
Today, communities in the Municipality of Khan does not form a proper tour. However, with the potential existing in the community. It is encouraging communities to develop tourism in the form of cultural tourism in the future and coupled with the limits and obstacles, especially in the corporate community. And facilities This will give visitors an impression and travel back into the community again. It is also good publicity. If the visit is to promote viral (Words of Mouth), which is another factor that will make communities in the Municipality of Khan succeeded in the development community as a cultural tourism destination next prototype.

Acknowledgements

I would like to express my sincere thanks to my thesis advisor, Dr.Udorn Oragun for him invaluable help and constant encouragement throughout the course of this research. I am most grateful for him teaching and advice, not only the research methodologies but also many other methodologies in life. I would not have achieved this far and this thesis would not have been completed without all the support that I have always received from him.

Finally, I most gratefully acknowledge my parents and my friends for all their support throughout the period of this research.

References

[1] Boonchom Sisaard (2535) Research, measurement and assessment results. Faculty of Education. University Srinakharinwirot Mahasarakham
A Model for Teacher Development in Local Administration in Mahasarakham Provincial Municipality by Local Wisdom of the Sufficiency Economy Philosophy for Educational Management Inclusive Schools

Prapatsorn Pre-iam*, Thamanoon Raweepong, Prasopsuk Rittidet, Sorn Homepan, Manoon Petmeekae and Sompong Marttan

Faculty of Education Rajabhat Maha Sarakham University
Thailand
(*author for correspondence, E-mail: Prapatsorn_ty@hotmail.com; Fax: 043-713206)

Abstract

This study aimed developing teachers’ quality, developing and using teachers’ learning management format based on sufficiency economy philosophy in schools under MuangMahaSarakham municipality in MahaSarakham Province. The experimental research methodology was used in this study. The data were gathered in both quantitative and qualitative forms. The study was divided into three stages. Stage 1: studying teachers’ problems and needs, stage 2: developing teachers’ quality by offering training in teaching and learning management format development and stage 3: finding the results of utilizing the learning management format based on the sufficiency economy philosophy in improving learners’ ability.

The findings are as follows:

1. The findings indicated that the problems and teachers’ needs for application of sufficiency economy philosophy for teaching and learning were at a high level. Teachers lacked understanding in applying the philosophy into the contents and academic activities in schools. For the teaching and learning management, teachers did not develop relationship between teaching and learning activities and transferring knowledge from networks of knowledge from local communities. And for improving learners’ quality, transferring local wisdom into teaching activities as suggested in Sufficiency Economy Philosophy was not taken into practice.

2. Three directions in elevating and developing teachers’ ability in utilizing local wisdom into school activities as suggested in Sufficiency Economy Philosophy: 1) Developing teachers’ ability in knowledge searching: Teachers’ ability in searching for information by setting up questions and finding answers from local communities was enhanced. 2) Applying Sufficiency Economy Philosophy into teaching and learning by using four teaching techniques: a) Learning from experience. b) Learning from practice by practicing reflecting their experience in collecting data from communities in four sufficiency areas; sufficiency in eliminating poverty, sufficiency in creating good health, sufficiency in supporting democracy and good governance, and sufficiency in sustainably preserving natural resources. c) learning through collaboration in four areas; self-reliance, sufficient living, co-operation with cares, and self-development. d) Learning through self-reliance by working on projects and club activities on the topics they were good at. 3) Teacher development that had effects on learners’ quality: Learners positively changed in three ways; a) knowledge, b) skills, and c) value and ethic system.

3. System Approach by Deming Cycle in addition with four step PDCA process was used in developing teachers’ ability in applying Sufficiency Economy Philosophy in teaching and learning in schools: 1) Plan (P): Planning policies and teacher development plan by setting up vision based on Sufficiency Economy Philosophy and studying how to apply Sufficiency Economy Philosophy into developing learners in three areas; knowledge, skills, and value and ethic system. 2) Do (D): Collaborative teacher development in teaching and learning management through practices was used. 3) Check (C): Evaluating teacher development. Teachers were able to use Sufficiency Economy Philosophy in evaluating learning. 4) Action (A): Teachers were able to analyze their works and use the results to improve their teaching which resulted in improving learners’ quality using sufficiency economy philosophy.

Keywords: Teacher development, Sufficiency economy, Philosophy, Teaching, Learning

Introduction

Constitution of the Kingdom of Thailand in 2007 emphasizes the application of the Sufficiency Economy Philosophy. The Act 78 of the Constitution states that the government administrates the country in three major areas: social and economic development including stability of Thailand based on the Sufficiency Economy Philosophy. The Act 83 of the Constitution also identifies that the government enhance and support Thai citizens to apply the Sufficiency Economy Philosophy for their daily life (Sunaisetboonsang: 2008).
Additionally, the 10th National Economic and Social Development Plan (2007-2011) emphasizes human resource development and integration of the Sufficiency Economy Philosophy for the sustainable development of Thailand leading to a peaceful and well being society in preparation for the future change of the globalization period (Office of the National Economic and Social Development Commission, Office, 2006).

The 11th National Economic and Social Development Plan (2012-2016) has carried on the concepts of the 8-10th Plan focusing on the Sufficiency Economy Philosophy and human resource development for all dimensions of the national development. The strategies for human resource development is to prepare man power for long life learning communities, and Thai people are provided the equal opportunity to access to the learning centers, and they improve the knowledge, professional skills, morality, virtue, value, culture and democratic knowledge for the future sustainable and peaceful society of Thailand. Family and religious institutes are important to improve all requirements for Thai children and teenagers. (Office of MahasarakhamProvincial Municipality: 2011)

Inclusive education is relevant to current issues in education under educators’ attempt based on educational paradigm of equity and rights as an compulsory acts toward human dignity (Cholathanon, 2003).Educational scholars have been trying to promote justice and learning of every student by using strategies to develop inclusive schoolas learning community possessed by everyone with acceptance to various individual differences (Hallahan&Kaufman, 1994).

Teacher development is a direct responsible role of responsible units. It has to be done systematically and continuously relevantly to problems and needs. Therefore, direction frame and clear policies have to be concerns for effective desired goals. Only 5% of responsible teachers earned their degree in special education and can effectively deal with IEP. Teachers developing by in-service training both contents and teaching methods following Peaget found that teacher developing need time for teacher to learn from students’ selves. They need to know about brain functioning as teachers are as treaters in school by screening, solving and rehabilitation students’ learning difficulties to support maximize students’ learning(Sri-Sa-Ard.2003).

Additionally, the Sufficiency Economy Philosophy has been added in the national standard of education in Thailand focusing on the required characteristics of all students. The national standard is the criteria for educational quality assessment of all educational institutes. The educational standards are composed of 1) required quality of Thai citizens(Intelligence, goodness, happiness), 2) educational management (learner-centered instruction and school based administration) 3) strategies for building learning society (learning strategies and excellent learning centers Moreover, the philosophy has been added in the National Education Act of 1999. The Education Act 6 emphasizes the full development of the Thai people in all aspects: physical and mental health, intellect and knowledge, morality, integrity and desirable way of life so as to live in harmony with other people.

An annual report on the application of the Sufficiency Economy Philosophy in schools in 1999, the results show that the successful schools of the practical application are resulted from the participation of all stakeholders: teachers, administrators and students in organizing sufficiency economy activities for problem solution or special aspects: saving, and diligence. There are policies in applying the Sufficiency Economy Philosophy for teaching and learning management. (Center for Sufficiency Economy Promotion, Special Affairs Office, Office of the Permanent Secretary. (Higher Education Commission, Office, 2010). A study visit and participatory methods are important for knowledge and problem solutions focusing on problem analysis, strengths and weaknesses, opportunities and threads analysis to establish strategies for the sufficiency economy management in schools. the Sufficiency Economy Philosophy in schools.

According to the recent study of the Sufficiency Economy Philosophy learning activities, the study indicates that the teacher do not understand the Sufficiency Economy precisely and they are unable to apply the philosophy for learning activities in schools. Additionally, the study also shows that the Sufficiency Economy philosophy has not been integrated with school administration for driving the application of the Sufficiency Economy philosophy. Therefore, a professional training project is necessary to improve the teachers’ administrators. Students. Skills and knowledge of the Sufficiency Economy philosophy. The local government organizations in MahaSarakham Province are working networks with RajabhatMahaSarakham University for the research.

Improving teachers’ attitude toward the Sufficiency Economy philosophy the major strategy for the teaching and learning activity management. The previous study shows that most of the teachers are in debts because there are many financial institutions offering them loans for their daily life (MantanaInthusmth, 2009).

Training is a useful strategy for improving teachers’ knowledge and professional skills in integrating their knowledge with local wisdom to create learning centers in communities such as raising chicken, fish, growing herbal plants, bio charcoal, and local music. Consequently, the students have many options of learning activities to participate in.
Additionally, teacher training is one efficient strategy to assess the competency and skill foundations of the teachers. The competencies include resource management, perception, information management, work system management, and thinking skills (PolsanPosrithong, 2009).

Teaching is one responsibility of Thai teachers at school. The teachers are a key person who can develop the students in many aspects based on the Sufficiency Economy philosophy. It is obvious that most of the families in rural area are poor, and their parents do not have time to take care of their children, some students have family problems. As a result, the students always make their serious problems at school: class absence, stealing, and extravagance, low achievement. Therefore, teachers are key persons to improve their skills and knowledge of teaching techniques and technology for instructional management (Center for Sufficiency Economy Drive, 2009).

Rajabhat Maha Sarakham University is a higher education institution for local development focusing on human resource development serving the national and local needs. The changes of economy and society of Thailand influences the students' behaviors which cause the bad reputation for family, and schools. Therefore, the Sufficiency Economy philosophy is necessary to improve students' knowledge and skills sustainably, and the students will be useful and valuable human resource for the country in the future.

Objectives

1. To analyze current conditions, problems and needs of teachers for self-development of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in schools
2. To design and develop a model for teacher development of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in schools
3. To assess learning outcomes of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in schools

Research Methodology

The research areas were 7 schools under the Local Administrative Organizations in Maha Sarakham Provincial Municipality: Burapapitayakarn, Srisawad Wittaya, Ban Sonngangyi, Samakkheewitaya, Phoasri, Ban Kho and Ban Mad schools.

Phase 1: Contextual study on problems and needs of teachers for self-development of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in schools
   Instrument was questionnaire for 120 target population

Phase 2: Design and development of a model for teacher development of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in schools.
   Instrument was a training model, an interview form and an observation form. Focus group and workshop methods were employed for the research.

Phase 3: Assessment of learning outcomes of the model implementation
   Instrument was two sets of an assessment form for teachers and students. Focus group method was used for knowledge management.

Data Collection

The data was collected from the target population of phase 1. The training activities were organized for teachers. The focus group, workshop and brain storming methods were used for phase 2 of the research. Phase 3 focused on knowledge management and synthesizing an appropriate model for teacher development of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in seven schools under the local administrative organization in Maha Sarakham provincial municipality.

Data Analysis

The descriptive statistics were used for quantitative data analysis of all variables. The results of observation, workshops, focus group and brain storming were used for qualitative analysis. The research framework is presented as follows.
Results

The results are as follows.

Phase 1
1. The policy and teacher development plan was the most serious problem of the teacher development in seven schools in MahaSarakham Provincial Municipality. The problems were knowledge of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management especially the royal project in communities on the problems of soil, water and forest.
2. The teachers have not known and applied the local learning networks for educational management in schools. The students did not have the opportunity to learn from local philosophers and study visit to the royal projects in communities.
3. The teachers did not apply the Sufficiency Economy Philosophy for educational management in schools.

Phase 2
The model for teacher development of the application of local wisdom based on the Sufficiency Economy Philosophy for educational management in schools consists of:
1. Basic skills for knowledge improvement was organized for the teachers focusing on local learning centers and local philosophers such as elderly experts, community leaders, and monks, including knowledge map of social landscape.
2. Four learning models for integrating the Sufficiency Economy Philosophy for educational management in schools: real experience, practice, and sharing experience focusing on four main areas: sufficiency for poverty management, sufficiency for good health, sufficiency for the good governance, and sufficiency for sustainable environment preservation. A collaborative learning model emphasizes three main areas: self-sufficiency, generousness, and self-development through project-based learning model.
3. The teacher development affects three major qualities of students: knowledge, skills and morality.

Phase 3
Assessment of learning outcomes of the model implementation was presented as follows.
1. The PDCA model was employed for phase 3 focusing on three main issues:
   1.1 Planning for policy and teacher development is composed of vision and, knowledge development of the Sufficiency Economy Philosophy for educational management in schools, which serves the 1st, 2nd, 3rd, 4th indicators of the education quality: promoting the sufficiency economy philosophy for educational management in schools, establishing policies on developing based on the sufficiency economy philosophy, applying vision of the Sufficiency Economy Philosophy, planning the suitable activities and work conditions of the sufficiency economy philosophy for students
   1.2 Participatory approach was employed for teacher development for four major areas which serves the 8th, 9th, 10th, and 11th indicators of the education quality: application and integration of the Sufficiency Economy Philosophy for educational management, creating learning activities of the sufficiency economy philosophy focusing on knowledge, morality and life skills, relationships of teachers with community leaders, elderly people and monks for real experience learning, and establishing learning networks of the
Sufficiency Economy Philosophy.

1.3 Check refers to the monitoring process of the teacher development project which serves the 1th indicator: assessment and evaluation of the sufficiency economy philosophy knowledge.

1.4 Action refers to the continuous educational management based on the sufficiency economy philosophy, which serves the 15th indicator.

2. The effects of model implementation consisted of:

2.1 Knowledge: the students improved significantly basic skills for creating knowledge from real experience, practice and collaborative learning and self-sufficiency learning, project-based learning. The students have learned from the local wisdom centers and philosophers: handicraft center, farming center, herbal plant center, art and culture center and natural resource and environment preservation center.

2.2 Skills: The students improve their basic professional skills for life quality improvement: poverty, health, democracy, and good governance including sustainable natural resource preservation through project-based learning such as environment preservation, saving energy project, 3 Rs project: Reduce, Reuse and Recycle. Reduce refers to use less plastic materials. Reuse refers to one of the primary benefits of using the object-oriented approach. Recycle refers to redesign or process used or waste materials so as to make suitable for reuse: recycling paper to save trees.

2.3 Creating morality and ethic: The students are aware of their duties and responsibilities for schools and communities including themselves. They recognize and follow the regulations of school for good behavior of school and family. The school disciplinary project emphasizes six aspects: punctuation, cleanliness, clothing, morning activity, respect and following the school regulations. The school health project are composed of seven activities: environmental management for health, school health service, safe food and good nutrition, getting exercises, sports and entertainment, saving for life project, and school bank.

Discussion

1. The findings indicated that the problems and teachers’ needs for application of sufficiency economy philosophy for teaching and learning were at a high level. Teachers lacked understanding in applying the philosophy into the contents and academic activities in schools. For the teaching and learning management, teachers did not develop relationship between teaching and learning activities and transferring knowledge from networks of knowledge from local communities. And for improving learners’ quality, transferring local wisdom into teaching activities as suggested in sufficiency economy philosophy was not taken into practice.

2. Three directions in elevating and developing teachers’ ability in utilizing local wisdom into school activities as suggested in sufficiency economy philosophy: 1) Developing teachers’ ability in knowledge searching: Teachers’ ability in searching for information by setting up questions and finding answers from local communities was enhanced. 2) Applying sufficiency economy philosophy into teaching and learning by using four teaching techniques: a) Learning from experience. b) Learning from practice by practicing reflecting their experience in collecting data from communities in four sufficiency areas; sufficiency in eliminating poverty, sufficiency in creating good health, sufficiency in supporting democracy and good governance, and sufficiency in sustainably preserving natural resources. c) learning through collaboration in four areas; self-reliance, sufficient living, co-operation with cares, and self-development. d) Learning through self-reliance by working on projects and club activities on the topics they were good at. 3) Teacher development that had effects on learners’ quality: Learners positively changed in three ways; a) knowledge, b) skills, and c) value and ethic system.

3. System Approach by Deming Cycle in addition with four step PDCA process was used in developing teachers’ ability in applying sufficiency economy philosophy in teaching and learning in schools: 1) Plan (P): Planning policies and teacher development plan by setting up vision based on sufficiency economy philosophy and studying how to apply sufficiency economy philosophy into developing learners in three areas; knowledge, skills, and value and ethic system. 2) Do (D): Collaborative teacher development in teaching and learning management through practices was used. 3) Check (C): Evaluating teacher development. Teachers were able to use sufficiency economy philosophy in evaluating learning. 4) Action (A): Teachers were able to analyze their works and use the results to improve their teaching which resulted in improving learners’ quality using sufficiency economy philosophy.

Suggestion

1. The sufficiency economy philosophy is practically applied for educational management of schools in the MakaSarakham Provincial Municipality.
The results of the model assessment in the practical application are very useful for promoting the model and creating learning networks of the sufficiency economy philosophy. The research results provide the best practice model for the practical application of the sufficiency economy philosophy. The practical applications of the research include community development based on the sufficiency economy philosophy through focus group method and sharing their experiences. Community leaders, local philosophers, monks, teachers and students, and youths in communities participate in designing models of knowledge management of the sufficiency economy philosophy. The outcomes of the focus group are four learning models: 1) Learning from experience. 2) Learning from practice. 3) Learning through collaboration. 4) Learning through self-reliance. The results of life skills and academic skills for students with learning difficulties should be considered to find direct and indirect variables under path analysis.

Acknowledgement

This research was not able to success without the kind patronages of Prof. Dr. Siroeng Kaewgangwan, Prof. Dr. Sampan Rittidet, Dr. Suwan Buapan, Mr. Somchai Runsilp.

References

The Development Process of Research Through the Integration with Critical Thinking Skills and Metacognition Among Pre-Service Teacher Students, Faculty of Education, Rajabhat Maha Sarakham University

Samarn Ekkapim*, Sompong Sriplunlaya, Poosit Boontongtueng and Bussakorn Khajornpuk
Faculty of Education, Rajabhat Maha Sarakham University
E-mail: ekka.sama@gmail.com

Abstract

Research process skills is significant shifts in pre-service teacher students’ perceptions of the importance of research in learning and teaching, as improvements in their educational research issues. This study aims of propose developing pre-service teacher students’ research process skills through the approach of research process, integrating with critical thinking skills, and metacognition. Target groups consisted of: 97 pre-service teacher students of 2nd - 4th year of Bachelor of Education (Science Education, Chemistry, Biology and Physics), and 8 pre-service teacher students of the 5th year (2 of each major), in the 2014 academic year. The research conducted in 3 steps: step 1 development of 5 packages of research activities; step 2 implementation of packages and evaluation, and step 3 study on application of research process of 8 pre-service teacher students. Research instruments included: 5 packages, 20 items multiple choice of achievement test, evaluation forms of critical thinking skills, metacognition, and research process skills, and questionnaire on attitude toward research process. Statistics employed to analyze collected data were percentage, mean, standard deviation, t-test pairs, and content analysis.

The results revealed that: efficiency of 5 packages were 80.20/88.32, 76.60/85.26, 82.37/88.25, 73.29/82.69 and 74.36/83.90 respectively and met required criterion 75/75. Post-test in achievement of research process skills was higher than pre-test at .05 level of significance, mean score of critical thinking skills and metacognition in overall was “good” level and mean scored of positive attitude toward research process in overall was “high” level. Mean scored of research process skills in overall was at high level. In conclusion, the developed packages of research process skills was “high” level.

Keywords: Research process skills, Critical thinking skills, Metacognition, Pre-service teacher students

Introduction

Research is an important tool and a process that can lead to wisdom and learning society, particularly on the process of enquiring systematically and purposefully to fact and knowledge and of other phenomena in order to construct new knowledge with system and reliability. Consequently, national Act B.E. 2542 and the second improvised version addressed the cooperation between research process and learning process and the development of learning as in Section 24 (5) and section 30 which addressed the employment of research process as a part of learning process. Learners can use research process to study their interested topic, to access desired learning and to solve facing problems. In addition, National Qualification Framework: NQF issued by many countries as addressed in Generic Knowledge, Skills, and competence wrote that research skill was interpersonal skills which was a competency that should be existed in education of all levels (Sillarat, 2010). Clearly explain the nature of the problem, previous work, purpose, and contribution of the paper (10 pt). Rajabhat Maha Sarakham University has launched educational mission as prescribed in Rajabhat Maha Sarakham University Act B.E. 2547.

According to the reviews on theories, approaches and principles related to development of aforementioned research process skills, it can be concluded that model of research process skills development which can lead efficient and effective research skills to education major students of Rajabhat Maha Sarakham University is development through integrating critical thinking skills and metacognition. Since research is fact - knowledge enquiry process, variety of methodology and paradigm of enquiry are employed depending on the selection of method or design of specific kinds of enquiry. This depends mostly on researcher focused paradigm. Generally, mixed, qualitative and quantitative methods are employed by researcher to solve problem in a situation. These three methods yield purposeful and satisfied results for such situation in order to access knowledge and fact accurately and reliably through experimental and manipulative methods. There are linkages of the results from any facts which are separated existing as the causal relationship to systemic manipulation (Aong-arnd Naiyapat, 2008). In the 21st century, it is necessary to learners who are interested and skillful in
information enquiry through technology to employ critical thinking skills and problem solving and decision making based on reasoning and intellectual. In short, important and necessary skills are analysis and synthesis. Learners in this century are to analyze and synthesize what they have studied whether it was good or bad, proper or improper, true or false, believable or unbelievable and to do or not to do (Praitoon Sinlarat, 2014; Ennis, 1985). Moreover, those necessary skills includes decision making skills; both internal and external behaviors that are to employ logic principles to be insight the process, intellectual and attitude (Paul & Elder, 2001). Another strategy which is necessary to the success of the integration of research process is metacognition. Metacognition is a thinking and control of thinking process of person (Flavell, 1985; Biggs & Moore, 1993 cited in Praitoon Suksri-ngam, 2000; Burke, 2007) or something about thinking process (Webster, 1991). Two elements of metacognition (Marzano et al, 1988) are knowledge and control of self and knowledge and control of thinking. The former are knowledge on skills, intellectual and competency of a learner while the later are thinking and learning strategies which monitor and control whether what learning strategy to use, when and why to use such learning strategies depending on task and documents. Performing under these two elements is called metacognition process that is performance of awareness and ability of planning, monitoring and evaluating.

According to principles, rational and importance as mentioned, researchers are interested in conducting research to develop research process skills through the integration of critical thinking skills and metacognition among pre-service teacher students in order to develop knowledge, ability and application of research process on learning development, study and problem solving and to help those teachers live critically in any situations, be a leader to systematically solve problems of community employing research process leading community to be strong local organization based on local wisdom and reform learning process of youth and community in the future which are important skills for Thai people in the 21st century.

**Objectives**

1. to develop of research process skills integrating critical thinking skills of information enquiry and metacognition
2. to study approach of research process skills through integrating critical thinking of information enquiry and metacognition for individual pre-service teacher students
1. Research process
   Systemic study which is developed from scientific method in order to comprehend, solve problems, search for knowledge, facts, principles, and any phenomena as predetermined by goals, and objectives. The findings may be a new body of knowledge, the extension to the border of former knowledge as well as the development, examination, evaluation and the application to get the most benefit to oneself and society.

2. The development process of critical thinking skills
   1.1. Set the varieties of environment and situation
   1.2. Set the varieties of learning
   1.3. Empowerment to critical thinking

3. Metacognition
   A personal ability on controlling, evaluating of cognitive activities or thinking process and the method to monitor, examine and control on self-learning in order to be aware of task and employ strategies to manage completely.

Research process skills
1. Locating the problems
2. Determining ways to solve
3. Collecting data
4. Analyzing data
5. Summarizing and writing reports.

Critical thinking skills
1. Ability of inference
2. Ability of recognition of assumption
3. Ability of deduction
4. Ability of interpretation
5. Ability of evaluation of argument
6. Application

Metacognition process: 2 elements
1. Awareness
2. Abilities
   2.1 Planning
   2.2 Monitoring
   2.3 Evaluating

The approach of development into research process skills for pre-service teacher students: 3 elements
1. Development process of critical thinking skills
2. Performing research process
3. Integrating of metacognition: awareness and abilities

Pre-service teacher students
1. Research process skills
2. Critical thinking skills on information enquiry, data collection, data analyses, and synthesis
3. Ability on metacognition
4. Learning achievement
5. Attitude toward research

Research and development process as Action Research

Figure 1 Conceptual framework
Materials and Methods

3.1 Sample
Pre-service teacher students, faculty of education, Rajabhat Maha Sarakham University:
3.1.1 97 pre-service teacher students in Bachelor of Education (Science Education, Chemistry, Biology and Physics), 2nd-4th year, in the 2014 academic year.
3.1.2 8 pre-service teacher students of the 5th year in Bachelor of Education (Science Education, Chemistry, Biology and Physics), who are able to use classroom action research process, critical thinking skills and metacognitive skills, 2 of each (one who was in high achievement group and one who was in low achievement group, in the 2014 academic year.
3.1.3 Research period was 12 months (the second semester academic year 2013- the first semester academic year 2014).

3.2 Materials
Six research instruments include 1) The package of research process skills practices, 2) Learning achievement test, 3) Critical thinking skills evaluation form, 4) Metacognitive evaluation form, 5) Positive attitude toward research evaluation form and 6) Research process skills evaluation form.

3.3 The development of research instruments
3.3.1 The package of research process skills: 5 packages of research process skills were developed and tried out with 156 pre-service teachers students of the 2nd year and 3rd year, Bachelor of Education (Science Education, Chemistry, Biology, and Physics), the third semester in the 2013 academic year, Faculty of Education, Rajabhat Maha Sarakham University.
3.3.2 20 items multiple choice of achievement test
3.3.3 Critical thinking skills evaluation form was 18-items 5 scales questionnaires.
3.3.4 Metacognitive evaluation form was 12-items three scales questionnaires.
3.3.5 Positive attitude toward research evaluation form was 17-items 5 scales questionnaires.
3.3.6 Research process skills evaluation form was 40-items 5 scales questionnaire.

3.4 Data collection
3.4.1 Implemented the developed packages with 97 pre-service teacher students in the first semester of academic year 2014 and evaluated through learning achievement test, critical thinking skills evaluation form and metacognitive evaluation form.
3.4.2 The evaluation on ability to apply research process through integrating critical thinking skills and metacognition of pre-service teacher student year five.

Results
The results were as follows.
The developed package on research process skills practice was efficient. That efficiency($E_1/E_2$) met the criterion set (75/75). Details were in Table 1.
Table 1 Mean, Standard Deviation, Percentages and Process Efficiency (E1) and Product Efficiency (E2) of developed package on research skills practice

<table>
<thead>
<tr>
<th>Package of activities</th>
<th>Score of during lesson</th>
<th>Score of post lesson</th>
<th>Efficiency of package (E₁/E₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage</td>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>Preparation</td>
<td>80.20</td>
<td>88.32</td>
<td>80.20/88.32</td>
</tr>
<tr>
<td>Locating problems</td>
<td>76.60</td>
<td>85.26</td>
<td>76.60/85.26</td>
</tr>
<tr>
<td>Collecting data</td>
<td>82.37</td>
<td>88.25</td>
<td>82.37/88.25</td>
</tr>
<tr>
<td>Analyzing data</td>
<td>73.29</td>
<td>82.69</td>
<td>73.29/82.69</td>
</tr>
<tr>
<td>Summarizing and writing research report</td>
<td>74.36</td>
<td>83.90</td>
<td>74.36/83.90</td>
</tr>
</tbody>
</table>
As can be seen in Table 1, the efficiency of each of developed packages (E1/E2); package 1Preparation, Package 2 locating problems, Package 3 collecting data, Package 4 Analyzing data and Package 5 summarizing and writing research report was 80.20/88.32 , 76.60/85.26 , 82.37/88.25 , 73.29/82.69 and 74.36/83.90 respectively. The results were related to the criterion set (75/75).

1. The results of learning achievement test of pre-service teacher students who had been developed through package were as Table2.

<table>
<thead>
<tr>
<th>Results</th>
<th>Numbers of student</th>
<th>Full score</th>
<th>Mean (X)</th>
<th>Standard Deviation (S.D.)</th>
<th>t</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>97</td>
<td>20</td>
<td>12.65</td>
<td>0.71</td>
<td>52.59</td>
<td>0.008*</td>
</tr>
<tr>
<td>Posttest</td>
<td>97</td>
<td>20</td>
<td>16.94</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P- Value = 0.05

Results in Table 2 showed that learning achievement score of pre-service teacher students after the implementation of the developed packages was statistic significantly higher than before the implementation at the level of 0.05.

The results both as a whole and each aspect of the evaluation on critical thinking skills of information enquiry of pre-service teacher students were in Table 3.

<table>
<thead>
<tr>
<th>number</th>
<th>Items</th>
<th>Full score</th>
<th>X</th>
<th>S.D.</th>
<th>Percentage of score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Locating problems</td>
<td>3</td>
<td>2.16</td>
<td>0.40</td>
<td>72.16</td>
</tr>
<tr>
<td>2</td>
<td>Data collection and enquiry</td>
<td>3</td>
<td>2.37</td>
<td>0.49</td>
<td>79.04</td>
</tr>
<tr>
<td>3</td>
<td>Data synthesis and hypothesis setting</td>
<td>3</td>
<td>1.42</td>
<td>0.56</td>
<td>47.42</td>
</tr>
<tr>
<td>4</td>
<td>Making conclusion</td>
<td>3</td>
<td>1.46</td>
<td>0.58</td>
<td>48.80</td>
</tr>
<tr>
<td>5</td>
<td>Evaluation and value judge</td>
<td>3</td>
<td>1.82</td>
<td>0.46</td>
<td>60.82</td>
</tr>
<tr>
<td>6</td>
<td>Application</td>
<td>3</td>
<td>2.16</td>
<td>0.40</td>
<td>72.16</td>
</tr>
</tbody>
</table>

As can be seen from Table3, percentage of score for critical thinking skills in searching information, analysis and synthesis for all six steps as a whole was 63.40.

Results of the evaluation on metacognition competency of pre-service teacher students after the implementation of the developed package were in Table 4.
Table 4 Mean, Standard Deviation and the percentage of score on metacognition competency of pre-service teacher students

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Full score</th>
<th>(\bar{X})</th>
<th>S.D.</th>
<th>Percentage of score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
<td>15</td>
<td>13.25</td>
<td>0.95</td>
<td>88.32</td>
</tr>
<tr>
<td>2</td>
<td>Monitoring and controlling</td>
<td>15</td>
<td>11.79</td>
<td>0.75</td>
<td>78.63</td>
</tr>
<tr>
<td>3</td>
<td>Awareness on self-thinking process</td>
<td>15</td>
<td>12.58</td>
<td>0.92</td>
<td>83.85</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>45</td>
<td>12.54</td>
<td>0.87</td>
<td>83.60</td>
</tr>
</tbody>
</table>

As can be seen from Table 4, percentage of score for metacognition of pre-service teacher students after the implementation of developed package as a whole was 83.60.

The results of the evaluation on positive attitude toward research process of pre-service teacher students after the implementation of the developed package were illustrated in Table 5.

Table 5 Mean, Standard Deviation and percentage of score of evaluation on positive attitude toward research process of pre-service teacher students

<table>
<thead>
<tr>
<th>No</th>
<th>Evaluated Aspects</th>
<th>(\bar{X})</th>
<th>S.D.</th>
<th>Percentage of score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The usefulness of research</td>
<td>4.30</td>
<td>0.46</td>
<td>85.98</td>
</tr>
<tr>
<td>2</td>
<td>The worriness on conducting research</td>
<td>4.22</td>
<td>0.41</td>
<td>84.33 **</td>
</tr>
<tr>
<td>3</td>
<td>Impacts which lead positive attitude to research</td>
<td>4.10</td>
<td>0.31</td>
<td>82.06</td>
</tr>
<tr>
<td>4</td>
<td>The relationship between daily life and research</td>
<td>4.31</td>
<td>0.46</td>
<td>86.19</td>
</tr>
<tr>
<td>5</td>
<td>Difficulties in conducting research</td>
<td>4.66</td>
<td>0.48</td>
<td>93.20 **</td>
</tr>
</tbody>
</table>

** Negative attitude

As can be seen from Table 5, the mean of pre-service teacher students had positive attitude toward research process ranging from much to less were The relationship between daily life and research (the percentage of 86.19), the usefulness of research (the percentage of 85.98) and Impacts which lead positive attitude to research (the percentage of 82.06) respectively. Meanwhile the negative attitude were difficulties in conducting research (the percentage of 93.20) and the anxiety on conducting research (the percentage of 84.33) respectively.

The results of the evaluation on competency in applying research process through integration of critical thinking skills and metacognition of the year five pre-service teacher students majoring in Science, Chemistry, Biology and Physics; two each, eight in total (divided by high and low learning achievement score) were illustrated in Table 6.

Table 6 Mean, Standard Deviation and quality level of classroom Action research of pre-service teacher students majoring in Science, Chemistry, Biology and Physics

<table>
<thead>
<tr>
<th>No</th>
<th>Evaluated aspects</th>
<th>(\bar{X})</th>
<th>S.D.</th>
<th>Quality level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Part 1 Introduction</td>
<td>4.36</td>
<td>0.50</td>
<td>Much</td>
</tr>
<tr>
<td></td>
<td>Part 2 Research methodology</td>
<td>4.27</td>
<td>0.38</td>
<td>Much</td>
</tr>
<tr>
<td>2</td>
<td>Part 3 Presentation of analyzed data</td>
<td>4.21</td>
<td>0.43</td>
<td>Much</td>
</tr>
<tr>
<td>3</td>
<td>Part 4 Conclusion, discussion and suggestions</td>
<td>4.08</td>
<td>0.24</td>
<td>Much</td>
</tr>
<tr>
<td>4</td>
<td>Part 5 writing research report</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Total</td>
<td>4.21</td>
<td>0.37</td>
<td>Much</td>
</tr>
</tbody>
</table>
As can be seen from Table 6, mean for the competency on classroom action research of pre-service teacher students year five majoring in Science, Chemistry, Biology and Physics as a whole was in “much” level ($\bar{X} = 4.21, \text{S.D.} = 0.37$).

**Conclusions and Discussion**

The results showed that the efficiency of each developed packages (E1/E2); package 1 Preparation, Package 2 locating problems, Package 3 collecting data, Package 4 analyzing data and Package 5 summarizing and writing research report was 80.20/88.32, 76.60/85.26, 82.37/88.25, 73.29/82.69, and 74.36/83.90 respectively. The results were higher than the criterion set (75/75). Reasons were that this research process skills package was developed through comprehensively reviewed on approaches, principles and theories based on three main key concepts which were 1) theories and principles on research methodology, 2) theories and principles on critical thinking and information enquiry and 3) theories and principles on metacognition. In addition, contextual study and needs analysis and the study of national qualification framework also integrally contributed to the construction of framework of the developed packages. The elements were manual of package to use worksheet, progressive test, learning materials. The packages were developed under the notion of Heathers (1964) who addressed six steps to construct packages including with 1) study the curriculum and making decision whether what topic to be used to teach students, sequence the selected topics via continuation of the content or difficulty of the content; 2) evaluate background knowledge of learners; 3) select learning activities, teaching method and materials depending on learners’ readiness and interests; 4) determine learning management; 5) determine the responsibility of the cooperation and facilitate the learning and 6) construct learning evaluation to check whether learning objectives were obtained or not, then asked the experts to judge for the first time and then tried out with 4 sections of pre-service teacher students in order to check its’ efficiency and effectiveness and evaluate learning achievement and other related contexts, then improved before being implemented to the target group.

According to the approach of skills development on research process integrating critical thinking skills in information enquiry and metacognition, there were two sub steps; step 1 the development of research process through the developed packages and step 2 the evaluation of research process of pre-service teachers who participated the full time practice. Interesting topics worth discussing were as follows.

**Step 1** The results of learning achievement of students after the implementation of developed package were that 1) learning achievement after the implementation was statistic significantly higher than before at the .01 level; 2) critical thinking skill as a whole was at the percentage of 63.40; 3) competency of metacognition as a whole was at the percentage of 83.60 and 4) positive attitude toward research process for each aspect all three aspect were higher than the percentage of 82 which relates to the study of Masoud Rezaei, Naser Zamani-Miandashhti and Shiraz IRAN (2013) and PAPANASTASIOU (2005). This is because this research was aimed to develop research process under the developed activities and integrated with two courses namely curriculum and curriculum development and Scenarios-Based and case study; principles of learning management in order to encourage students to be eager to know and search for the answer by themselves. They had to practice to make conclusion from various ways and to make linkage between theories and principles in pedagogy concerning to the application to various context. In addition, learning research process is meaningful and interesting to students. This leads students to be industrious and practical. They can construct their own knowledge together with the continued promotion of employing metacognitive strategies and critically enquire information through computer and information technology and other resources. This relates to the study of SuntraTobua (2013) which addressed the importance of learning management through reflection and research based to self-development on research competency of graduated students. According to findings, research competency of most graduated students was in “very good” level (B+) and learning achievement was in “Excellent” level (A) and they participated all steps of the developed packages. Apart from practicing critical thinking, graduated students had to analyze and synthesize the collected data in order to make a conclusion to answer research questions, build up principles and theories and the application of the findings (Thippawan Srichan, 2003). Moreover, students can apply the logic and the relationship among the information through two main principles which were syllogisms or deduction and induction reasoning. Students can continually learn evaluation and many advanced value judgment such as analysis, creation, evaluation, logic and reasoning, decision and assessing problem-solving. (Brookhart, 2001 cited in Banjong Amornchiwin, 2013)
In addition, while students were performing under all steps of research process; starting from locating problems, conducting research, presenting the analyzed data and research conclusion, discussion and writing research report, students were able to use metacognition competency to support their selected notions and methods or even the fault ones (Science Teacher Association of Thailand, 2551). This was related to the study of Ming-Huey Tseng (2008) which addressed that the repeatedly practice based on Problem Based Learning Approaches. This would help students apply their metacognitive competency and conclude new body of knowledge in various levels. However, this research focused on the integration of research process with general courses. This may cause time limited to search for information which related to five learning packages. This may affect the development of skills on searching information that was at the percentage of 63.40. That the evaluation of positive attitude toward research process and the competency in conduction classroom action research of pre-service teacher students was at the percentage of 82 and over may cause by the package developed through needs analysis on research competency of pre-service teacher students and students were encouraged to answer questions that forced students to think, cooperate, brain storm and think aloud in order that students can continually integrate their metacognition competency. This may also the impact of content. Research was a process to access the truth, knowledge and innovation that the researcher conducted systematically using scientific methods in order to construct body of knowledge, product and develop practice including with to explain, predict and make understanding the occurred phenomena accurately and reasonably(Aong-Ard Naiyapat, 2011). Through these experiences students could have both positive and negative attitude toward research process.

Step 2 According to the evaluation of competency on research process of 5th year of pre-service teacher students who had participated the practicum in school, mean for the competency on classroom action research of pre-service teacher students year five majoring in science, Chemistry, Biology and Physics as a whole was in “much “ level ( \( \bar{X} = 4.21, \text{S.D.} = 0.37 \) ). The results may be affected by the continuation of the development of critical thinking skills in information enquiry and the study on research process skills which was general courses. This helped students be skillful in information enquiry, analysis and synthesis. They could apply these to research process while they were conducting full time practicum at school accurately and properly (Aong-Ard Naiyapat, 2554).

Conclusions

1. The efficiency of each developed packages (E1/E2); package 1 Preparation, Package 2 locating problems, Package 3 collecting data, Package 4 Analyzing data and Package 5 summarizing and writing research report was 80.20/88.32, 76.60/85.26, 82.37/88.25, 73.29/82.69 and 74.36/83.90 respectively. The results were higher than the criterion set (75/75).

2. According to the results of research process skills development through integration critical thinking and metacognition for pre-service teacher students, there were 2 steps; step 1 the development of research process skills using five packages of skills practices and evaluate learning achievement of students. Results showed that learning achievement after the implementation of the developed packages was statistic significantly higher than before, 2) Total critical thinking skills was at the percentage of 63.40, 3) Total competency of metacognition was at the percentage of 83.60 and 4) Positive attitude toward research process was over the percentage of 80. Step 2 the evaluation on competency of research process of classroom action research of students who conducted fulltime practicum at school as a whole was in “much” level.

According to the suggestions on the development of research process through the integration with critical thinking and metacognition were that learning environment and atmosphere should be set as to introduce students to think in problem solving, self-construction on knowledge, cooperative learning, brain storming, intervening and encouraging student to conduct think aloud through questioning and making linkages in order to introduce meaningful learning.

Acknowledgements

The researchers would like to thank the office of Higher Education Commission for financial support; Rajabhat Maha Sarakham University, and Research and Development Institute for encouragement and facilitation to make this study reach the objectives; and special appreciation to the researcher’s advisors, entrepreneurs, who gave professional experiences which were fruitful to enable this research to completion.
References

Learning Process for Improving Waste Management in Communities by using Participation-Based Technology Model

Wilert Wanathip¹, Udorn Orakul² and Thaksin Sithisak²

¹Lecturer of the Educational Management for Local Development, Faculty of Education Rajabhat Maha Sarakham University
²Lecturer of the Educational Management for Local Development, Ph.D Candidate of the Philosophy program in Educational Management for Local Development Thailand

Abstract

This study aimed to analyze needs of people for creating a learning process of waste management in communities. The target population was 138 participants consisting of people, community leaders, health volunteers, teachers, students, monks municipality council members, public health officers, and sub-district municipality majors. The instruments used to collect the data were a document analysis form, a survey form and an assessment form for the National Basic Education Curriculum in 2008 concerned with the public participation in waste management. The descriptive statistics were used for content analysis.

The results indicated that technology of participation (TOP model) was a new strategy that has been created and developed for practical application for the different groups and purposes. Three basic strategies for the successful management are discussion ORID method, workshop method and action planning method. The findings showed that the large amount of garbage was composed of plastic bags (32.0%), glass (18.0%), paper (12.0%), metal products (8.0%), beverage cans (5.0%), plastic products (10.0%), food scraps from markets and restaurants (5.0%), other (10.0%). Additionally, waste water from home in communities made the water in the canal or river polluted and dirty, garbage was dumped in public areas or forest, and it smelled very terrible, and its smell disturbed people in communities. Moreover, coconut garbage, beverage cans and plastic containers were left along the street, which the garbage was the breeding places for mosquito. According to the report of the Thawatchaburi hospital and Thong Thani health promotion hospital, it was found that the number of infectious disease in the areas has increased from 20 to 24 diseases. In 2014, the number of dengue patients was 9.34 persons per thousand population, leptospirosis was 0.86 persons per thousand population. Regarding the waste management in school, the finding indicated that the number of garbage bins were insufficient in schools, the location of the garbage bins were not appropriate. The major reasons were caused by carelessness, and unawareness of people in the communities. The garbage was not classified before management. Regarding the educational management, there were four major core learning contents with 14 sub learning contents concerned with the waste management. The core competencies were composed of communication, thinking skills and problem solutions, life skills and using technology. The desired characteristics included faith in the nation, religion, monarchy, honestly, orderly, enthusiasm, self sufficiency, intention, being proud of Thai citizenship and service mind. Lastly, the purpose of the environmental study was to improve awareness, knowledge, attitudes, skills and participation, and evaluation.

Keywords: Learning Process, Management, Community, Education

Introduction

Nowadays Thailand and many countries have encountered the serious problems of natural resources and environment. The laws have been implemented strictly for natural resource and environment protection. The experts in environment indicate that the serious problems caused by the environment damage are drought, snowing, earth quack and insufficient natural resource for humane being (Department of Environmental Quality Promotion. 2005:10-18).

Regarding the environmental impact on the life quality of human being, it is obvious that there are many serious problems of soil, air, water, forest and pollutions in communities. As a result, people on the earth have faced directly the global warming, and natural disasters. It is expected that the amount of water in the sea have been increasing greatly because of melting snow in the south and north poles of the earth. Farming and living areas have been destroyed and replaced by water. Additionally, the number of people have increased dramatically in the big cities around the world, and the citizens in the big cities have encountered many serious problems of traffic, air pollution, water pollution and waste which have negative impacts on health of people in...
the big cities (Department of Environmental Quality Promotion. 2005:17). In case of the farmers, they have encountered the problems of farming cost, epidemic, flooding, drought, and soil salinity.

It is obvious that the problems are caused by human beings because of the unawareness (Li Fabiana: 2001). Life quality of human being is related significantly to the environment (Patana Moonpruek. 2002: 19). On the other word, the environment influences health of all people on the earth. The problems indicate that the environment has both positive and negative impact on the life quality of human beings (Jiraporn Khotchasesi: 2006). Yanyong Inmueang (2006) states that economic and industrial development affects the environmental changes: flooding, and Ozone depletion.

In case of health, Patana Moonpruek (2002:9) states that health of people is composed of six dimensions: physical health, social health, emotional health, environmental health, mental health and intellectual health. The environmental health refers to the sickness and disease caused by the environmental factors: physical factor: problems of sound, light and heat; chemical factors: deaf, and Airy Blistering skin; asymptomatic lead poisoning and black fever; biological factors: microbe, virus, bacteria, Protozoa, parasites, and fungus. The factors cause many diseases: diarrhea, Leptospirosis, and dengue fever tuberculosis, etc. The health report of Roi Ed Public Health Office in 2010-2014 shows that the people in Roi-Ed are likely to be sick of 13 diseases, and the report confirms that people in Roi-Ed died because of Leptospirosis, and dengue fever (Office of Roi-Ed Provincial Public Health: 2014).

According to the report on the contagious diseases of Thawatburi Hospital and Tong Thani Public Health Hospital, the study shows that there are more victims of 20 diseases, which are caused by the environmental problems in communities. In 2014, there were 9.34 victims of dengue fever per 1000 population, and .86 victims of Leptospirosis per 1000 population (Thawatburi Hospital: 2014). The major factor is mosquito which brings dengue fever virus. Therefore, destroying the mosquito breeding places: cans, water jars, vase, etc., is an efficient strategy for mosquito control. Additionally, your family members are safe from the mosquito by using the mosquito net. (Siripen Kanyaruj. 2003: 167).

Although people in communities earn more money and have wellbeing, the health problems of the people in communities have increased greatly. One important factor is economic and industrial development which influences the environment, and the environment affects health of people in communities. (Yanyong Inmueang. 2001:6 : Ematcha2 Wathanaburanon: 2004) There are many methods for solving problems in communities. Training is an efficient and effective strategy for human resource development. Prayoon Usomsiang (1998) states that creating a process aims to improve knowledge, awareness, attitude and skills of human being. Iverson (2001) asserts that training is an efficient strategy for improving knowledge and professional skills. Nantiya Muneekiul (2012) reveals that the measures for the problem solution should focus on developing knowledge and professional skills including awareness of environment preservation. (Kasem Jankaew. 1993: 71). Strategies for the natural study is a learning process for environmental education with high quality educational technology (Suwimol Wongwanich, Alisara Chichart and Prewit Erawan. 2012: 96-97) claim that few studies on improving awareness of the environment have been conducted. Awareness refers to problem and ability in expecting future problems, which the problems may be caused by many factors: man, economic and social factors.

According to the problems of garbage mentioned above, it is obvious that the problems are caused by human being, and the problems influence people’s health, and life quality of people in communities. (Duroy Quentin: 2003) Therefore, community participation and training are useful and efficient strategies for waste management. The training model aims to improve knowledge, professional skills, attitude and awareness of the environmental issues. Consequently, the study is a partial and appropriate strategy for improving awareness and ability in making a decision for community problem solutions for environmental health and wellbeing.

**Objectives**

1. To analyze concepts, theories and research relating to community participation in waste management
2. To investigate waste management and amount of waste in schools and communities
3. To analyze core curriculum contents and sub learning contents of environmental education of the Basic Education Core Curriculum 2008

**Expected Outcomes/Significance**

1. To know needs for learning processes of waste management by using a participation-based technology model
2. To know both qualitative and qualitative components of waste for efficient community environment development plan
3. To get useful information for improving community environment based on the principles and process of the environmental education

**Research Methodology**

1. The target population was 138 participants consisting of people, community leaders, health volunteers, teachers, students, monks, municipality council members, public health officers, and sub-district municipality majors.

2. Research instruments were a document analysis form, a survey form and an assessment form for the National Basic Education Curriculum in 2008.

3. Instrument design and development:
   3.1 Documentary study
   3.2 Design of a document analysis form
   3.3 ICO assessment by five experts (IOC: Index of item objective congruence)
   3.4 Instrument Development

4. Data Analysis
   4.1 Study of concepts, theories and research relating to community participation in waste management
   4.2 Survey of waste management in communities and schools focusing on both qualitative and quantitative aspects
   4.3 Analyze the Basic Education Curriculum 2008

5. Data Analysis
   5.1 The concepts, theories and research relating to community participation in waste management were analyzed. Content analysis was used for the study.
   5.2 Waste management in communities and schools was surveyed focusing on both qualitative and quantitative aspects
   5.3 The National Basic Education Curriculum 2008 was analyzed. Content analysis was used for the study.

**Data Analysis**

The results are summarized as follows.

1. The study showed that technology of participation (TOP model) was a new strategy that has been created and developed for practical application of the different groups and purposes. Three basic strategies for successful management are group discussion method, workshop method and action planning method. The ORID model is a group discussion method, which consisted of four levels: Objective, Reflective, Interpretative and Decisional. Workshop method is appropriate and efficient in encouraging the participants to create and share their ideas for the goal achievement. Action planning method refers to the strategy for the operation focusing on future direction, present position and process. The study indicates that public participation in sustainable development by connecting both government sectors and private sectors to participate in making a decision for local development.

2. The findings showed that the large amount of garbage was composed of plastic bag (32.0%), glass (18.0%), paper (12.0%), metal products (8.0%), beverage cans (5.0%), plastic products (10.0%), food scraps from markets and restaurants (5.0%), other (10.0%). Additionally, waste water from home of all families in communities made the water in the canal or river polluted/dirty, garbage was dumped in public areas or forest smelled very terrible, and its smell disturbed people in communities. Moreover, coconut garbage, beverage cans and plastic containers left on the streets were the breeding places for mosquito. According to the report of the Thawatchaburi hospital and Thong Thani health promotion hospital, it was found that the number of infectious disease in the areas increased from 20 to 24 diseases. In 2014, the number of dengue patients were 9.34 persons per thousand population, leptospirosis was 0.86 persons per thousand population. Regarding the waste management in school, the finding indicated that the number of garbage bins were insufficient in schools, the location of the garbage bins were not appropriate. The major reasons were caused by carelessness, and unawareness of school personnel. The study revealed that the garbage was not classified before management.

3. Regarding the educational management, there were four major core learning contents with 14 sub learning contents relating to the waste management. The core competencies were composed of communication, thinking and problem solution, life skills and using technology. The desired qualitie of Thai citizens included faith in the country, religion, monarchy, honestly, orderly, enthusiasm, self sufficiency, intention, being proud of Thai citizenship and service mind. The study indicated that the purpose of the environmental education aimed at
improving awareness, knowledge, attitudes, skills and participation, and evaluation. Additionally, the results of the standard analysis indicated that the core learning contents concerned with environmental education included the 1st learning content of “Live Creatures and Living Process”, the 2nd learning content of “Life and Environment”, the 5th learning content of “Energy”, the 6th learning content of “Process of the Global Change, the 7th learning content of Astronomical and Space, the 8th learning content of “Nature of Science and Technology”; the 1st learning contents of Social Study, Religion and Culture, the 2th learning content of roles of Thai Citizens, Culture and Living in Society, the 3rd learning content of Economy, the 4th content of Geography; Core learning content of Health Study and Physical Education”, the 5th learning content of health, competency promotion and disease protection the 5th learning content of Save Life”; the core learning content of Vocation and Technology, the 1st learning content of Living and family”, the 2nd learning content of Design and Technology, the 3rd learning content of Technology and Communication focusing on the key competencies: communication, thinking, problem solution, life skills, use of technology, required quality: Fait in Nation, Religion and Monarchy, honesty, self discipline, enthusiasm, self sufficiency, being proud of Thai citizenship, and service mind. The objectives of the environmental education included awareness, knowledge, attitude, skills, participation and evaluation.

**Conclusion and Discussion**

1. The study shows that technology of participation (TOP model) is a new strategy that has been created and developed for practical application of the different groups and purposes. Three basic strategies for successful management are group discussion method, workshop method and action planning method. The ORID model is a group discussion method, which consists of four levels: Objective, Reflective, Interpretative and Decisional. Workshop method is appropriate to encourage the participants in creating and sharing their ideas for the goal achievement. Action planning method refers to the strategy for the operation focusing on future direction, present position and process. The study indicates that public participation in sustainable development should connect the government sectors with private sectors to participate in making a decision for local development. Janpen Meenakhorn (2011: 46) asserts that the waste management in Bang na Li Sub-district is successful. Janpen Meenakhorn (2011:46) asserts that people in Bang Nang Li Sub-district created a self-sufficiency community, and they should work together on waste management by applying their knowledge, understanding and awareness of the waste problems in the communities. They can classify, collect and dispose the garbage efficiently, and they can also produce the organic fertilizer from garbage to for agricultural purposes and commercial purposes. As a result, they can earn money for the family by selling reused and recycled garbage. People in community are provided the opportunity to share and propose the problem solutions with community leaders and sub-district administrative organization members for the efficient waste management in the communities.

2. The findings showed that the large amount of garbage was composed of plastic bag (32.0%), glass (18.0%), paper (12.0%), metal products (8.0%), beverage cans (5.0%), plastic products (10.0%), food scraps from markets and restaurants (5.0%), other (10.0%). Additionally, waste water from home of all families in communities made the water in the canal or river polluted and dirty. garbage was dumped in public areas or forest smelled very terrible, and its smell disturbed people in communities. Moreover, coconut garbage, beverage cans and plastic containers left on the street were the breeding places for mosquito. According to the report of the Thawatchaburi hospital and Thong Thani health promotion hospital, it was found that the number of infectious disease in the areas has increased from 20 to 24 diseases. In 2014, the number of dengue patients was 9.34 persons per thousand population, *leptospirosis* was 0.86 persons per thousand population. Wassa Kongnakhorn (2010: 3-4) states that most of the garbage source are from home, market, educational institution, commercial community and industrial areas. The percentage of the garbage amount was 73.0, 10.0, 8.0, 7.0 and 2.0% respectively. The ratio of producing garbage .47-1.56 kilogram/person/day

3. Regarding the waste management in school, the finding indicated that the number of garbage bins were insufficient in schools, the location of the garbage bins were not appropriate. The major reasons were caused by carelessness and unawareness of school personnel. The garbage was not classified before management. Thongchai Thongthawee (2010: 58) states that people in Nong Kham Sub-district Administrative Organization could not solve the problem of the garbage in the community. The study revealed that they did not know and understand the efficient waste management, and they solved the problems without the clear master plan for the garbage disposal.

4. Regarding the educational management, there were four major core learning contents with 14 sub learning contents were related to the waste management. The core competencies were composed of...
communication, thinking and problem solution, life skills and using technology. The desired qualities of Thai citizens included faith in the nation, religion, monarchy, honestly, orderly, enthusiasm, self sufficiency, intention, being proud of Thai citizenship and service mind. The study also indicates the purpose of the environmental study is to improve awareness, knowledge, attitudes, skills and participation, and evaluation. Supaporn Sirisopana. (2011: 119) states that application of the scientific processes for education consists of analytical thinking, creative thinking and physical science. The basic learning science consists of eight major contents: 1) living creatures and living, 2) life and environment, 3) substance and components, 4) power and movement, 5) energy, 6) process of the global change, 7) astrology and space, and 8) nature of science and technology. In case of the 1st and 2nd contents, the quality of water is necessary to living creatures and ecological system, and water is used for multi purposes of human being. For instance, the farmers use water for agricultural purposes and the quality of water should be composed of the suitable amount of light and oxygen.

References

A Stud of Organic Rice Development Model for Youths

Pikit Srichana\(^1\), Chayakarn Reuangsuwan\(^2\), Prasopsuk Rithidetch\(^2\) and Prapatsorn Pree-iam\(^2\)

\(^1\)Educational Management for Local Development, Faculty of Education, Rajabhat maha Sarakham University

\(^2\)Lecturer of the Philosophy Program in Educational Management for Local Development, Faculty of Education, Rajabhat Maha Sarakham University, Thailand

(*author for correspondence, E-mail: Pikit-senate@hotmail.com)

Abstract

The research aimed to investigate problems in growing rice of the youths in Sok Khum Pun village, Naso Sub-district, Kudchum District, Yasothorn Province, and to analyze models of an organic rice development model for the youths. The mixed methodology was employed for the research consisting of quantitative and qualitative studies. The instruments were two sets of questionnaires on problems in growing rice and the organic rice development model and a note-taking form. Focus group method was employed for the study. The target population were 30 youths in Na So community, Naso Sub-district, Kudchum District, Yasothorn Province, 10 successful organic rice farmers and 10 parents of the youths. They were selected by using the purposive sampling method. The descriptive analysis was used to present the research results.

1. The research findings showed that the problems in growing organic rice of the youths in Na So Community, Naso Sub-district, Kudchum District, Yasothorn Province included economy, production factors, organic rice market, health and behavior of the youths. The most serious problem of the youths was shortage of funds for growing organic rice. The total production cost was quite expensive, which the youths spent much on fertilizer, pesticide, labor, seeds, and transport. The organic rice market was not popular for people in the community because they were not likely to eat organic rice. The youths were aware of organic rice for health without chemical substance. Lastly, the youths always spent their time on roaming, loafing, drinking alcohol and disputing. The results of focus group discussion indicated that the most serious problems of the youths’ families were in debt, rice farming with pesticide and chemical fertilizer, and sickness of beriberi and joint pain.

2) The needs for organic rice development model consisted of 1) growing rice with organic fertilizer, herbal liquid for insecticide, and labour of the youths for organic rice farming. The organic rice should be available at the local market. Additionally, the youths needed to reduce the use of the chemical substance for growing rice, and they needed to produce organic brown rice for both local and regional markets. Lastly, the parents wanted the youths to spend their free time in growing and selling organic rice.

**Keyword:** Study, Organic rice, Rice development, Sok Khum Pun youths

Introduction

The government of Thailand has created the strategies for the national development based on the 1\(^{\text{st}}\) - 7\(^{\text{th}}\) National Economic and Social Development Plan under the capitalism economy system focusing on one aspect of the economic development leading to the imbalance of the national development structure and the differences in economy and society. It is obvious that the number of the poor are three times more than that of the rich. The poor in Thailand are deficient in the potentials for life. Consequently, the poor people moved to big cities in Thailand for jobs. The big cities have become crowded communities with many serious social problems, e.g. crimes and conflicts. These national problems have obstructed sustainable development of Thailand. (Supplementary Document for the Annual meeting of 2011: 9\(^{\text{th}}\) -10\(^{\text{th}}\) Plan for Sustainable Development, 2011). In fact, rice farming is the national major source for food and economic stability of Thailand because most Thai people are farmers and rice is the most important agricultural products of Thailand. Therefore, the government of Thailand has tried to improve the life quality of farmers in Thailand through providing various supports: finance, technology, knowledge for sustainable development of the country. However, research is the most important scientific method in finding problem solutions and strategies for farmers and entrepreneurs of the rice industry. The farmers and entrepreneurs may apply the knowledge from research efficiently and effectively to their daily work and industry, and the farmers and entrepreneurs may be able to work independently and coordinate with the government sectors. (Research report on Goal-Based Project serving to the urgent needs for the national development for the rice farming group 2013-2014: A)
According to the national policies of community development, the 11th National Economic and Social Development Plan (2012-2016), rice farming has been developed for the major economic crop of Thailand. Coeducational system of schools, community learning centers, local wisdom learning center have been created for people in communities. The farmers’ paradigm has been also improved for new value, self-sufficiency by integrating previous knowledge with local wisdom to create new knowledge. Schools have been improved to be a long life learning center for people in the communities (Prawet Wasri. 2010: Khamnam and Waraporn Samkoset. 2010: 9-47). Therefore, the author has studied organic rice farming models in Ban Na So community, Kudchum District, Yasothorn province, and the study indicates that there are excellent organic rice farmers in the communities, and the communities will be local learning centers for organizing rice farming for youths in the communities.

**Objectives**

1. To analyze the problems of rice farming of the youths in Sok Khum Pun Village, Naso Sub-district, Kudchum District, Yasothorn Province
2. To investigate the needs for a model of organic rice farming development of the youths in Sok Khum Pun Village, Naso Sub-district, Kudchum District, Yasothorn Province

**Instrument**

The research instruments were 1) two sets of questionnaire on problem analysis and needs for an organic rice farming model, a note-taking form for the focus group discussion.

**Research Methodology**

The research methodology was composed of qualitative and quantitative studies.

**Scope**

1. The population consisted of 150 youths who were at the age of 8-18 years from five villages in Naso Sub-district. They were 90 male youths and 60 females.
2. The samples were 20 females and 20 males at the age of 8-18 years from five villages in Naso Sub-district. They were drawn by the simple random sampling method.
3. The target population consisted of six excellent organic rice farmers from six families in Naso Sub-district, who were selected by using the purposive sampling method.
4. Study Contents
   3.4.1 Problems about rice farming of the youths in Naso Sub-district, Kudchum District, Yasothorn Province
   3.4.2 Needs for an organic rice farming model for the youths in Naso Sub-district, Kudchum District, Yasothorn Province
5. Research Area
   Naso Community in Naso Sub-district, Kudchum District, Yasothorn Province
6. Time Period
   January-April 2015

**Data Collection**

The data were collected through a documentary study and contextual study consisting of focus group discussion, surveys of problems and needs of the youths for an organic rice farming model.

**Data Analysis**

The data were results of the documentary study, problem and needs analysis of the young organic rice farmers.

**Statistics**

Percentage
Results

1) The research findings indicated that the major problems of the young organic rice farmers in Na So community, Naso Sub-district, Kudchum District, Yasothorn Province included economy, production factors, organic rice market, health and behaviors of the youths. The most serious problem of the young organic rice farmers was the expensive cost for organic rice production, which the youths spent much money on fertilizer, pesticide, labor, seeds, and transport (95%). The second serious problem of the youths was shortage of funds for growing organic rice (90%). The results of focus group discussion indicated that the third serious problem of the youths’ families was debt, rice farming with pesticide and chemical fertilizer, and sickness of beriberi and joint pain (85%). The fourth problem of the young farmers was not being aware of organic rice for health without chemical substance. Lastly, the youths always spent their time on roaming, loafing, drinking alcohol and disputing (80%). The organic rice market was not popular for people in the community because they were not likely to eat organic rice (78%).

2) The needs for organic rice development model consisted of growing rice with organic fertilizer, herbal liquid for insecticide, labor of the youths for organic rice farming (100%). The organic rice should be available at the local market (78%). The youths needed to have a study visit to excellent organic rice farming sites. Additionally, the young farmers need to change their behavior in reducing chemical substance in growing rice, and they needed to produce organic brown rice for both local and regional markets. Lastly, the parents wanted the youths to spend their free time in growing and selling organic rice. Lastly, the youths needed to change their behavior to stay away from roaming, loafing, drinking alcohol and disputing.

Discussion

The findings indicate that the serious problems of the young farmers in Naso community include 1) the family debt with banks, financial institute and businessmen, 2) production factors: expensive cost for new production technology, labors, chemical fertilizer and pesticide and 3) farming capital. Parichart Wilaisathian and et al (2010: 46) state that the serious debt of Thai farmers has resulted in the immigration of the farmers to find extra jobs after crops harvest season. Chatip Nartsuda (2001: 57-58) claims that farmers should produce rice for family food rather than for sales, and the farmers should create extra jobs such as growing perennial plants, herbal plants from excellent organic rice farming centers in communities, focus group discussion including knowledge transfer of the organic farming to the youths. The policies of the National Economic and Social Development Plan (2011: 48-51) emphasize creating self identification of community, a learning process, preserving and promoting local wisdom to the new generation in communities, establish various long life learning centers in communities, and providing continuously learning opportunity to people in communities. Lastly, people should be provided the opportunity to participate in deciding the strategies for local development based on the self sufficiency philosophy.

Suggestions

For practical application

Problem and needs analysis of communities is necessary to find an efficient and appropriate solution to the problems.

For further study

A future research should study on how a model of organic rice farming development affects the quality of life of young farmers.

References

Fostering Communication Capability of Mathematical Language for Secondary School Student in Vietnam

Vu Thi Binh
Lao Cai Teacher Training College
Group 13, Binh Minh Ward, Lao Cai City, Lao Cai Province, Vietnam
E-mail: vtbinh.c08@moet.edu.vn

Abstract
Mathematical communication is one of the important part-competencies formed mathematical competency for students. The article clarifies the concept of mathematical language in terms of: mathematical terms, mathematical signs, mathematical symbols and grammatical rules to combine them. At the same time, it asserts the important role of mathematical language in shaping mathematical communicative competency for students.

Interested in the reality of the communicative competency of secondary school students in math class, we attended class time, communicated and delivered survey forms to 1900 secondary school students in Lao Cai City for their self-assessment in terms of related mathematical language and communication, such as: The ability of understanding and using mathematical language of students in their math class; The participation in communicative forms of students in math class time; the difficult situations of students when they communicate with others on the mathematical language, etc. From that, the article proposes the important remarks in the process of teaching mathematics to help secondary school students use mathematical language to communicate effectively in math class. In particular, the article refers to some suggestions oriented in the forming and training of students on vocabulary, semantics and syntax of the mathematical language as well as it needs to interest in the accuracy and scientific of mathematical language in the process of organizing communicative activities in math class. From that, it forms and develops mathematical communicative competency to students and contributes to improve the quality of learning math at school.

Keywords: Mathematical language, Vocabulary, Syntax, Semantics, Mathematical communication

Introduction
The indispensable orientation of the radically and comprehensively educational reform in Vietnam is rapidly shifting the education from knowledge provision to development of comprehensive competency and credentials for the learners. Based on the general competency framework and specific competency relating to Mathematics in schools, the components of the competency structure developed by V.A Kruteski showed that mathematical language, mathematical communication play an important role in all elements (collection, processing, storage of information and application), which become one of the foundations for forming and developing mathematical competency for students (according to [7]). It can be said that mathematical communication is both a target and a method to form and develop mathematical ability for the students. “As students are asked to communicate orally or in writing about the mathematics they are studying, they gain insights into their own thinking. In order to communicate their thinking to others, they naturally reflect on their learning and organize and consolidate their thinking about mathematics. Students should be encouraged and expected to increase their ability to express themselves clearly and coherently over time. In particular, the ability to express thoughts and describe solutions in writing should be a major focus of the mathematics curriculum.” ([9], page 13) Therefore, improving mathematical communication competency for students of junior high schools is an important task and a matter of concern.

Materials and Methods
There are many ways to describe mathematical language. Mathematical language consists of mathematical terms, mathematical signs and symbols and rules in combination which are used to present the objects and mathematical relations in speaking, writing or thinking. Where:

Sign consists of numbers, letters, alphabetic characters, mathematical signs, symbols, brackets of all kinds used in mathematics.
Mathematical term consists of words and phrases which are the name of the concepts, objects and relations in field of mathematics (for example: prime number, combinable number, point, line, vertically opposite, parallel, power,...); words, phrases of natural language have specific meanings in field of mathematics (for example: side, center, denominator, numerator,...). The same as scientific terms in general, mathematical terms are definite in meaning, systematic, mono-semantic, international and unexpressive.

Mathematical symbol consists of pictures, drawings, diagrams or models used to express the mathematical relations and specific mathematical objects.

In order to express a mathematical object or relation, we can use mathematical language in form of mathematical terms, signs or symbols.

For example:

<table>
<thead>
<tr>
<th>Mathematical term</th>
<th>Sign</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle ABC</td>
<td>∆ ABC</td>
<td><img src="image" alt="Symbol of Triangle" /></td>
</tr>
<tr>
<td>Set A consists of components a, b, c</td>
<td>A = { a, b, c}</td>
<td><img src="image" alt="Symbol of Set" /></td>
</tr>
</tbody>
</table>

In math class, for effective communication, first of all the students need to have enough vocabulary of mathematical language, a thorough understanding of grammatical structure, meaning of each word and each sentence. Additionally, the students need to have and develop the skills including listening, response, observation, making questions, comprehensive reading, summarization, etc.

It can be said that mathematical communication occurs during the math teaching and learning process which uses mathematical language as an important and primary means for expressing mathematical ideas, knowledge, making arguments, demonstration, solving the question with a view to obtaining the goal of math learning. Obviously, effective mathematical communication is always associated with the potentiality of understanding and using mathematical language in skillful manner. Thus, communication competency is considered the competency of the learner to use mathematical language for expressing its mathematical ideas and understand the mathematical messages during the learning process, suitable for the object and purpose of communication.

By NCTM, Communication Standard: Instructional programs from prekindergarten through grade 12 should enable all students to:

1. Organize and consolidate their mathematical thinking through communication;
2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
3. Analyze and evaluate the mathematical thinking and strategies of others;
4. Use the language of mathematics to express mathematical ideas precisely

In order to learn about the actual situation of using mathematical language in teaching math for the junior high school students aiming to seek, propose the measures for improving communication competency using mathematical language for the students, we surveyed randomly 1900 students (28%) out of 6726 students at the age of 12 – 15 (grade 6 – grade 9) at junior high schools in Lao Cai to learn about:

1. Students’ competency to understand and use Mathematical language in math class;
2. Students’ participation into activities using mathematical language in math class; their mathematical communication competency;
3. Situations in which students face with difficulties in communicating by mathematical language;
4. Students’ self evaluation of their communication competency
Results and Discussion

1. Communication competency using mathematical language of junior high school students survey results

We went to every classes from grade 6 to grade 9 in all secondary schools in Lao Cai City, Vietnam to conduct questionnaire survey. There are about 40 students in each class in secondary schools, we delivered questionnaires to 10-15 random students and gave them about 40 minutes complete the questionnaires. During that time, investigators would discuss with the teacher and other students about the contents mentioned in the questionnaire for further information. The survey data was analyzed by Microsoft Excel software. The results are as follows:

Table 1.  Junior High School students evaluated their competency to understand and use Mathematical language in math class.

<table>
<thead>
<tr>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent</td>
</tr>
<tr>
<td></td>
<td>Quantity %</td>
</tr>
<tr>
<td>(a) Understand and use mathematical terms</td>
<td>193 10,2</td>
</tr>
<tr>
<td>(b) Understand and use mathematical signs</td>
<td>226 11,9</td>
</tr>
<tr>
<td>(c) Understand and use drawings</td>
<td>81 4,3</td>
</tr>
<tr>
<td>(d) Understand and use graphs and charts</td>
<td>93 4,9</td>
</tr>
<tr>
<td>(e) Understand and use diagrams and tables...</td>
<td>96 5,1</td>
</tr>
</tbody>
</table>

Thus, most of the students evaluated their competency to understand and use mathematical language at average level or higher (making about 87%- 95%). The number of students evaluated themselves at poor level for: Understand and use drawings (10,8%); Understand and use graphs and charts (11,5%); Understand and use diagrams and tables (13,2%).

About the students' participation in communication in math class, the result is shown as follows:
Table 2. Junior High School students themselves evaluated their participation in communication in math class.

<table>
<thead>
<tr>
<th>Forms of communication</th>
<th>Very regularly</th>
<th>Regularly</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>%</td>
<td>Quantity</td>
<td>%</td>
</tr>
<tr>
<td>Listen and answer question made by teacher</td>
<td>156</td>
<td>8,2</td>
<td>1410</td>
<td>74,2</td>
</tr>
<tr>
<td>Read, discuss, make question and answer question</td>
<td>131</td>
<td>6,9</td>
<td>1378</td>
<td>72,5</td>
</tr>
<tr>
<td>Listen and evaluate the answers given by friends</td>
<td>97</td>
<td>5,1</td>
<td>1350</td>
<td>71,1</td>
</tr>
<tr>
<td>Present mathematical solutions in writing form (paper, notebook, blackboard)</td>
<td>156</td>
<td>8,2</td>
<td>1409</td>
<td>74,2</td>
</tr>
<tr>
<td>Present mathematical solutions in speaking form.</td>
<td>101</td>
<td>5,3</td>
<td>1136</td>
<td>59,8</td>
</tr>
<tr>
<td>Combine speaking and writing during presentation of mathematical solutions (argument, demonstration, explanation,...)</td>
<td>95</td>
<td>5,0</td>
<td>1171</td>
<td>61,6</td>
</tr>
</tbody>
</table>

The number of students who think that they rarely or never participate in the forms of mathematical communication from case to case always makes up of 17.5%-24.4%. The number of students who think that they participate regularly in the form of mathematical communication is fairly low, between 5%-8%.

According to the survey data, it is said that the form of mathematical communication which requires the students to “Present the mathematical solutions in speaking form” or “Combine speaking and writing during presentation of mathematical solutions (argument, demonstration, explanation,...)” attracts few students to participate in. Particularly, the 6th or 7th-grade students find many difficulties in presenting fluently and accurately their mathematical ideas.

Thus, it can be seen that such six forms of mathematical communication appear fairly regularly in the mathematical hours. However, it does not mean that the students participate regularly in the activities of mathematical communication. The issue is that it is required to apply the measures to increase the number of students involving in the activities of mathematical communication and improve the quality of communication in the mathematical hours.

After the survey of communication cases which the students of junior high schools often face with difficulties in participating in the mathematical communication, we summarize the students’ ideas follows:
Table 3. The situations in which students face with difficulties in communicating by mathematical language

<table>
<thead>
<tr>
<th>Situations</th>
<th>Level</th>
<th>Quantity</th>
<th>%</th>
<th>Quantity</th>
<th>%</th>
<th>Quantity</th>
<th>%</th>
<th>Quantity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and answering questions in mathematical documents</td>
<td>Very regularly</td>
<td>204</td>
<td>10.7</td>
<td>288</td>
<td>15.2</td>
<td>1228</td>
<td>64.6</td>
<td>180</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>Regularly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rarely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening to understand mathematical contents and answering questions</td>
<td>Very regularly</td>
<td>307</td>
<td>16.2</td>
<td>290</td>
<td>15.3</td>
<td>1179</td>
<td>62.1</td>
<td>124</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Regularly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rarely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussing and exchanging ideas of mathematical contents with classmates</td>
<td>Very regularly</td>
<td>198</td>
<td>10.4</td>
<td>260</td>
<td>13.7</td>
<td>1328</td>
<td>69.9</td>
<td>114</td>
<td>6.0</td>
</tr>
<tr>
<td>and teachers</td>
<td>Regularly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rarely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presenting (speaking or writing) mathematical issues</td>
<td>Very regularly</td>
<td>213</td>
<td>11.2</td>
<td>261</td>
<td>13.7</td>
<td>1334</td>
<td>70.2</td>
<td>92</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>Regularly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rarely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

About 25%-30% of students think that they often face with difficulties in communication using the mathematical language. Such figure shows that, although the students are taught to understand correctly the mathematical language, in the practical mathematical communication, many obstacles must be overcome in timely manner.

Finally, we have surveyed the students who self-assessed their mathematical communication competency. It can be seen that, in general, the mathematical communication competency of students of junior high school via their self-assessment is mostly at an average level (49.7%-56.1%).

Table 4: Self-assessment of students of junior high school on their mathematical communication competency

<table>
<thead>
<tr>
<th>Communication competency</th>
<th>Level</th>
<th>Quantity</th>
<th>%</th>
<th>Quantity</th>
<th>%</th>
<th>Quantity</th>
<th>%</th>
<th>Quantity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Organize and consolidate their mathematical thinking through communication:</td>
<td>Good</td>
<td>99</td>
<td>5.2</td>
<td>519</td>
<td>27.3</td>
<td>1036</td>
<td>54.5</td>
<td>246</td>
<td>12.9</td>
</tr>
<tr>
<td>(b) Analyze and evaluate the mathematical thinking and strategies of others:</td>
<td>Fairly good</td>
<td>113</td>
<td>5.9</td>
<td>584</td>
<td>30.7</td>
<td>945</td>
<td>49.7</td>
<td>258</td>
<td>13.6</td>
</tr>
<tr>
<td>(c) Communicate their mathematical thinking coherently and clearly to peers, teachers,</td>
<td>Average</td>
<td>97</td>
<td>5.1</td>
<td>561</td>
<td>29.5</td>
<td>982</td>
<td>51.7</td>
<td>260</td>
<td>13.7</td>
</tr>
<tr>
<td>and others:</td>
<td>Poor</td>
<td>95</td>
<td>5.0</td>
<td>452</td>
<td>23.8</td>
<td>1065</td>
<td>56.1</td>
<td>288</td>
<td>15.2</td>
</tr>
</tbody>
</table>

The survey results show that the teachers need more efforts in organizing the language activities in the mathematical hours as well as conducting research and selecting measures to improve the communication competency by mathematical language for students systematically in order to increase the efficiency of communication in teaching the mathematics in junior high schools.

2. Orienting measures to improve the mathematical communication competency for students in teaching the mathematics in junior high schools

(1). Establishing and practicing the vocabulary, syntax and semantics of mathematical language for the students while organizing of mathematical communication activities

a) Vocabulary:
The vocabulary of mathematical language includes signs, terms (words and phrases), symbols (drawings, charts, diagrams, graphs...) used in the mathematics. In mathematics, the vocabulary is highly specialized.

Example 1: The presentation of “The least common multiple of two numbers is the smallest number (excluding zero) that is a multiple of both of the numbers” contains a series of words as “common multiple”, “set”, “smallest number”. If the students do not understand the mathematical contents of such words, they will not understand the mathematical content of such presentation.

The daily language appears in the mathematics: The students often face with difficulties in overcoming “individual experiences” to approach the mathematical science. We also meet different signs which present the same object or one sign which present different specific contents. For example, with two points A and B on the plane, we have two concepts related to AB: Straight line AB, ray AB, line segment AB, length of line segment AB... The teachers should use the context-based suggestions so that students learn which are the correct meanings, unify the usage, understand the meanings of words, figures and signs, supplement firmly and use flexibly their vocabulary in mathematics and reality.

b) Syntax:

First of all, in the mathematics, the students are familiar with many syntagmatic issues; however, the new presentations have currently been used. For example: mark “=” is used to present the equality (identity) of two objects (numbers, presentations...); however, such relationship has currently been defined by figure signs: \( AB = CD \). But in the essence, it still presents the identity of numbers. Thus, it is required to emphasize such difference so that the use of syntagmatic presentations has still been familiar but bearing the new semantics.

In the mathematical teaching, there are many opportunities for improving the communication competency by mathematical language for students: exercises in the form of finding out mistakes in solutions; giving questions under the given mathematical presentations; reading and looking at figures to answer the questions and write the results by signs or draw the figures according to given signs or symbols. In the nature, the students “interpret” from the natural and symbolic language into signal language and vice versa. Such exercises provide good opportunities to establish the mathematical language for students, particularly the signal and symbolic language, helping the students grasp thoroughly “grammatical rules” of mathematical language.

c) Semantics:

The semantics of mathematical language are the contents which are presented by simple signs or complex signs. Upon thorough grasp of rules and regulations of linking signs and transformations, the students will more understand the semantics of mathematical language.

The organization of mathematical communication activities can be commenced by asking the students to read and understand a simple content, give example and describe by their own language then the level of difficulty is gradually increasing by assigning the students to read and understand the solution of a short exercise, then a complicated demonstration or methodical knowledge.

The teachers must give purposely questions so that the students can distinguish the meaning of signs in each defined context. For example, the teachers ask students to show the different meanings of \( x\bar{O}y \) and \( y\bar{O}z \) signs used in the following clause:

“Because \( x\bar{O}y \) and \( y\bar{O}z \) are adjacent supplementary, so \( x\bar{O}y + y\bar{O}z = 180^\circ \).” Here, \( x\bar{O}y \) and \( y\bar{O}z \) signs are used twice with two different meanings, but still ensuring the syntax without mixing their meanings.

In summary, by the mathematical communication activities, it is required to suggest some methods which help the students understand the concepts, clauses or theorems when they face with difficulties in language and orient the teachers to take care and pay much more attention to the teaching language. Concurrently, it is also required to have more specific measures to approach the mathematical terms, signs and symbols for the students of the early junior high schools in order to improve the efficiency of mathematical language used in teaching.

(2) Ensuring accuracy and science of mathematical language in mathematical communication.

As mathematics uses symbols in addition to words of mathematical language in the standardized meaning, so mathematical language plays a role in speaking tasks by interpreting a written statement or showing the necessary inferences if necessary.

A small test, when teacher writes on board: “\( AB = CD \)” and requires students to explain what the information on board show? Consequently, many students who know will give out exact explanation such as: Length of segment AB is equal to length of segment CD, segment AB is equal to segment CD, segment AB and segment CD is equal to each other, etc. The above situations also get some answers: (1) “\( AB \) equals to \( CD \)”, which is not wrong in mathematical language, but it is not exact in the aspect of mathematics (it should be clarified what students understand AB, CD to be: line, segment, or ray; (2) “\( Line \ AB \) is equal to \( line \ CD \)” and
(3) “Length of line AB is equal to line CD”. Case (2) and (3) are wrong statements since line doesn't have a determined length. Teacher should have certain sensitiveness about students' statements to ensure that “standardization” is complied strictly during mathematical communication and presentation using mathematical language, and enable students to see the role and relationship of mathematical language and flexibility of this language form.

For example, when a teacher reads out “triangle ABC”, and students are required to re-write the above content in different ways. At that time, we have a presentation in sound when reading, and writing presentation: in writing: “triangle ABC”, use sign “△ABC” and use drawing of triangle ABC (symbol).

Students who choose to present by words and symbols get quite similar results. For those using symbol languages, products obtained quite diverse: drawings as a right triangle, isosceles triangle, equilateral triangle, normal triangle, etc. Although, 6-grade students may not know the "appropriateness" of such triangles. Teachers should give out comments on the “best" drawing a general shape, not falling in any “special” case. Rigor of mathematical language requires the use of different symbols to indicate different objects, which may be difficult for students to perform and communicate in mathematics, especially when using symbolic language.

In addition, teachers should introduce communication tasks in various forms (listening- speaking/writing; reading – speaking/writing) in the process of formation and consolidation of concepts, theorems, properties and mathematical methods for students. They should assign students to read books, discuss, make questions and answer questions, use language to present mathematical ideas accurately, organize mathematical communication activities, encourage students to listen and assess answers of their classmates in order to form and train the clear mathematical thought for students. Also they should select exercises to train students to use exact terms, signs and symbols; require students to present mathematical solutions in form of writing (paper, notebook, blackboard) or speaking create diversified communication environment, using types of questions and exercises with the aim to form and train the competency of solving mathematical problems for students.

**Conclusion**

In teaching mathematics, it is frequent to ask students to think and discuss mathematics. Thus, communication using mathematical language is both an objective and a means to improve mathematical study outcome. In junior high schools, it should be paid special attention so that communication using mathematical language attracts the participation of many students and a variety of methods for students to compare, discuss and perceive. Teachers should create a trustable and respectful environment to enable students to be aware that learning mathematics is for the sake of themselves and other peers.

Also, communication of teachers and students should be standardized as it directly affects students. Students will learn through teacher's communication. Therefore, teachers should use exact, brief, clear language and fluent presentation with the correct attitude. Furthermore, language is the presentation of thought, and the student's understanding is revealed through language activities. Thereby, teachers can be aware of how the students understand practical situation to make appropriate teaching plan.

**References**

**A. Vietnamese**


[4]. Ministry of Education & Training - Teachers Department.


B. English


Training Teachers at the Hand of Competence Approach at Lao Cai Teacher Training College in Lao Cai Province, Vietnam

Hoang Van Duong
Deputy Director of the Department of Lao Cai Education and Training; Principal of Lao Cai Teacher Training College, Vietnam
Group 13, Binh Minh Ward, Lao Cai City, Vietnam
E-mail: hoangduonglc711@gmail.com
Tel: (+84) 0978494396

Abstract

As globalization becomes more prevalent deal with increased cultural diversity within the workforce to require employees ought to have extensive knowledge and skills was integrated, helpfully on survivors of their work in multi-cultural environment. Therefore, Vietnamese Communist Party and Government have given the orientation on training teachers at teacher training schools whose must be supplied from teacher staff that they have had in qualifications, excellently on knowledge to be able to achieve the mission of educational innovation. The essay has been written with based on analyzing the role of educational innovation at pedagogical schools in Vietnam, affirming that training teacher at the hand of competence approach is a necessary condition to success on education system at high school level. The process of an innovation needs to ensure aspects likely; to be fully aware of training innovation policy through ability approach for most officers and teachers, to innovate activities of careers guidance, and pedagogical enrolment and training experience, to invent the innovation for studying program that it was to build up for the training documents on innovating of teaching forms, organizations, methods and meaning definitions; to assess of the innovating control and evaluation of the teacher’s competencies to practice and internship of their training innovation toward students’ skills, successfully.

Keywords: Training, Teachers, Education, Lao Cai Province

Introduction

Globalization requires employees to have extensive knowledge and skills which help integrate, survive and work in multi-culture environment. Nowadays, human’s knowledge grows continuously, teaching model in traditional methods is no longer suitable, therefore, it is necessary to have another model to replace the old one. This is a difficult mission and who will assume this assignment. The world determines that education will have to face and solve this issue and teacher will take a major role, because they are central characters in most programs of education innovation, and reform.

The roles of training teachers on educational innovation in Vietnamese Communist Party and Government have realized of their determinant factors that they would be expected and revealed teaching skills toward their quality and honored by society, clearly. “Teachers are important factors of education quality and honored by society”. Educational Law in Vietnam suggests that teachers’ play has affected to determinate of the role of educational quality, insurability. “Teachers play an important role in ensuring education quality”. The 11th evolitional policy of the (Resolution of the Vietnamese Communist Party) has to promote the quality of human resources with quick win on training the innovation and educational development, comprehensively. Focusing on the new modeling implementation on education onto innovative content and training program for teaching and learning for students’ needs and globalizations were emphasized and enhanced extra educational program throughout high school level in Vietnam. Which emphasize that: “Innovate content, program, method of teaching and studying in all grades and educational level. Good preparation needs to be made to implement the new education program in high schools after 2015”.

The policy of the Vietnamese Communist Party and Government on educational innovation has required to the pedagogical schools whereas the teachers’ local educational institutes to be trained with the teacher staff that they have to be experiencing better qualifications were arranged, the trainers ought to have too enough competency skills for training teachers to implement education innovation mission. Therefore, it is necessary and important to promote training teachers at the hand of competence approach.
Research Mission and Method

* Research mission:
- Point out the role and importance of innovation in training teacher at pedagogical schools in Vietnam currently.
- Propose solutions for innovation in training teacher at Lao Cai Teacher Training College.
* Research method: Interdisciplinary research method, attendance observation method, method of comparison, analyze, and generalization.

Research and Discussion Result

Requirements for qualification and competence which teachers need to have to implement the education innovation

The 2nd Central Resolution (Session VIII) of Vietnamese Communist Party Government: “…must enhances qualification and ability for teacher staff”. Qualification and ability combination well done and affect each other. There are many conceptions about two issues:

4.1. Conceptions about qualification and ability
- In terms of the psychologists, qualification is a system that it’s including psychological attributes manifested for everyone’s specific relationship, and showed in attitude and behavior.

Enhancing qualification of teacher staff is to form a worldview which helps them have a basic to orient attitude and behavior to natural world, society and career reality; to create passion for the teaching, discipline organization sense and responsibility spirit; to form good characteristics for teachers as: be exemplary, have sense of social responsibility, be enthusiastic to participate in community activities, be good morality model, have a didactic, modest, simple, sociable, close and helpful life.

- Competency has a lot of meanings, and it has no to definite consistence about the concept yet. However, it is able to be divided into two major groups that depending on different signs:

According to sign of psychological factor, competency is a integrated attribute of personality, a combination of individuals’ psychological characteristic which is suitable with requirements of a determined activity, and makes sure that activity has a good result.

According to action ability, competence is ability which helps control a system of knowledge, skill and attitude, and operates it’s reasonably in implementing the mission or solving problems in the life.

Career of teacher competencies is ability implementing teaching activities with high quality which they were manifested in action process and combined with appropriating skills. Competency has composed with the synthesis and generalization. Exactly, in the training process, it is necessary to determine on the basic competence frame and form of the basic teachers’ competencies.

4.2. Basic competence groups need to be formed for teachers to satisfy education innovation

Teachers’ competency is a affecting determinant factor of their teaching and education quality in schools. This research methodology was enhanced to promote teachers’ competencies of their developing educational innovation to their training skills toward their competence approaches on differentiating innovation was used. For example: career standard for teachers has career competence for teachers including: teaching and educating competence, result evaluation competence of educating students, cooperation competency, …

Administrations of the 2-competence groups for participating the functional teachers’ competencies to their teaching and educating competence approaches were provided for blending and combining processes together with carry out the mission of teachers’ competencies. A writer, Tran Ba Hoanh used to get opinions on viewpoint and orientation contents to register for training innovation of training teacher program by the policy of the Ministry of Education and Training. Researcher has planed to determine of this study that it’s composed with the competency form was based on teachers’ needs namely:

(1) Competence for researching educational objects and environments

This competence requires teachers to develop skills of composing questionnaires, holding the investigation, collecting and processing information about students’ needs and traits; applying collected information to the teaching and educating; studying the environment, collecting and processing information about schools, economic, cultural, and social situation in the local to apply it to the teaching and educating.

(2) Development competence of educational program at school, subject program

Innovating educational program with basic requirements: establishing competence for students, improving experience and creative activities, combining closely between school activities and real life, locals and regions and so on; there is not a common program for schools. Therefore, teachers need to be trained the
Subject of Program Development to help them actively establish educational program at school, control class, manage activities in class.

3. Competence of designing the teaching plan and educational plan
Research skills were required of the teachers’ competencies, such as: purpose, content, textbook program, document, guiding document of upper level, characteristic of object surveyed to make a teaching plan in accordance with integrating inter-subject topic, experience and creative plan for students, topic and special subject implementation plan. Plans must indicate elements of input, output, activities, process and assigning perform responsibility.

4. Competence of organizing to perform teaching plan and educational plan
Teachers need to have skills of applying science knowledge of subject, inter-subject, educational science, using of facilities to organize teaching in accordance with integrating inter-subject topic, teaching divided; skills of studying result assessment of students according to the trend of approaching competence: skills of studying circumstance for students, guiding students to study by themselves, replying information to teachers to adjust teaching process; ability of applying active teaching methods according to circumstance to develop learning of students’ competency, improving festive quality of teaching and educational activities.

This competence requires teachers to have communicative skills to make cooperative relationship, combine resources, mobilize resources to serve education; organize activities of movement, culture, performance, sports and physics and experience and creative activities; management skill of teaching and educational activities, assessment of practicing result of students and use of coequal assessment in assessment for practicing result of students; attracting resources and encouraging everyone to participate together and ensure to perform the plan.

5. Competence of supervision, result assessment of teaching and educational activities
Assessment is an important stage of teaching and educational process, it is not only to mark result or situation but also to propose decision to change situation according to aim available. For the teaching trend of competence development, teachers must have methods and skills of suitable assessment, combine flexibly between traditional assessment method and modern innovation; learning knowledge on how to use means proficiently, assessing technique and combinations quantity and quality assessments, harmoniously. In addition, teachers also develop self-assessing capacity into students.

For performing supervision and assessment are better teachers who are able to set up criteria, standards to assess students, concurrently know how to solve and announce assessment result in public.

6. Competence of science research and organization of deploying science research which can apply in high school
This competence is based on skills: discovering, identifying, expressing issues need to be solved to become topic, setting up science supposition, outline, combining research resources, organizing research, assigning to basic survey, processing information and surveying result, pedagogic experiment, science report, assessment of research result, applying to deploy result and learn from experience, organizing to transfer research result into activities at school and real life.

7. Social competence
This teachers’ competency requires to set relationship between school and family and community, taking part in local’s activities, propagandizing policies of education to community, mobilizing children to go to school, helping the elder, children, disabled people in society.

8. Competence of job development
This competence requires teachers to have self-assessment skill under job standard, define clearly strengths and weakness to make self-studying plan, practice and try by themselves political quality, ethic, professional level to improve quality of teaching effect and educating students.

4.3. Some proposals of innovating to train teachers to satisfy educational innovation requirement
4.3.1. Being fully awareness of the training innovation policy according to the trend of approaching competence
The innovation of training teachers which according to the trend of approaching competence rises from policy of basic and comprehensive educational innovation, concurrently satisfying innovation of program, textbook in education in high schools. The training innovation relates to all steps from enrolling to setting up programs, textbooks, documents; organizing training, testing, assessing and considering to recognize graduation. The training innovation only gets good results when all of officers, teachers understand well, agree and try their best to perform. This is a difficult and essential issue because a major obstacle is in their knowledge.

Due to recognizing difficulty, the mission of being fully awareness needs to be comprehensive and consistent from level of party, committee to departments, groups, divisions, collective organization and officers and teachers. The process needs to unify from setting research groups, assessing education at present, analyzing education in high schools, setting output standards and having programs of training some fields according to the
trend of approaching competence, checking and taking over and showing new training program for practice, learning from experience and having change frequently.

4.3.2. Innovation of career guidance and educational enrollment

Educational enrollment has been basically conducted like other major enrollment. Through practice showing that teaching is a special job; therefore, it needs to have specific enrollment regulation to be selected students who are having quality, capacity which is suitable for teaching job. From experience of training teachers, we have some suggestions that:
- Combining with high school to have career guidance class for students which shows professional characteristics of teachers, essential requirements of quality and capacity for students who are choosing this major in order to make students to have foundation in their occupation.
- Industries are belonging to aptitude (Board M), training agencies should have entrance examination or preselecting aptitude examination before considering for acceptance; it is necessary to test skills of presentation, communication, writing and primary contest of appearance.
- Defining competences and essential quality of students belonging to pedagogic industry, setting enrollment methods according to the trend of approaching full capacity assessment, combining closely examination and selection.

4.3.3. Innovation of making program and document for research studying

At workshop of training innovation, improving teachers in high school (May 2015), Education and Training Ministry conducted pedagogical school to establish program to train teachers who will teach according to the trend of competence development. Implementation of the policy needs to do some things:
- Pursuant to Resolution No. 29 – NQ/TW on basic and thorough innovation, Resolution No. 88/2014/QH13 on innovation of program, textbook in education in high school:
  Decision No. 44/QD-TTg on approving innovative project of curriculum and textbooks for students in high school for pointing out basic requirements and goals that the new curriculum aims at. They are: \textit{formatting competence for students, building integration curriculum, enhancing creative experience activities}.
  - Organize and review the training curriculum of study codes, determine whether periods of each block of knowledge (general knowledge, basic knowledge, specialized knowledge, and optional subjects) are appropriate or not. What kinds of competence do students obtain in the subjects of the new training curriculum? Which subjects should we need adding? And should be adjusted periods of subjects in order to form mentioned eight competencies for students? Design and apply the training curriculum with credits or modules for practicing soft skills for students to satisfy reform of performance and teaching methods at high school.
  - Course Syllabus of each subject is not only specific curriculum, but also material for teachers to set teaching methods, to use as assignments and materials for students. Therefore, we must determine all the syllabus of the training curriculum to confirm that whether they are in accordance with competence approach or not. With the current basis of assessment, faculties, teaching groups and teachers have to redesign specific syllabus which is suitable for outcome-based approach, reaching the goals of high school grades so that students are not surprised with process of educational innovation when they graduate or researching and constructing the curriculum in accordance with the trend of creating knowledge module for teaching.
  - New training curriculum, structure of knowledge blocks must be reasonable. The number of periods for vocational training increases. Periods for theory need reducing, and periods for practice, discussion and seminar should increase. The curriculum of theory-based orientation has to change into competence-based orientation for students: wise scientific competence of subject, educational competence, self-learning competence and teaching competence, etc.

4.3.4. Innovation of forms of organization, methods and use of teaching means

Nowadays, innovation of teaching performance in high school is very various. In addition to teaching in class, self-learning and extracurricular activities, discussion, seminar, vocational practice, social activities, creative experience and science research are also emphasized. To response this innovation, educational school needs to innovate forms of training, teaching and practice organization for students so that teachers know how to organize teaching activities with the mentioned forms. Especially, creative experience must be enhanced so that trainees can participate in social activities and activities at high school besides studying at school.

Besides reforming teaching organization, innovation of teaching methods also takes place strongly at high schools. Students are in the central of educational activities. They actively get knowledge, train their skills, etc. by teacher’s guiding. To satisfy the requirements of innovation in educational schools, students have to be taught how to self-study, strengthen science research, help to guild teaching methods. Teachers must take the lead in reforming teaching methods, mastering teaching skills, especially being positive teaching methods and techniques, using competently modern teaching equipment, applying information technology to educational activities and samples for students.
4.3.5 Examination and assessment reform

Reforming examination and evaluation in accordance with competence development of learners is a breakthrough in training of the schools.

Evaluating study activities of learners consists of input-based assessment, learning process-based assessment and outcome-based assessment. These assessments are conducted in many different ways. Enhancement of applying information technology in evaluating, assessment of short and long-term process must be focused. All assessment criteria must identify students’ level of competence obtained in comparison with outcome standards of the subject. Combining use of evaluating result in study process and assessment of final term and whole year, peer review, evaluation of trainers, head teachers, consultants, assessment of practice school, assessment of recruitment agencies.

Training process must ensure students to gain self - evaluated competence in accordance with testing, examining and evaluating in the program in high school.

4.3.6 Reform of practice and internship for students

Practice and internship play an important role in procedure of training teachers. Time of practice and internship of students are different in training programs. It depends on training program. Generally, practice and internship are implemented in the second year or the third year under mode of study after completing subjects of psychology, pedagogics and teaching method.

To improve training skills for students, task of practice and internship must changed basically:
- Building training curriculum based on outcome standard, professional standard of teachers. The curriculum must ensure that periods for training educational credits take 25% in limitation and regularly update practical issues in local.
- Practicing to get acquainted with the school, observing educational activities implemented in the first year of the course.
- In building basic practice system, it is necessary to determine clearly beneficial, responsible and liable relationship between educational school and practice units. There is a policy of sending teachers to practice schools for teaching and teachers of practice school teaching some topics for students at educational school.
- Designing sample teaching periods and typical educational activities in the practice schools, connecting internet with classes in the practice school or recording to provide materials for lecturers and for students.
- Evaluating recognition of graduation needs to include teaching content and assessment of the practice school’s teachers.

Conclusion

Basic competencies of mentioned teachers are necessary; however, they are not an appropriate “angorit” technology procedure in all educational circumstances of their complexity and constant change. Therefore, in the process of training teachers, training agencies need to select and apply themselves appropriately in the reality of local.

Innovation of training teachers with competency based approach is a condition for ensuring the success of reforming high school as well as enhancement on training agencies were received from requirements to set out from the reality of high school education to orientate for pedagogical reform. Deploying the content of training teachers must be comprehensive and simultaneous, determining schedule, procedure and method, and vital issues appropriately to prioritize on human resources.

References

[5] The Communist Party of Vietnam, Resolution No. 29 - NQ/TW on radical innovation, comprehensive education and training to meet the requirements of industrialization and modernization in economic
conditions market and the socialist-oriented integration International - 2013.

A Model of Teaching-Self-Learning for the 21st Century in High School Physics Subject of Vietnam

Pham Thi Phu¹ and Truong Thi Phuong Chi²

¹Faculty of Physics, Vinh University, Viet Nam
E-mail: phudhvinh@gmail.com
²Binh Thuan Department of Education, VietNam
E-mail: phuongchi.it@gmail.com

Abstract

Self-learning is defined as a core capacity that schools have to build and develop for students in training curriculum according to capacity development teaching’s point of view, in order to realize the fundamental and comprehensive innovation of education in these first decades of the 21st century in Vietnam. How this educational content can be fulfilled via high school physics subject in Vietnam? This article introduces the research result about one teaching – learning model in order to answer the proposed question. The model is called teaching – self-learning with the help of e-learning, applied for nuclear and atomic physics knowledge in 12th grade.

Keywords: Teaching-self-learning, ICT, E-learning, Nuclear, Just-in-time teaching

Introduction

The concept of "teaching - self learning" has the connotation of teaching oriented to develop self-learning capability of students. Learners’ capacity development including self-learning capability is the approach in establishing and developing educational programs of many countries around the world such as Australia, Canada, New Zealand, France, Finland, South Korea, Indonesia, etc. [1]. In our country, teaching - self-learning is discussed with the model of two-way cooperation teaching - self-learning between teachers and students by the author Nguyen Canh Toan, Nguyen Ky, Le Khanh Bang, Vu Van Tao [2], [3], [4], [5], [6], [7].

Different from the traditional teaching – learning that mainly teaches traditional knowledge, one - way indoctrinating from teachers to students: teachers indoctrate – students receive, understand, remember and repeat, the model of Teaching - self-learning mainly focus on the learning method, students play a key role to impact on cognitive objects to automatically find the knowledge to make the original study products which shall be later exchanged and cooperated between students – students, and students – teachers at the classroom community to socialize the learning products, legalize knowledge found by the learners. The teacher plays the role of guiding, organizing, attributing, counseling to the learners during the search of knowledge, application of knowledge, skills development, character formation. In the model of teaching - self-learning, the role of the teachers is an expert on learning, instructing the studying method for the learners to study the knowledge, and study how to act as a human; different from the role of teachers in traditional model that teachers teach the knowledge, training and behaviour.

In the world, the model of "just in time" teaching (abbreviated JiTT) is the model combining self-learning before class time and study in the classroom with the means of home study of Website. The students do exercises on the Website for a short time before class and teachers read all of the works "just in time" to adjust the content and teaching methods to suit the needs and understanding of students [8].

However the projects [2], [3], [4], [5], [6], [7] and [8] focused on researching this model in university education. We believe that the model of teaching – self-learning is entirely consistent with high school education innovation under capacity approach, in order to foster self-learning capability for learners. In the 21st century, the model of teaching – self-learning must use electronic technology and information technology as a means of self-learning at anytime and anywhere. So the research to apply the model of teaching – self-learning for each science subject in high schools is necessary. This article presents the application of the model of teaching – self-learning in Physics, applied for nuclear and atomic physics knowledge in 12th grade.

Materials and Methods

1. Proposals of three-phase process of teaching – self-learning model in high schools

Based on the general process of comprehending Physics knowledge and characteristics of the model of teaching – self-learning mentioned above, for ease of use in practice, we offer a three-phase process of teaching – self-learning model a physics lesson, shown in Table 1.
### Table 1. Three phases in the model of teaching – self learning

<table>
<thead>
<tr>
<th>Phase</th>
<th>Study target</th>
<th>Teachers’ activities</th>
<th>Students’ activities</th>
<th>Study products</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Self-learning capability</td>
<td>Indirect self-learning Instructions</td>
<td>Self-learning with documents and guidance handouts</td>
<td>Handout Other products as requested by Handout (personal products, may contain errors)</td>
</tr>
<tr>
<td></td>
<td>- Practice the willpower to perform self-learning plan;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Collect and process information as requested;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Demonstrate self-learning results by writing, drawing;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Ask questions (expected) Perceiving new knowledge (preliminary)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Self-learning capability</td>
<td>Direct study Instructions. - Check the self-learning result assessment; instruct peer review; - Organize the exchanges between students - students, students - teachers; arbitration; - Legalize new knowledge.</td>
<td>(Exchanges, cooperation); -Peer Review; -Presentation of the study; -Ask questions, discuss, defend; -Adjust the study; standardize new knowledge.</td>
<td>Social products, more complete original products.</td>
</tr>
<tr>
<td></td>
<td>- Self-evaluate the study according to the answers and basis benchmarks;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Self-demonstrate the products by oral language;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Debate, protect, question; - Self-adjust, draw experience about how to learn; Perceiving new knowledge (standard format)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Self-learning capacity:</td>
<td>Instruct how to apply new knowledge, expand and deepen, systematize knowledge (demo presentation). Instruct new study mission.</td>
<td>(Self-learning with direct instruction) Solving application questions of new knowledge; Listen, take notes, observe demo. Receive new study mission.</td>
<td>Demo presentation</td>
</tr>
<tr>
<td></td>
<td>- View demo presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Take notes during listening; - Receive self-learning tasks for new content. Deep understanding of new knowledge.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Design E-learning as a means of self-learning outside class

During the first phase of the process of teaching – self-learning, students study at home with personal learning facilities. To create favorable conditions for the students to learn at anytime, anywhere, in the age of information technology, that the Internet and other means of internet access as a laptop, smartphone, iphone, ipad, etc. become close and popular, we choose E-learning model. E-learning is a teaching method based on electronic technology and information technology; there exists a virtual school on the Internet, where people can enroll a course according to individual plan with input test, learners study by there own with the lessons compiled and arranged as different modules, self-learning and self-assessment; at the end of course, the learners take the exam to recognize the study results and choose the next study plan depending on the test results. E-learning is often used for adults’ self-learning to improve their professional skills. In the twenty-first century, the schools must facilitate students to acquaint with this learning environment, instruct them self-learning with modern means of study; teaching and self-learning model in the 21st century must use E-learning, different from teaching and self-learning model of the 21st century only use the traditional means of learning.

Results: We have designed, built e-learning system, the interface of the E-learning is on the website http://schoolviet.com. In Physics, the module "Atomic nucleus" is organized as Figure 1.
Figure 1. Interface to arrange the lessons of Atomic nucleus in E-learning
A self-learning lesson of Physics in E-learning is built in four formats: multimedia lectures, PowerPoint lectures, PDF lectures, practice; each format is organized according to each unit of knowledge (see Figure 2).

Figure 2. Schematic structure of the lesson of Radioactivity in E-learning
3. Design lesson plan in the class according to teaching – self-learning model with the support of E-learning
3.1. Changes of lessons designed according to teaching – self-learning model
The classroom lesson according to teaching – self-learning model is students’ self-learning with direct guidance of Teachers, different from traditional lessons as delivering knowledge. Therefore, lessons are
3.1.1. About teaching target

Traditional lessons must achieve the objectives of the knowledge, skills and attitudes specified in the standard. The goal of the lesson in teaching – self-learning with the support of E-learning is not only to implement the Standards but also target towards the goal of establishing and developing self-learning capacity. Accordingly, depending on the content, study facilities have been integrated in E-learning, that teachers identify the specific skills necessary for students to practice in the lesson. These specific skills should be the elements of self-learning skills in general, and is divided into three basic groups:

Self-learning planning skill: This group includes the following specific skills: analytical skills to determine the self-learning objectives, self-learning contents, determine the order of work to do, distribute and arrange time for each task in a reasonable manner, in accordance with the existing material means [9].

Plan implementation organization skills: this group includes specific skills such as information gathering skills (reading printed materials, electronic documents), information storage skills, information forming (recording via traditional recording media and recording media, modern storage), information handling and manipulation skills to solve cognitive tasks, presentation skills, communication skills in spoken languages, written languages, etc.

Self-examination, self-evaluation skills: include skills to select the method to implement the actions to perform self-examination, self-assessment, using the self-testing, self-evaluation.

3.1.2. Regarding teaching facilities

To conduct the lessons designed according to the model of teaching – self-learning with the support of E-learning, apart from the usual traditional media like tables, textbooks, experiments (if any), there must be the following amenities:

E-learning for students in the self-learning: self-learning lessons on e-learning must ensure the scientific Physics as well as ensure pedagogical science as medium strength, attractive with a string of questionable situations to encourace and maintain the stimulus to study, intuitive multimedia integration, etc.

Computers connected with the projector for teachers to instruct the students to assess self-learning results, that is the means teachers use to formalize, systematize knowledge.

Handouts has the functions of guiding self-learning with e-learning, as well as a product for the teachers to assess self-learning results and students implement self-assessment based on answers and basis benchmarks. Based on the objectives and content on E-learning lesson, Teachers design Handouts according to the questions, exercises, puzzles, etc. following the targets of knowledge and skills in the lessons with specific guidelines about Lesson address, method to collect and process information from self-learning lessons on e-learning for students to perform and complete learning tasks outlined in the handout..

3.1.3. Main activities and activities products

Time period of 45 minutes/lesson in the classroom is an opportunity for Teacher and Students to meet each other, direct exchange of information, “face to face” information with enormous educational value in terms of social aspects, implement the fourth pillar of the four pillars of education as announced by UNESCO to be "study for live with people,” this is a characteristics that online learning at home can not replace schools.

Main activities in the class include:

a. Students check self-learning results assessment at home with E-learning(Phase II of the process of teaching – self-learning in Table 1)

This is the first activity of Phase II in the process of teaching – self-learning in continuation with the process of self-learning at home with E-learning, the students bring their productions to the classroom, looking forward to be tested, praised, reviewed, answered their questions, etc. The activity of assessment of self-learning products have large effects to encourage students to self-learning, promote self-learning functions at home: practice self-learning skills without direct instructions of teachers, develop self-awareness, willpower, planning skills in learning activities, basic intelligence (analysis, synthesis, comparison, generalization, abstraction, etc.) practice thinking skills, especially independent thinking. Students present their products, exchange and discuss, argue with other students and teachers.

Content and forms of activities:

Teachers take slideshows about answers and scale. Students perform peer review.

Representative of students in Excellent, Good, Average, Poor Group to present products, other students listen, question, answer. Teachers play the role to guide and referees.

b. Students ask questions
During the learning process in the classroom, students have an opportunity to raise their questions. Meanwhile, by sharing and comparing results of receiving knowledge with teachers and classmates, students can practice skills in presenting arguments in the language of physics, skills of questioning physical object, skill of selection and evaluation of different information sources. In addition, the students can determine their existing levels of knowledge, skills and attitudes of learning.

c. Teachers legalize, and systematize knowledge / skills
After the Students present self-learning products, Teachers make some comments, legalize knowledge/skills following the lesson targets. General form used to systematize lessons is mind maps or diagrams. Based on the students presentation results, Teachers capture the ideas, critical thinking of students to rectify mistakes in thinking, reasoning, presentation of students. Thereby, students can practice the skills of thinking, evaluation and self-assessment, self-tuning, recording, summarizing and logical systematization of knowledge.

d. Enhance knowledge and assign the next self-learning tasks at home with E-learning
This activity helps students understand and apply learned knowledge. Additionally, students are trained for creative thinking skills, educated with aesthetic worldview, and they can see the meaning and importance of the knowledge learned in the reality. Self-learning guiding activities at home with E-learning are implemented by new handouts.

3.2. Lesson design process according to teaching – self-learning model with the support of E-learning
Pursuant to the three-phase process, the characteristics of classroom lessons in the model of teaching – self-learning, a number of similarities between the model of teaching – self-learning with the support of E-learning and "just in time" teaching model [10], we propose the design process of classroom lesson in the model of teaching – self-learning as follows:

- Step 1. Study the lesson objectives according to Standard and knowledge content in the curriculum;
- Step 2. Roleplay students read the data related to the lesson available on E-learning;
- Step 3. Determine specific objectives for self-learning skills;
- Step 4. Design Handouts to instruct self-learning at home with E-learning;
- Step 5: Design legalized mind maps, systematize lesson knowledge;
- Step 6. Design the activities of students aiming to the key activities outlined in 2.3.1.3.

Results

Examples of lesson designed according to the model of teaching – self-learning with the support of E-learning
Lesson 53. Radiation (Physics Class 12 Enhance)

1. Lesson Target
Knowledge, skills attitudes according to Standards: State the definition of radioactive phenomena, nature and characteristics of the type of radiation ray, make speech and write the radioactive law relation, mention some application of radioactive isotopes, use the radioactive law to address some exercises in the program. Be aware and take measures to protect the health of themselves and their community before dangerous effects of radiation.

Self-learning skills: read, watch, choose, collect and process information from multimedia data (video, simulation, photographs, drawings, diagrams, graphs, tables, etc.) of all radioactive on E-learning to independently complete tasks at home; skills of application of mathematical knowledge as exponential, logarithmic, etc.; Skill of reporting, presentations; Group work skills.

2. Preparation
a.Teachers prepare:
(1) Data of Radioactivity lesson on E-learning for students self-learning at home; self-learning lesson of "Radiation" is posted at http://schoolviet.com is divided into 4 modules corresponding to 4 units of knowledge: The phenomenon of radiation, radioactive rays, radioactive law and radioactivity, radioactive isotopes and applications. The modules are designed visually by integrating multimedia (see Figure 3). With each module, there is input and output test. Input testing is to check the prerequisite to learn the knowledge of that module. Students are confirmed to complete a module when completing 80% of the final module test questions. Contents of test questions focus on supporting learning personalization and positive of perceptions activities of students. Each module also includes an excersize parts, the content of questions and practice exercises with increasing difficulty level, according to the program branch structure, appropriate to each level of cognitive and thinking of each student. These data are distributed to students by LMS (Learning Management Systems) at the same time as the basis for LMS to manage and give feedback of the learning outcomes of those students.
Figure 3: Module 3 - The Law of Radiation.

(2) Radioactivity Lesson handouts require the students to complete before classtime by by self-learning on e-learning

(3) Design mind maps to legalize and systematize lesson knowledge (see Figure 4).

b. Students prepare:
Self – learning Radioactivity lesson on E-learning, complete Handouts.
3. Classroom teaching process
Activity 1: Check the self-learning result assessment of all students: Teachers announce a peer review scheme, slide answers, scale for the students to assess the handouts. The Teachers collect Handouts into 3 groups: Good, Excellent, Average, Weak based on scores.
Activity 2: Teacher organize for students to present and report on self-learning products; Students discuss according to the lesson content development step to answer the following questions and complete additional self-learning products

<table>
<thead>
<tr>
<th>Knowledge unit</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. The phenomenon of radioactivity</td>
<td>What is radioactive phenomena? Give examples of radioactive phenomena? Is it possible to use external effects such as increasing temperature or pressure of the surrounding environment of radiation source to alter the process of radioactive decay or not? Why?</td>
</tr>
<tr>
<td>II. Radioactive rays</td>
<td>Compare the nature and characteristics of the type of radiation rays. Radioactive rays is invisible, how to recognize them?</td>
</tr>
<tr>
<td>III. Radioactive law. Radioactivity</td>
<td>What is a half-life? What does it mean with Half-life of radon 219 of 4s, of Cachon14 of 5730 year? Which relation denote radioactive law? What is radioactivity? With relation express the connectio between radioactivity and the amount of radioactive nuclei decay? What does it mean if Radioactivity of one gram of Radium 226 is 1 curium (Cr)?</td>
</tr>
<tr>
<td>IV. Radioisotopes and applications</td>
<td>What is Tracer method? How is applied? Unit Question: Which method is used to determine the age of a mummy? Present the principles of this method.</td>
</tr>
</tbody>
</table>

Activity 3: Legalize, systematize the knowledge with mind maps.
Strengthening, systematizing the knowledge by mind maps will train students how to take notes, summarize the contents of the lesson in a scientific way, help students to memorize the knowledge easily and more deeply. When systematizing the knowledge in mind maps, students get an overview to possibly orient the thinking logically and systematically thereby contributing to self-learning skill, promote positive, initiative and creativity in the learning process of students.
Activity 4: Teachers assign new self-learning tasks at home for the next lesson.
This design lesson is taught in practice whose initial results show the feasibility and effectiveness of the teaching - self-learning model with the support of E-learning.
Conclusions and Discussion

Tsunesaburo Makiguchi, Japanese famous educator wrote: “Education is considered as a process of self study instruction process, its motivation is to stimulate learners to create the values to achieve self-happiness and the community itself” [11]. Through the organization for students to implement self-study at home with e-learning, Teachers have guidance for student the discipline and cultivate self study skills. Students conduct self study tasks in a three-phase orientation: individual self study with e-learning (Phase 1), actively coordinate learning activities in the classroom environment with teachers and classmates to socialize with study products (phase 2), legalize and systematize the knowledge, observe samples (phase 3). Teaching - self study model with the support of e-learning has similarities with "just in time" teaching model (JiTT) [8] on the following factors: self-learning with Website before class time and activities in the classroom to feedback self study outcomes, develop cognition. But there are many differences; for example, JiTT does not set up its own Website but use available online resources, self-study tasks are not required to present by personal products to perform self-evaluation and self-assessment; JiTT’s goals do not emphasize teaching the method of learning, etc. In the world, JiTT is mainly used for adults training [12] ... We can say that the model of teaching - self-study with the support of e-learning is the combination of teaching - self-study model introduced by Nguyen Canh Toan and JiTT model applied on high school education in the era of information technology. Our research results will further replicate for other contents of Physics program and may also extend to other subjects in order to realize the orientation of self-study capacity development education – a general core capacity for learners.

References

[35] Do Ngoc Thong (2011), Building general education program in the direction of capacity approach
[38] Nguyen Canh Toan (ed), Nguyen Ky, Vu Van Tao, Bui Tuong (2001), The process of teaching - self study, Education Publishing House, Ha Noi
[41] Nguyen Canh Toan (editors), Nguyen Ky, Le Khanh Bang, Vu Van Tao (2001), Learning and teaching how to learn, Publishing house of University of Education.
The aims of this study are to describe on physics classroom learning environment for the upper secondary educational students in Srinakarintra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School. Students’ perceptions of their actual and preferred classroom learning environments were assessed and compared with a sample size of 142 physics students in 6 classes at Grade 10-12. Associations between students’ perceptions and their attitudes toward their physics environments were determined. The learning perception were obtained of the 30-item Constructivist Learning Environment Survey (CLES) and students’ attitudes were assessed with a short version of the Test of Physics–Related Attitude (TOBRA) that they were translated into Thai language for administrating research methodology. Statistically significant differences between the students’ perceptions of actual and preferred of their classroom learning environment also were found. Associations between students’ perceptions of their attitudes to their physics classroom learning environment and value indicates that 78% of the variance in students’ attitude was also determined. Suggestion that constructivism has been used as a referent for building a classroom that maximizes student learning and a constructivist approach to learning is based on the idea that the student constructs his or her own knowledge through negotiation of meaning of physics laboratory classes.

Keywords: Constructivist, Learning, Physics classroom, Learning

Abstract

A revised version of the Constructivist Learning Environment Survey (CLES) has been developed for researchers who are interested in the constructivist reform of high school physics and mathematics. Constructivist theory and critical theory have been combined to create a powerful interpretive framework for examining science and mathematics teaching. The cognitive focus of the earlier instrument has been broadened by including a concern for the socio-cultural forces that shape the rationality of traditional physics and mathematics classrooms. The revised CLES is concerned with the extent of emphasis within a classroom environment on: (a) making physics and mathematics seem relevant to the world outside of school; (b) engaging students in reflective negotiations with each other; (c) teachers inviting students to share control of the design, constructivist, and evaluation of their learning; (d) students being empowered to express concern about the quality of teaching and learning activities; and (e) students experiencing the uncertain nature of scientific and mathematical knowledge. The revised CLES was trialled in an innovative empirically-oriented mathematics classroom. The results of the study, which combined statistical analyses and interpretive inquiry, confirmed the practical viability of the CLES and generated important insights into use of learning environment questionnaires in classrooms undergoing constructivist transformation (Taylor, Fraser, and White, 1994). The original version of the CLES was written on a theory of constructivism that underpins recent research in physics and mathematics education that is concerned with developing teaching approaches that facilitate students’ conceptual development (Tregust, Duit, & Fraser, 1996). This conceptual change research highlights: (1) the key role of students’ prior knowledge in their development of new conceptual understandings, especially the problematic role of students’ alternative conceptions; and (2) the reflective process of interpersonal negotiation of meaning within the consensual domain of the classroom community.
Science Classroom Learning Environment

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currently trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, teacher education and teacher assessment) (Taylor, Fraser & White, 1994).

Using students' perceptions to this study educational environments can be approached to studying science classroom environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991).

Science Learning Environment

In the past four decades, there are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos & Trickett 1987). Focused on contemporary classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currently trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, teacher education and teacher assessment) (Taylor, Fraser & White, 1994).

Selected the Classroom Learning Environment Instruments for this Study

The Constructive Learning Environment Survey (CLES)

The CLES (Taylor, Fraser, & White, 1994) was developed to assist researchers and teachers to assess the degree to which a particular classroom’s environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice. The CLES has 30 items with 5-response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation). According to the constructivist view, meaningful learning is a cognitive process in which individuals make sense of the world in relation to the knowledge which they already have constructed, and this sense-making process involves active negotiation and consensus building. The CLES developed to assist researchers and teachers to assess the degree to which a particular classroom’s environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice. The CLES has 30 items with 5-response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation).

The Test of Physics-Related Attitudes (TOBRA)

To investigate of associations between students’ perceptions of their physics laboratory classroom environment constructivist and their attitudes toward physics laboratory learning classes for upper secondary educational students at Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School, Roi-Et Province. This study modified the Test of Physics-Related Attitudes (TOBRA) from the original of the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981; Santiboon, 2011, 2013) of Thai
version was designed to measure eight distinct classroom-related attitudes among upper secondary educational students at upper secondary education in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School classes, Roi-Et Province. The eight items are suitable for group administration and all can be administered within the duration of a learning and physics classroom constructivist. Furthermore, TOBRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Research Objectives**

10. To assess and investigate of constructivist learning of student’s perceptions to their physics laboratory environment classes of the upper secondary educational students in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School, Roi-Et Province.

11. To compare between students’ perceptions of their actual and preferred physics laboratory environment classes of the upper secondary educational students in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School, Roi-Et Province.

12. To associate between students’ physics attitudes and their actual perceptions toward their physics laboratory environment classes for upper secondary educational students in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School, Roi-Et Province.

**Previous Researches on the CLES and TOBRA**

The purposes of this study were to validate an instrument to explore students’ preferences toward the assessing and investigating constructivist learning environments for physics classroom environments at the upper secondary educational classes. The instrument was customized and modified from the Constructivist Learning Environment Survey (CLES) questionnaire. Taylor, Fraser, & White (1994) reported of their study on an instrument for assessing and investigating the development constructivist learning environments of items in revised CLES scales. The five scales of the revised CLES were refined and reduced to seven items each. It included five components of constructivist learning: *Personal Relevance, Physics Uncertainty, Shared Control, Critical Voice* and *Student Negotiation*, the allocation of the 30 items is to the 5 scales.

These criticisms were responded to in Korea’s new sixth National Science Curriculum which tried to reduce the amount of content knowledge and give an added emphasis to students’ problem solving in everyday contexts. This is particularly so in General Science which was introduced as a compulsory subject for all high school students and reflects the constructivist view was assessed. Students are expected to learn about and understand basic scientific concepts through student-centered activities and negotiation. The content is organized in a way that relates it to actual, concrete problems encountered by students in daily life. The intention is to facilitate the students’ understanding of physics knowledge and the process of scientific inquiry (Han, 1995). However, other physics subjects, such as Physics, Chemistry, Physics, and Earth Science, have remained academically content oriented in Korea (Heui-Baik Kim, 2006).

**Steps on Assessing Students’ Perceptions with the CLES and TOBRA**

Using the CLES was follows as for assessing students’ perception of their actual form on the 11th week, and preferred form on the 14th week and the TOBRA on the 15th week for associating physics laboratory environment in physics laboratory constructivist classes for upper secondary educational students at Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School, Roi-Et Province.

Each scale of the CLES were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1, 2, 3, 4, 5, and 6; the second scale; Physics Uncertainty is composed the item of 7, 8, 9, 10, 11, and 12; the third scale; Critical Voice is composed the item of 13, 14, 15, 16, 17, and 18; the fourth scale, Shared Control is composed the item of 19, 20, 21, 22, 23; and 24; the fifth scale, Student Negotiation is composed the item of 25, 26, 27, 28, 29, and 30.

**Data Analysis**

Quantitative data were obtained using the two questionnaires (CLES and TOBRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual CLES scale to investigate whether students have significant different perceptions of their actual and preferred physics laboratory environment constructivist classes for upper secondary educational students at Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School Wat Sathong Municipal School.

**Sample**

This study is improved and developed physics laboratory environment constructivist classes for the upper secondary educational students in Srinakarindra the Princess Mother Smdej Roi-Et, Patronage of Her Royal
Highness Maha Chakri Sirindhorn School of their physics learning classroom environments with actual and preferred student’s perceptions with sample size of 142 physics laboratory environment students in 6 classes at Grade level 10-12, Roi-Et Province, Thailand.

Results

Validity and Reliability of Research Instrument

C. Validation of the CLES

Description of quantitative data of analyzing responses for Master of Physics teacher student’s assessments is reported in Table 1.

Table 1.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the CLES

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>Actual</td>
<td>22.37</td>
<td>3.72</td>
<td>0.43</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.21</td>
<td>4.20</td>
<td>0.47</td>
<td>0.69</td>
</tr>
<tr>
<td>Physics</td>
<td>Actual</td>
<td>18.96</td>
<td>3.16</td>
<td>0.32</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>24.87</td>
<td>4.14</td>
<td>0.39</td>
<td>0.62</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Actual</td>
<td>18.68</td>
<td>3.11</td>
<td>0.39</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>24.96</td>
<td>4.16</td>
<td>0.40</td>
<td>0.63</td>
</tr>
<tr>
<td>Critical View</td>
<td>Actual</td>
<td>18.75</td>
<td>3.12</td>
<td>0.26</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.78</td>
<td>4.29</td>
<td>0.40</td>
<td>0.63</td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>23.21</td>
<td>3.86</td>
<td>0.34</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>24.68</td>
<td>4.11</td>
<td>0.44</td>
<td>0.66</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five CLES scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 6 and 30, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the CLES. For the remaining five scales, namely; Personal Relevance, Physics Uncertainty, Critical View, Shared Control, Student Negotiation scales.

Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the CLES.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVAResults (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>Actual</td>
<td>0.84</td>
<td>0.86</td>
<td>2.33</td>
<td>5.24</td>
<td>0.04*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.90</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>Actual</td>
<td>0.91</td>
<td>0.84</td>
<td>2.04</td>
<td>8.74</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Actual</td>
<td>0.86</td>
<td>0.86</td>
<td>0.84</td>
<td>7.69</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical View</td>
<td>Actual</td>
<td>0.84</td>
<td>0.86</td>
<td>2.79</td>
<td>2.01</td>
<td>0.01**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>0.82</td>
<td>0.86</td>
<td>2.79</td>
<td>5.54</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version CLES used in this study was determined by calculating Cronbach alpha coefficient for the 30 items of the CLES using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the CLES, which ranged from 0.80 to 0.85 when using the students’ actual climate scores and from 0.87 to 0.93 when using the students’
preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the CLES, which suggests that each scale of the CLES was able to differentiate significantly \((p < 0.05)\) between students’ perceptions in environmental climates in the same school classes. The \(t\)-test statistic which is the ratio of "between" to "total" sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.79 to 7.71 for different scales, respectively.

**B. The Circumplex Nature of the CLES:**

To investigate the circumplex nature of the CLES correlations between the scales were calculated. The sample in Table is presented the results show that the correlations between a scale and the next scale.

Table 3.  
*Scale Intercorrelations for the CLES Using the Actual and Preferred Forms*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pr</th>
<th>Uc</th>
<th>Cv</th>
<th>Sc</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr</td>
<td>Actual Preferred</td>
<td>0.76**</td>
<td>0.71**</td>
<td>0.78**</td>
<td>0.84**</td>
</tr>
<tr>
<td>Uc</td>
<td>Actual Preferred</td>
<td>0.58**</td>
<td>0.89**</td>
<td>0.83**</td>
<td>0.80**</td>
</tr>
<tr>
<td>Cv</td>
<td>Actual Preferred</td>
<td>0.67**</td>
<td>0.81**</td>
<td>0.83**</td>
<td>0.80**</td>
</tr>
<tr>
<td>Sc</td>
<td>Actual Preferred</td>
<td>0.73**</td>
<td>0.63**</td>
<td>0.43**</td>
<td>0.54**</td>
</tr>
<tr>
<td>Sn</td>
<td>Actual Preferred</td>
<td>0.73**</td>
<td>0.80**</td>
<td>0.78**</td>
<td>0.86**</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
C. Factor loading Analysis of the CLES

The Actual and Preferred Forms of the CLES were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score. Table 4.

Factor Loading for Items in the Actual and Preferred Forms of the CLES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>0.88</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.85</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.74</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>0.72</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0.66</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>0.65</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>0.89</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>0.89</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>0.87</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>0.83</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>0.78</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>0.75</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>15</td>
<td>0.93</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>14</td>
<td>0.85</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>17</td>
<td>0.80</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.79</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>13</td>
<td>0.63</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>0.46</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>22</td>
<td></td>
<td></td>
<td>0.88</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td></td>
<td></td>
<td>0.87</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>20</td>
<td></td>
<td></td>
<td>0.82</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>19</td>
<td></td>
<td></td>
<td>0.77</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>23</td>
<td></td>
<td></td>
<td>0.72</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>24</td>
<td></td>
<td></td>
<td>0.66</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.88</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.86</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.68</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.66</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.64</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance

<table>
<thead>
<tr>
<th>Item</th>
<th>Act.</th>
<th>57.80</th>
<th>70.63</th>
<th>58.15</th>
<th>62.82</th>
<th>55.08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr</td>
<td>Pref.</td>
<td>67.05</td>
<td>60.18</td>
<td>57.57</td>
<td>73.20</td>
<td>65.19</td>
</tr>
</tbody>
</table>

Eigen value

<table>
<thead>
<tr>
<th>Item</th>
<th>Act.</th>
<th>3.46</th>
<th>4.23</th>
<th>3.48</th>
<th>3.77</th>
<th>3.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr</td>
<td>Pref.</td>
<td>4.02</td>
<td>3.61</td>
<td>3.45</td>
<td>4.39</td>
<td>3.91</td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 142 students.

D. Validation of the TOBRA

To measure physics laboratory environment classes assessing and investigating constructivists for upper secondary educational students at Grade 10 in Srinakarindra the Princess Mother Smdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School of their attitudes towards physics laboratory learning constructivist classes, the present study adapted the eight-item of the Test Of Physics-Related Attitude (TOBRA) (Fisher, Rickards, Goh, & Wong, 1997; Santiboon & Fisher, 2005; Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the TOBRA had a value of 0.81 which was considered satisfactory for further use in this study.

E. Comparisons between Student’s Perceptions of their Actual and Preferred Physics Laboratory Learning Environment Classes

Table 1 and 2 are comparing differences between the students’ perceptions of their actual and preferred physics laboratory constructivist environment classes for upper secondary educational students at Grade 10 in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn
Schoolenvironment classes show in Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Personal Relevance, Physics Uncertainty, Critical View, Shared Control, and Student Negotiation scales than students’ actual perceptions.

Figure 1. Significant differences between physics students’ perceptions of their actual and preferred scores on the CLES.

The results of this study also indicate that using the CLES helps physics laboratory environment constructivists’ classes for the upper secondary educational students in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School environment classes for physics teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the physics laboratory constructivist environment classes for the upper secondary educational students in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School environment constructivist’s classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the physics educational assessment and investigation of their classes.

F. Associations between Students’ Perceptions of Actual Physics Classroom Learning Constructivist’s Environments with the TOBRA

In this study, it was also considered important to investigate associations between physics laboratory environment classes for the upper secondary educational students in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School environment classes of their physics constructivist classroom learning environments with their attitude toward physics classes. The Cronbach alpha reliability of the selected the TOBRA was 0.81, when using individual student as the unit of analysis. This suggests that the TOBRA is reliable for measuring students’ attitudes in physics classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environments scales as a whole and the TOBRA that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their physics educational assessing and investigating constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Physics Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their physics laboratory constructivist classes. In the other hand, the sample correlation values (r) are reported which shows statistically significant correlations between students’ attitudinal outcomes and assessing and investigating their physics laboratory learning environment constructivist’s classroom environment on all scales of the Actual Form.
Table 5. Associations between CLES Scale and Attitude Scale to Physics Classroom Learning Constructivist Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Simple Correlation</th>
<th>Standard Regression Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>0.73***</td>
<td>0.76***</td>
</tr>
<tr>
<td>Physics Uncertainty</td>
<td>0.26**</td>
<td>0.28***</td>
</tr>
<tr>
<td>Critical View</td>
<td>0.36***</td>
<td>0.36***</td>
</tr>
<tr>
<td>Shared Control</td>
<td>0.31***</td>
<td>0.32***</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>0.32***</td>
<td>0.33***</td>
</tr>
</tbody>
</table>

Multiple Correlation (R) 0.6130***

R² 0.3758**

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

Conclusions

The actual and preferred perceptions of 142 physics laboratory environment constructivist’s students for the upper secondary education in 6 classes in Srinakarindra the Princess Mother Somdej Roi- Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School of their physics laboratory environment constructivist’s classes were measured with the CLES. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their physics laboratory environment constructivist’s classes. In generally, students’ perceptions of their preferred physics laboratory environment constructivist’s classes were to greater than what they actually perceive to be provided. The results of this study also indicate that using the CLES helps for assessing and investigating physics laboratory environment constructivist’s classes for the upper secondary educational students at Grade 10 in Srinakarindra the Princess Mother Somdej Roi- Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School of physics teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their physics classroom learning constructivist classes, with regard to the CLES, it was found that all of five scales were positively associated with students’ attitude to physics laboratory environment constructivist’s classes. The multiple correlation R is significant for the CLES and shows that when the scales are considered together there are significant associations with the TOBRA. The R² values indicate that 38%, with actual form of the variance in students’ attitudes to their physics laboratory environment constructivist’s classes were attributable to their perceptions of their physics laboratory classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their physics laboratory environment constructivist’s lessons.

Discussions and Implications

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Physics teacher could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate Constructive Learning Environment Survey (CLES). This instrument provides the information of students’ perceptions on actual and preferred physics laboratory environment constructivist’s classes. The information from this instrument could be used for improvement and effectiveness teaching in physics subject to their laboratory classroom learning constructivist.

As described in the results section, Upper Secondary Educational students at Srinakarindra the Princess Mother Somdej Roi- Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School classes show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the CLES questionnaire. Focusing on physics laboratory environment classes for upper secondary educational students in 6 classes in Srinakarindra the Princess Mother Somdej Roi- Et, Patronage of Her Royal Highness
Maha Chakri Sirindhorn School classes show relatively favorable perceptions of their physics laboratory environment constructivist’s lessons, with the higher score occurring for the whole prefer scales of the CLES. It seems that physics laboratory environment classes to assess and investigate constructivist lesson activities related to physics laboratory environment subject classes are operated rather as supplementary to theory classes rather than being independently important in their own right. Overall, this study replicated previous studies using the CLES, with the findings being consistent with the situation in assessing and investigating physics laboratory environment constructivist’s classes in Srinakarindra the Princess Mother Somdej Roi-Et, Patronage of Her Royal Highness Maha Chakri Sirindhorn School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from this school environment, responsibility.

References


**Psychological Environment Inventory in Science Laboratory Learning Classes for Lower Secondary Educational Students in Burabu Wittayakhan School**

Jeeraphon Sarabun¹, Wandee Rakrai², Sujitra Bunpasong³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
²Department of Science Education Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
³Science Learning Group, Borabu Wittayakhan School, Thailand

(*) author for correspondence, E-mail: toansakul35@yahoo.com.au; Fax: +6643713206)

**Abstract**

Using the 35-Items of Science Laboratory Environment Inventory (SLEI) was developed to examine students' perspectives about their earth science laboratory classes. The SLEI is in two parallel forms to examine of five scales: integration, rule clarity, student cohesiveness, open-endedness, and material environment and consists of 7 items for each scale, which are answered through a 5-Point Likert scale. This study was to describe student’s perceptions of their actual (assesses the class as it actually is) and preferred (asks the students what they would preferred their class to be like-the ideal situation) were assessed with a sample of 298 secondary educational students in 8 classes at Grade level 7-10 in Borabu Wittayakhan School. Associations between students’ perceptions and their attitudes toward their science were determined, and students’ attitudes were assessed with a short Thai version of the Test Of Science-Related Attitude for administrating research methodology. Statistically significant differences were found between students’ perceptions of their actual and preferred earth science environment toward their science also were found. Cronbach’s alpha reliability coefficients for the scales were adequate, and confirmatory factor analyzes provided support for the theoretical framework behind the questionnaire were omitted. The multiple correlations $R^2$ is significant for the SLEI and considered associations with the TOSRA, and value indicates that 44% of the variance in students’ attitude was also determined. This study showed that prefer students’ perception perceived their learning environment more favourably than actually. These differences in perceptions are presented and some implications for science laboratory teaching are provided.

**Keywords:** Education, Psychological, Science laboratory, Burabu Wittayakhan school

**Introduction**

Generally, researches on the classroom learning environment have spanned more than four decades with significant contributions to the field of education. Reviews of research (Fraser, 1986; Fraser, 1998; Fraser & Walberg, 1991; Haertel, Walberg & Haertel, 1981) reported that most of the studies on classroom learning environments used the perceptual measures approach to investigate the nature of classroom learning environments. This approach involved the use of classroom environment instruments to measure teachers’ and students’ perceptions of their classroom environments for investigating the nature of the classroom learning environment. These studies had developed many well-validated and robust classroom environment instruments for use in many countries in different classroom contexts (Fraser, B. J. (1998))².

Normally, science/laboratory teaching is one of the hallmarks of education in the sciences, but writers are questioning whether the great expense of maintaining and staffing laboratories is really justified, and whether many of the aims of laboratory teaching could be pursued more effectively and at less cost in non-laboratory settings. However, we know little about the effects of laboratory instruction on student learning and attitudes. In reviewing 16 recent studies, Gallagher (1987)³ concluded that “Laboratory work is an accepted part of science instruction. Given its important place in the education of youth, it is surprising that we know so little about its functioning and effects” was assessed (p. 351). New research will illuminate students’ views of laboratory settings and show the impact of laboratory classes on student outcomes.

The Science Laboratory Environment Inventory (SLEI) was developed to examine students’ perspectives about their science laboratory courses (Fraser et al., 1993)⁴. The SLEI is unique in that it comes in two parallel forms, one which addresses the current class, and one which addresses how they would prefer the class to be (Fraser et al., 1993). The SLEI examines five subscales: integration, rule clarity, student
cohesiveness, open-endedness, and material environment (Fraser et al., 1993)[4]. The SLEI consists of 7 items for each subscale, yielding 35 total items which are answered through a 5-Point Likert scale.

This research describes the development of a new instrument for assessing student perceptions of psychosocial environment in science laboratory classrooms, and reports comprehensive validation information for large samples of senior high school and university students from Mahawichanukul School, Mahasarakham in Thailand. The work is distinctive because it extends classroom environment research in non-laboratory settings to science laboratory classes, and provides one of the few classroom environment studies conducted in Thailand during the last decade.

The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Borabu Wittayakhan School at Grade 7-10 in Mahasarakham Province for demonstrating the reliability and validity of the Science Laboratory Environment Inventory (SLEI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Science-Related Attitude (TOSRA), the instruments need to be thoroughly analyzed psychometrically.

Science Education Classroom Learning Environment

Science education classroom learning environment of research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currents trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998)[2].

**Approaches to Studying Educational Environments**

To approach students’ perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991)[5].

**Historical Science Education Learning Environment Instruments**

In the four last decades, there are educational researchers (Fraser, B. J. & Walberg, H. J.(1991))[6], began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics Moos, R.H. (1974)[7]. Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos &Trickett 1984)[8]. The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Wubbels, T., Brekelmans, M. &Hooymayers, H. (1991))[9], literature reviews (Fraser B. J. & Fisher, D. L. (1983a))[10], and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fraser B. J. & Fisher, D. L. (1983a))[11].

Developing the contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974)[7], scheme for classifying human environments.
Differences between Student Perceptions of Actual and Preferred Environment

Research reviews on student perceptions of Actual and Preferred Environment were differentiated and reviewed. The previous two decades have witnessed considerable international interest in the conceptualization, measurement, and investigation of perceptions of psychosocial characteristics of learning environment in elementary, secondary, and higher education classrooms (Fraser, B. J. & Walberg, H. J. (Eds.). (1991)). Most recent classroom environment instruments have distinct versions measuring student perceptions of actual and preferred classroom environment. The preferred forms include goals and value orientations and preferred classroom environment. In the present study, parallel actual and preferred versions were developed and field-tested in six countries.

The most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. A typical item in the actual form of the Student Cohesiveness scale is: “Students in this laboratory class get along well as a group.” The wording of the preferred version is almost identical except for the use of such words as “would.” For example, the item “Our laboratory class has clear rules to guide student activities” in the actual version is reworded in the preferred version to read “Our laboratory class would have to clear student activities”

Using Instruments on Science Laboratory Environment Inventory (SLEI) Classes

Assessments of the Science Laboratory Environment Inventory of students’ or teachers’ perceptions of five dimensions of actual or preferred classroom environment, namely, Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment. The instrument was field-tested in Canada, Australia, the United States, England, Israel, and Nigeria, both in secondary and in post-secondary institutions. Various analyses attested to each scale’s internal consistency, reliability, discriminant validity, factorial validity, predictive validity, and ability to differentiate between the perceptions of students in different classes. The instrument is equally valid for use in its actual and preferred versions, for senior secondary school and university laboratory classes, for the individual or the class mean as the unit of analysis, and for each of the six countries.

The Test Of Science-Related Attitude (TOSRA)

To investigate of associations between Actual and Preferred students’ perceptions of their science laboratory environment classes in Mahawichanukul School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected for this study. Because the scale was intended to measure student’s in all School’s students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred students’ perceptions of their science laboratory environment classes. Furthermore, the TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Research Purposes

1. To assess student’s perceptions of their earth science laboratory environment classes at Grade 7-10 in 8 classes in Borabu Wittayakhan School, Maha Sarakham Province.
2. To compare between students’ perceptions of their actual and preferred earth science laboratory environment classes in 8 classes at Grade 7-10 level in Borabu Wittayakhan School, Maha Sarakham Province.
3. To associate student’s attitudes of their perceptions to their actual earth science laboratory environment classes in 8 classes at Grade 7-10 level in Borabu Wittayakhan School, Maha Sarakham Province.

Literature Review

Researches review on classroom environment instruments have served as sources of predictor and criterion variables in international studies in elementary and secondary schools. Student perceptions of actual classroom environment are consistently related to student cognitive and affective outcomes (Haertel, Walberg, 1981). For example, Fraser and Fisher’s (1982) study involving 116 Australian science classes established sizeable associations between several inquiry skills and science-related attitudes and classroom environment dimensions measured by the Classroom Environment Scale and the Individualized Classroom Environment Questionnaire. Furthermore, research on person-environment fit has shown that students achieve better in classroom environments they prefer (Fraser & Fisher, 1983).

Studies reviewed by Fraser (1981) and involving the actual form of scales as criterion variables have revealed that classroom psychosocial climate varies among different types of schools and between coeducational and single-sex schools. Both researchers and teachers have usefully employed classroom climate dimensions as criteria of effectiveness in curriculum evaluation because they differentiate revealingly between alternative curricula when student outcome measures show little sensitivity (Fraser, 1981). Research in several countries
(Fraser, 1981) compared students’ and teachers’ perceptions and found that, first, both students and teachers prefer a more positive classroom environment than they perceive as being actually present and, second, teachers perceive the classroom environment more positively than do their students in the same classrooms. In promising small scale practical applications, teachers have used assessments of their students’ perceptions of their actual and preferred classroom environment to identify and discuss actual-preferred discrepancies, followed by a systematic attempt to improve classrooms (Fraser & Fisher, 1981).

Aladejana (2007) reported of her study to determine how students assess the various components of their science laboratory environment. It also identified how the laboratory environment affects students’ learning outcomes. The modified ex-post facto design was used. A sample of 328 randomly selected students was taken from a population of all Senior Secondary School science students in a state in Nigeria, using Science Laboratory Environment Inventory (SLEI) designed and validated by Fraser et. al. (1993) was administered on the selected students. Findings revealed that students could assess the five components of the laboratory environment. Student cohesiveness has the highest assessment while material environment has the least. The results also showed that the five components of the science laboratory environment.

Santiboon (2012) reported the research described science student programs’ perceptions of their physics laboratory classroom learning environments in UdonThaniRajabhat University, Thailand. Associations between these perceptions and students’ attitudes toward physics laboratory were also determined. Using the 35-item Physics Laboratory Environment Inventory (PLEI), which was a modified from the original Science Laboratory Environment Inventory (SLEI) (Fraser, McRobbie, and Giddings, 1993) was assessed with the Actual and a Preferred Forms. Students’ attitudes were assessed with the Test Of Physics-Related Attitude (TOPRA) modified from the Test of Science-Related Attitude (TOSRA) (Fraser, 1981). The questionnaires administered to a sample of 577 students in 13 science and technological program classes. Statistically significant differences were found (p<0.001). The results also showed that the five components of the science laboratory environment.

The initial development of the new instrument, called the Science Laboratory Environment Inventory (SLEI), was guided by five criteria; (1) Consistency with the literature on laboratory teaching important in the unique environment of the science laboratory class (Hofstein&Lunetta). (2) Consistency with instruments for non-laboratory settings to guidance obtained by examining all scales settings (Fraser, 1981). (3) Coverage of Moos’ general categories that scales provided coverage of the three general categories of dimensions identified by Moos (1974). (4) Salience to teachers and students the secondary and university levels showed that SLEI’s dimensions and individual items were salient. (5) To achieve economy in terms of the time needed for answering and scoring, the SLEI had a relatively small number of reliable scales, each containing items.

Materials and Methods

Research Procedure

Using the SLEI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating science laboratory classroom learning environments in science classroom learning environment for secondary educational students at Grade 7 in 2 classes in Mahawichanukul School, MahaSarakham Province.

Each scale of the SLEI were composed with the 7-item, minimum scoring is 7 and maximum score is 35. The first scale, Student Cohesiveness is composed the item of 1, 6, 11, 16, 21, 26, 31; the second scale, Open-Endedness is composed the item of 2, 7, 12, 17, 22, 27, 32; the third scale, Integration is composed the item of 3, 8, 13, 18, 23, 28, 33; the fourth scale, Rule Clarity is composed the item of 4, 9, 14, 19, 24, 29, 34; and the fifth scale, Material Environment is composed the item of 5, 10, 15, 20, 25, 30, 35.

Data Analyses

The scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred SLEI forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the SLEI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the SLEI with students’ attitudes to associate were analyzed.

Sample

This study is improved and developed students’ science laboratory classroom environment with actual and preferred student’s perceptions with a sample size of 298 secondary educational students in 8 classes at Grade 7-10 in BorabuWittayakhan School, Mahasarakham Province, in the first semester in academic year 2015.
Results

Validity and Reliability of Research Instruments

This section reports typical validation data for selected classroom environment scales. Table 1, 2, and 3 provide a summary of a limited amount of statistical information for the SLEI and TOSRA instruments considered previously. Attention is restricted to the student actual form and to the use of the individual student as the unit of analysis. Table 2 provides information about each scale’s internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms (significance level and eta² statistic from ANOVAs).

A. Validation of the SLEI

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

The results given in Table 1 shows that on average item means for each of the five SLEI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 7 and 35, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the SLEI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the SLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Actual</td>
<td>29.31</td>
<td>4.19</td>
<td>0.43</td>
<td>0.19</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>preferred</td>
<td>30.63</td>
<td>4.38</td>
<td>0.47</td>
<td>0.22</td>
</tr>
<tr>
<td>Opened-</td>
<td>Actual</td>
<td>26.71</td>
<td>3.82</td>
<td>0.58</td>
<td>0.33</td>
</tr>
<tr>
<td>Endedness</td>
<td>preferred</td>
<td>27.94</td>
<td>3.99</td>
<td>0.56</td>
<td>0.31</td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>30.50</td>
<td>4.36</td>
<td>0.56</td>
<td>0.31</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>preferred</td>
<td>31.41</td>
<td>4.49</td>
<td>0.55</td>
<td>0.30</td>
</tr>
<tr>
<td>Material</td>
<td>Actual</td>
<td>27.69</td>
<td>3.96</td>
<td>0.57</td>
<td>0.33</td>
</tr>
<tr>
<td>Environment</td>
<td>preferred</td>
<td>29.47</td>
<td>4.20</td>
<td>0.49</td>
<td>0.24</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five SLEI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 7 and 35, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the SLEI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.
Table 2. Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the SLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach's alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results ($\eta^2$)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Actual</td>
<td>0.64</td>
<td>0.76</td>
<td>15.39</td>
<td>0.23</td>
<td>0.00***</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Preferred</td>
<td>0.70</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening-Endedness</td>
<td>Actual</td>
<td>0.69</td>
<td>0.68</td>
<td>8.49</td>
<td>0.18</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.73</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>0.81</td>
<td>0.65</td>
<td>2.51</td>
<td>0.12</td>
<td>0.04*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>0.62</td>
<td>0.70</td>
<td>21.74</td>
<td>0.26</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Actual</td>
<td>0.71</td>
<td>0.67</td>
<td>12.93</td>
<td>0.21</td>
<td>0.00***</td>
</tr>
<tr>
<td>Environment</td>
<td>Preferred</td>
<td>0.75</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version SLEI used in this study was determined by calculating Cronbach alpha coefficient for the 35 items of the SLEI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the SLEI, which ranged from 0.64 to 0.81 when using the students’ actual climate scores and from 0.70 to 0.85 when using the students’ preferred climate scores. The SLEI was able to differentiate significantly ($p<0.05$) between students’ perceptions in science laboratory environment. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 2.51 to 21.74 for different scales, respectively.

To investigate the circumplex nature of the SLEI, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

**B. The Circumplex Nature of the SLEI:**

To investigate the circumplex nature of the SLEI, correlations between the scales were calculated. The result is presented in Table 3. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 3. Scale Intercorrelations for the SLEI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>OE</th>
<th>In</th>
<th>RC</th>
<th>ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Actual</td>
<td>0.46**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening-Endedness</td>
<td>Actual</td>
<td>0.58**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>0.77**</td>
<td>0.47**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82**</td>
<td>0.47**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>0.74**</td>
<td>0.66**</td>
<td>0.69**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.74**</td>
<td>0.59**</td>
<td>0.65**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Actual</td>
<td>0.78**</td>
<td>0.62**</td>
<td>0.80**</td>
<td>0.79**</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Preferred</td>
<td>0.82**</td>
<td>0.68**</td>
<td>0.80**</td>
<td>0.73**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
**C. Factor Loading Analysis of the SLEI**

The Actual and Preferred Forms of the SLEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 4. Factor Loading for Items in the Actual Form of the SLEI

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>21</td>
<td>0.89</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>11</td>
<td>0.87</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>0.74</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>31</td>
<td>0.73</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>26</td>
<td>0.69</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>0.57</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.48</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>2</td>
<td>0.77</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>12</td>
<td>0.71</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>32</td>
<td>0.67</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>22</td>
<td>0.65</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>27</td>
<td>0.58</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.54</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>0.53</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>8</td>
<td>0.75</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>28</td>
<td>0.73</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.69</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.63</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>0.61</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>18</td>
<td>0.53</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>23</td>
<td>0.49</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>34</td>
<td></td>
<td></td>
<td>0.74</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>29</td>
<td></td>
<td></td>
<td>0.63</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>19</td>
<td></td>
<td></td>
<td>0.57</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td></td>
<td></td>
<td>0.54</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td>0.36</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.93</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.87</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.67</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.44</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.41</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.35</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**% of variance**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>38.63</td>
<td>46.99</td>
<td>32.78</td>
<td>25.15</td>
<td>32.81</td>
<td>41.58</td>
<td>34.66</td>
<td>28.56</td>
</tr>
<tr>
<td>OE</td>
<td>2.70</td>
<td>3.28</td>
<td>2.29</td>
<td>1.76</td>
<td>2.29</td>
<td>2.91</td>
<td>2.42</td>
<td>2.91</td>
</tr>
<tr>
<td>IN</td>
<td>3.24</td>
<td>1.59</td>
<td>2.91</td>
<td>1.99</td>
<td>2.91</td>
<td>1.99</td>
<td>2.55</td>
<td>2.91</td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 156 students.*

The Actual and Preferred Forms of the SLEI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the SLEI. Table 4 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
D. Validation of the TOSRA

To measure science students’ attitudes towards science laboratory classroom learning environment in science learning group, the present study adapted the eight-item Attitude Scale (Kijkosol & Fisher, 2005[20], Santiboon, 2010, 2011, 2012, 2013, 2014[17]), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981)[13]. Using internal consistency reliability the TOSRA had a value of 0.80 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the SLEI helps science laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the science laboratory classroom learning environment curriculum for the Mahawichanukul School students in science classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in science laboratory classroom learning environments.

---

**Figure 1.** Significant differences between science students’ perceptions of their actual and preferred scores on the SLEI.

**Associations between Students’ Perceptions of their Actual and Preferred Earth Science Laboratory Classroom Learning Environments toward their Attitude (TOSRA)**

In this study, it was also considered important to investigate associations between students’ perceptions of their science laboratory classroom learning environments with their attitude toward earth science laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOSRA was 0.77, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in science laboratory classes.
Table 5.
Associations between SLEI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regress Weigh Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td></td>
<td>0.17*</td>
<td>0.16*</td>
</tr>
<tr>
<td>Opened-Endedness</td>
<td></td>
<td>0.18*</td>
<td>0.19*</td>
</tr>
<tr>
<td>Integration</td>
<td></td>
<td>0.15*</td>
<td>0.15*</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td></td>
<td>0.25**</td>
<td>0.26**</td>
</tr>
<tr>
<td>Material Environment</td>
<td></td>
<td>0.24**</td>
<td>0.25**</td>
</tr>
<tr>
<td></td>
<td>Multiple Correlation (R)</td>
<td>0.6652**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R²</td>
<td>0.4436**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOSRA that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their science laboratory classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their science laboratory classroom learning environments on all scales of the Actual Form.

Conclusions and Discussion

Table 5 is compared to investigate associations between science students’ perceptions of their science laboratory classroom learning environments with their attitude toward science laboratory classes. Using the SLEI instrument in the higher education level, of 298 secondary educational students in 8 classes at Grade 7-10 in Borabu Wittayakhan School, Thailand, will help teachers to evaluate their learning environments in science laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the SLEI could be useful as the guide to enhance the effectiveness of science laboratory classes. The effectiveness in science laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of science laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 298 student of their science laboratory classroom learning environments were measured with the SLEI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their science laboratory classroom learning environments. In general, students’ perceptions of their preferred science laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the SLEI helps science teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science laboratory classroom learning environments with regard to the SLEI, it was found that all of five scales were positively associated with students’ attitude to science laboratory classroom learning environments. The multiple correlation R is significant for the SLEI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 44%, with actual form of the valiance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights (β) show that
in classes where the students perceived greater than all scales in their science laboratory classroom learning environments lessons.

Learning environment is an important aspect in education process. It not only influences the students' outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (SLEI). This instrument provides the information of students' perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science laboratory classroom learning environments.

Overall, this study replicated previous studies using the SLEI, with the findings being consistent with the situation in Borabu Wittayakhan School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the science laboratory classroom learning environments, interestingly.

The SLEI could be used as either a predictor or an outcome variable depending upon the research questions being asked. It may also be a useful evaluation tool. For example, if one was testing a new type of laboratory course, the SLEI could be used to see not only what students would prefer in the course, but also to see how they felt about the course after it was implemented.

Acknowledgements

Firstly, I would like to thank the students of 298 secondary educational students in 8 classes at Grade 7-10 in Borabu Wittayakhan School who were part of the study. Thank you to Dr. Waorawan Ubunlert, and Winai Suriyawho allowed students to complete the questionnaire.

Secondary, I would like to my fellow Master of Science students, Supanee Anengsupha to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Finally, mygreatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References

In order to facilitate physics laboratory classes use of classroom climate assessments, to develop and adapt economical short forms of the actual and preferred questionnaires of the 25 Items on 5 scales of the *My Class Inventory* (MCI) which is amenable to easy hand scoring was compared. Using this instrument was administered with a sample of 102 physics students in Burapha Pittayakharn Municipal School which supported each scale with internal consistency reliability, discriminant validity, and ability to differentiate between the actual and preferred perceptions of students. Actual students’ perceptions of their classes to their attitudes with a short the *Test Of Physics-Related Attitude* (TOPRA) that they were translated into Thai language for administrating research methodology was associated. Statistically significant differences were found between the students’ perceptions of actual and preferred physics classroom environment of their attitude to physics laboratory classroom learning management toward physics also were found. The factors were analyzed to appear to be affecting students’ perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients were adequate while confirmatory factor analyses provide support for the theoretical framework behind the questionnaire. The multiple correlations $R^2$ is significant for the MCI and considered associations with the TOPRA, and value indicates that 66% of the variance in students’ attitude was also determined, interestingly. These findings revealed that it has occurred students’ perceptions of their attitudes on actual and preferred dimensions on which change had been attempted of students’ achievement on their physics classroom learning environment inventory were improved.

**Keyword:** Actual forms, My Class Inventory (MCI), Secondary Educational, Burapha Pittayakharn Municipal School, Physics laboratory

### Introduction

Constructing the classroom learning environment more stimulating for students to improve their cognitive and affective outcomes is one of the major objectives of educators. The aspects of classroom learning environment such as satisfaction, friction, competitiveness, difficulty and cohesiveness are the most important variables which may be used for the prediction of the cognitive variables (e.g. stages of mental processing such as knowledge, comprehension, application, analysis, synthesis, & evaluation; and achievement) and evaluation of affective variables (e.g. self-esteem, attitudes, motivation, and satisfaction) (Wong, Young & Fraser, 1997). Classroom learning environments include several characteristics which influence socio-psychological growth, intellectual development and academic achievement of students (LaRocque, 2008). The classroom climate that is perceived as safe, friendly, warm, supportive and non-threatening has been reported to improve achievement, develop higher self-esteem, and promote more positive student attitudes toward their learning (Chionh & Fraser, 2009). It has been also argued by Fraser & Fisher (1982) and LaRocque (2008) that making the aspects of classroom environment more congruent with the perceptions favoured by students may improve learning outcomes of students.

The classroom learning environment research has spanned more than three decades with significant contributions to the field of education. Reviews of research (Fraser, 1986; Fraser, 1998; Fraser & Walberg, 1991; Haertel, Walberg & Haertel, 1981) reported that most of the studies on classroom learning environments used the perceptual measures approach to investigate the nature of classroom learning environments. This approach involved the use of classroom environment instruments to measure teachers’ and students’ perceptions of their classroom environments for investigating the nature of the classroom learning environment. These studies had developed many well-validated and robust classroom environment instruments for use in many countries in different classroom contexts (Fraser, 1998).
Focusing on the early 2001, the Ministry of Education began developing new national curricula in an endeavor to model the system of education on child, or student-centered learning methods. The years from 2001 to 2009 showed some of the greatest improvements in education, experiments had also been tried with restructuring the administrative regions for education or partly decentralizing the responsibility of education to real change and many attempts to establish a clear form inappropriate or mismatched syllabus in the schools that it should be followed as the Thai policy government. The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Burapha Pittayakharn Municipal School at Grade 10 in Roi-Et Province for demonstrating the reliability and validity of the My Class Inventory (MCI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Physics-Related Attitude (TOPRA), the instruments need to be thoroughly analyzed psychometrically.

Science Classroom Learning Environment

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers' use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currents trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998).

Approaches Classroom Learning Environments

Using students’ perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991).

Science Education Learning Environment

In the past three decades, There are educational researchers (Walberg & Moos, 2011) began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos & Trickett 1984). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley, 1990; von Saldern, 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).

Instruments for Assessing Classroom Environment

Focussed on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974) scheme for classifying human environments.
Selected Classroom Learning Environment Instrument for this Study

My Class Inventory (MCI)

The My Class Inventory (MCI) was the major instrument used in the present study (Abdul Majeed, Barry J. Fraser & Jill M. Aldridge, 2001). The initial development and validation of the Learning Environment Inventory (LEI) began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research).

Table 1

<table>
<thead>
<tr>
<th>Scale Description for the Individual Dimensions in the MCI</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>Extent of enjoyment of class work</td>
</tr>
<tr>
<td>Friction</td>
<td>Amount of tension and quarrelling among students</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Emphasis students competing with each other</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Extent to which students find difficulty with the work of the class.</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Extent to which students know, help and are friendly towards each other</td>
</tr>
</tbody>
</table>

The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O’Brien, 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study). The MCI differs in five important ways, in order to minimize fatigue among younger children, the MCI contains only five of the LEI’s original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI’s four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O’Brien (1985) developed a short 25-item version. Typical items are “Children are always fighting with each other” (Friction) and ”Most children can do their school work without help” (Difficulty).

To obtain a quick and easy assessment of their classroom environments, teachers can use the MCI. It satisfies two basic criteria (Fraser & Fisher, 1983a). First, the total number of items is small, thus providing economy in testing and scoring time. Because many teachers do not have ready access to computerized scoring methods, the MCI is suitable for easy hand scoring. Table 1 provides a scale description and sample item for the original form of the MCI.

The Test Of Physics-Related Attitude (TOPRA)

This study investigated associations between Actual and Preferred students’ perceptions of their physics laboratory environment classes in Burapha Pittayakharn Munipal School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected to the Test Of Physics-Related Attitude (TOPRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among physics laboratory environment classes in Burapha Pittayakharn Munipal School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their physics laboratory environment classes. Furthermore, the TOPRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Actual and Preferred Forms of the Research Instrument Scales

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example,
an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

Materials and Methods

Research Purposes
1. To assess student’s perceptions of their physics laboratory environment classes at Grade 10 in Burapha Pittayakharn Munipal School, Roi-Et Province.
2. To compare between student’s perception of their actual and preferred physics laboratory environment classes at Grade 10 in Burapha Pittayakharn Munipal School, Roi-Et Province.
3. To associate student’s attitudes of their perceptions to their actual physics laboratory environment classes at Grade 10 in Burapha Pittayakharn Munipal School, Roi-Et Province.

Research procedure
Using the MCI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOPRA on the 15th week for associating physics laboratory classroom learning environments in physics classroom learning environment for upper secondary educational students at Grade 10 in Burapha Pittayakharn Munipal School, Roi-Et Province.

Each scale of the MCI were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3, 8, 18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.

Data Analyses
Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistencies (alpha coefficients) were computed for each of the derived factors of the actual and preferred MCI forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the MCI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the MCI with students’ attitudes to associate were analyzed.

Sample
This study is improved and developed students’ physics laboratory classroom environment with actual and preferred student’s perceptions with a sample size 102 upper secondary educational students at Grade level 10 in 3 classes in Burapha Pittayakharn Munipal School, Mahasarakahm Province, in the second semester in academic year 2014.

Results

Validity and Reliability of Research Instruments
A. Validation of the MCI
Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 2.

Table 2.
<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>22.68</td>
<td>4.33</td>
<td>0.13</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.76</td>
<td>4.44</td>
<td>0.14</td>
<td>0.36</td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>22.21</td>
<td>4.45</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.23</td>
<td>4.49</td>
<td>0.13</td>
<td>0.32</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>22.71</td>
<td>4.58</td>
<td>0.21</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.94</td>
<td>4.63</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>21.55</td>
<td>4.31</td>
<td>0.22</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>21.77</td>
<td>4.38</td>
<td>0.23</td>
<td>0.46</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>22.33</td>
<td>4.47</td>
<td>0.13</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.53</td>
<td>4.55</td>
<td>0.13</td>
<td>0.35</td>
</tr>
</tbody>
</table>
The results given in Table 2 shows that on average item means for each of the five MCI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the MCI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.

The internal consistency reliability of the version MCI was determined by calculating Cronbach alpha coefficient for the 25 items using both actual and preferred environmental climates’ perceptions scores. Table 3 reports the internal consistency of the MCI, which ranged from 0.60 to 0.77 when using the students’ actual climate scores and from 0.70 to 0.83 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the MCI, which suggests that each scale of the MCI was able to differentiate significantly (p<0.05) between students’ perceptions in physics laboratory environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.81 to 13.92 for different scales, respectively.

Table 3.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>0.60</td>
<td>0.65</td>
<td>3.81</td>
<td>0.12</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.71</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.63</td>
<td>0.63</td>
<td>3.97</td>
<td>0.16</td>
<td>0.00**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>0.77</td>
<td>0.62</td>
<td>12.51</td>
<td>0.18</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.64</td>
<td>0.62</td>
<td>7.36</td>
<td>0.26</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.70</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>0.65</td>
<td>0.66</td>
<td>13.92</td>
<td>0.21</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.83</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)
C. Factor Loading Analysis of the MCI

The Actual and Preferred Forms of the MCI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 4. Factor Loading for Items in the Actual Form of the MCI.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>9</td>
<td>0.75</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>19</td>
<td>0.75</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td>0.61</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>24</td>
<td>0.03</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.22</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td></td>
<td></td>
<td>0.68</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>22</td>
<td></td>
<td></td>
<td>0.67</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td></td>
<td></td>
<td>0.62</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>12</td>
<td></td>
<td></td>
<td>0.61</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td></td>
<td></td>
<td>0.56</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.90</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.89</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.46</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.83</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70</td>
<td>0.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.46</td>
<td>0.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.42</td>
<td>0.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.88</td>
<td>0.85</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.76</td>
<td>0.83</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.79</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.64</td>
<td>0.76</td>
</tr>
<tr>
<td>11</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.54</td>
<td>0.67</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 156 students

B: The Circumplex Nature of the MCI:

To investigate the circumplex nature of the MCI, correlations between the scales were calculated. The sample in Table 4 is presented the results show that the correlations between a scale and the next scale.

Table 4. Scale Intercorrelations for the MCI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>CO</th>
<th>FR</th>
<th>DI</th>
<th>SA</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.61**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.58**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR</td>
<td>Actual</td>
<td>0.31*</td>
<td>0.60**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.41*</td>
<td>0.61**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI</td>
<td>Actual</td>
<td>0.97*</td>
<td>0.63**</td>
<td>0.41*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.45*</td>
<td>0.53**</td>
<td>0.51**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>Actual</td>
<td>0.41*</td>
<td>0.47**</td>
<td>0.51**</td>
<td>0.58**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76*</td>
<td>0.51**</td>
<td>0.42*</td>
<td>0.45*</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
D. Validation of the TOPRA

To measure physics students’ attitudes towards physics laboratory classroom learning environment in science learning group, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005, Santiboon & Fisher, 2005; Santiboon, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the TOPRA had a value of 0.78 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the MCI helps physics laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the physics laboratory classroom learning environment curriculum for the Burapha Pittayakharn Munipal School students in physics classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in physics laboratory classroom learning environments.

![Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the MIC.](image)

**Associations between Students’ Perceptions of their Actual and Preferred Physics Laboratory Classroom Learning Environments toward their Attitude (TOPRA)**

In this study, it was also considered important to investigate associations between students’ perceptions of their physics laboratory classroom learning environments with their attitude toward physics laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOPRA was 0.78, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in physics laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOPRA that’s reported in Table 6.

**Table 6.**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlation Attitude (r)</th>
<th>Standard Regress Weigh Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>0.48***</td>
<td></td>
<td>0.29***</td>
</tr>
<tr>
<td>Friction</td>
<td>0.27**</td>
<td></td>
<td>0.21**</td>
</tr>
<tr>
<td>Difficulty</td>
<td>0.24**</td>
<td></td>
<td>0.18**</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0.29**</td>
<td></td>
<td>0.22**</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>0.24**</td>
<td></td>
<td>0.19**</td>
</tr>
</tbody>
</table>

**Multiple Correlation (R)**

| Multiple Correlation (R) | 0.8139*** |

| R²            | 0.6624**   |

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)
In Table 6, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values ($r$) are reported which show statistically significant correlations ($p<0.05$) between students attitudinal outcomes and their physics laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their physics laboratory classes. In the other hand, the sample correlation values ($r$) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their physics laboratory classroom learning environments on all scales of the Actual Form.

**Conclusions and Discussions**

Table 6 is compared to investigate associations between physics students’ perceptions of their physics laboratory classroom learning environments with their attitude toward physics laboratory classes. Using the MCI instrument in the higher education level, Burapha Pittayakharn Munipal School, Thailand, will help teachers to evaluate their learning environments in physics laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the MCI could be useful as the guide to enhance the effectiveness of physics laboratory classes. The effectiveness in physics laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of physics laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 102 student of their physics laboratory classroom learning environments were measured with the MCI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their physics laboratory classroom learning environments. In general, students’ perceptions of their preferred physics laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the MCI helps physics teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their physics laboratory classroom learning environments with regard to the MCI, it was found that all of five scales were positively associated with students’ attitude to physics laboratory classroom learning environments. The multiple correlation $R$ is significant for the MCI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 56%, with actual form of the variance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights ($\beta$) show that in classes where the students perceived greater than all scales in their physics laboratory classroom learning environments lessons.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (MCI). This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in physics laboratory classroom learning environments.

Overall, this study replicated previous studies using the MCI, with the findings being consistent with the situation in Burapha Pittayakharn Munipal School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the physics laboratory classroom learning environments, interestingly.

**Acknowledgements**

I am heartily thankful to my supervisors; Assist. Prof. Dr. Toansakul Santiboon and Dr. Panwilai Chomchid of Master of Science of Education Program, Faculty of Education, Burapha Pittayakharn Munipal School, whose encouragement, guidance and support instruments and computing system for analysis of this research. I am grateful to my trainer teacher, who is Kru Wiyada Srichomsang, to be supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Burapha Pittayakharn Munipal School.
References


What is Happening in Biology Classroom Learning Environments at Grade Level 10 in Thakhonyang Pittayakom School?

Titima Panyong¹, Panwilai Chomchit², Watchana Yardniyom³ and Toansakul Santiboon¹*¹

¹Department of Master of Science Education Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 4400
²Department of Chemistry Program Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 4400
³Science Learning Group Section, Thakhonyang Pittayakom School, Maha Sarakham

(‘author for correspondence, E-mail: Toansakul35@yahoo.com)

Abstract

This study utilized the What Is Happening In this Class (WIHIC) questionnaire (original modified by Fraser, Fisher, and McRobbie 1996, 2004) to examine factors that influence biology student perceptions of their learning environment. Data were collected from 102 upper secondary educational school biology students in 3 classes at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province, Thailand. Several background variables were included in the study to investigate their effects on actual and preferred students’ perceptions of their biology classroom learning environments was also selected, and using the Test Of Biology-Related Attitude (TOBRA) (adapted version from the original modified of the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981) was associated. A hierarchical analysis of variance was conducted to investigate separate and joint effects of these variables, such as; Factor Loading Analysis, Cronbach Alpha Reliability, One-way ANOVA (eta²), Simple and Multiple Correlations. Results from this study indicate that all scales of the WIHIC are more inclined to measure personal or idiosyncratic features of student perceptions of their learning environment whereas contains preferred form more variance than at the actual class form. Also, it was found that different variables affect different scale scores. A variable that consistently affected students’ perceptions, regardless of the element of interest in the learning environment was student’s learning achievements. The factors were analyzed to appear to be affecting student perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients for the scales were adequate (0.84-0.96), while confirmatory factor analyses provided to support for the theoretical framework behind the questionnaire (0.39-0.94 omitted). Associations between students’ perceptions and their attitudes toward their actual biology classroom learning environments were determined. The multiple correlations R² is significant for the WIHIC and considered associations with the TOBRA, and value indicates that 34% of the variance in students’ attitude was also developed. Based on findings, speaking preferred classroom learning perceived their learning environment more positively than did actual form of biology learning environment classes are achieved.

Keyword: Biology classroom, Learning, Student perception, Thakhonyang Pittayakom school

Introduction

Generally, it has been suggested that at the end of secondary schooling, a student will have spent as much as 15,000 hours in school (Fraser, 1989). Most of their time is spent interacting among themselves as well as with their teachers. Besides, they use a variety of tools and information resources in their pursuit of learning activities in the classroom. The classroom can indeed be considered a miniature society, which consists of individual students with varying interests, diverse backgrounds and wide-ranging personalities. One class may be quiet and passive, but another can be noisy and active. The nature of the classroom environment and psychosocial interactions can make a difference in how the students learn and achieve their goals. In over two past decades, the study of the classroom learning environment has been gaining momentum and making significant contributions to the improvement of teaching and learning.

In the past four decades, there are educational researchers (Walberg and Moos, 2011) began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Biology (Walberg & Anderson 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979, Moos &Trickett 1987). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books
(Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley 1990; von Saldern 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (e.g., Fisher 1994).

While the above mentioned learning environment research instrument contributed to a better understanding of the socio-psychological climate of the classrooms, some researchers felt that there was a need for a single instrument which incorporated some of the best features of the instruments previously constructed. Based on past studies, Fraser, Fisher, and McRobbie (1996) developed a new learning environmental instrument named What Is Happening In This Class? (WIHIC), which incorporate scales have been used and proven to be significant predictors of learning outcomes. They also included additional scales which were designed to measure current concerns in the classrooms, such as equity issues.

Since its development, the WIHIC has been used to measure the psychosocial aspects of the classroom learning environment in various contexts. In some research, the questionnaire has been used without any modification, and in others the questionnaire was adapted to suit a specific context. To date the original questionnaire in English has been translated into the Chinese language for use with Chinese medium students in Taiwan and Singapore, and the Korean language for use in Korea.

The science classroom learning researches were developed and explored to study in terms of cultural differences was highlighted and it appears that the education system in Taiwan is examination-driven and teaching styles are adopted to suit this particular situation. It was found that in Taiwan the most important element of being a good teacher was perceived as having good content knowledge, but in Australia, having good interpersonal relations between teacher and students may be considered the most important element in the education process. Taiwanese classrooms offer a teacher-centred lesson in which students appear to play a passive role and there were only few opportunities to discuss or question. This study suggests that the WIHIC questionnaire was able to differentiate between cultural differences and therefore maybe suitable for cross-cultural studies.

The What is Happening in this Class (WIHIC) questionnaire, adapted by Adolphe (2002) from the earlier version developed by Fraser, Fisher and McRobbie (1996), was used to measure students’ perceptions of their classroom environment. The five possible responses were: Almost Never; Never; Sometimes; Often; and Almost Always. The 56-Item questionnaire contained the following eight scales with seven items. The purpose of this study will be to investigate the background of the study of learning environment and to introduce a recently developed questionnaire called What is Happening in This Class? (WIHIC), that it will be used in education system in Thailand. The questionnaire will be designed to measure students’ perception of their biology classroom environment in upper secondary education various school classes.

Research Purposes
13. To assess student’s perceptions of their biology laboratory classroom learning environment for upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.
14. To compare between students’ perceptions of their actual and preferred biology laboratory classroom learning environment for upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.
15. To associate between students’ biology laboratory attitudes and their actual perceptions toward their biology laboratory classroom learning environment for upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.

Literature Review
Smith and Ezeife (2010) studied in Canada to determine if there was a statistically significant relationship between students’ perceptions of the classroom environment and their attitudes toward science in grade nine applied science. The following research question guided the study. What is the strength of the relationship between students’ perceptions of their classroom environment and their attitudes to science in grade nine applied science classrooms?

Perry den Brok (2006) utilized the What Is Happening In This Class (WIHIC) questionnaire to examine factors that influence Californian student perceptions of their learning environment. Data were collected from 665 USA middle school science students in 11 Californian schools. Several background variables were included in the study to investigate their effects on students’ perceptions, such as student and teacher gender, student ethnic background and socio-economic status (SES), and student age. Class and school variables, such as class ethnic composition, class size and school socio-economic status were also collected. A hierarchical analysis of variance was conducted to investigate separate and joint effects of these variables. Results from this study indicate that some scales of the WIHIC are more inclined to measure personal or idiosyncratic features of student perceptions of their learning environment whereas other scales contain more variance at the class level.

Also, it was found that different variables affect different scale scores. A variable that consistently affected students' perceptions, regardless of the element of interest in the learning environment was student gender. Generally speaking girls perceived their learning environment more positively than did boys.
Dorman (2003) reported of the using The What Is happening In this Class? (WIHIC) questionnaire was validated cross-nationally with a sample of 3,980 high school students in Australia, the UK and Canada. Confirmatory factor analysis supported the seven-scale a priori structure of the instrument. Fit statistics indicated a good fit of the model to the data. While all items loaded strongly on their a priori factor, model fit indices revealed the degree of scale overlap of the whole instrument scales. The use of multi-sample analyses within structural equation modeling substantiated invariant factor structures for three grouping variables: country, grade level and student gender. This study supported the wide international applicability of the WIHIC as a valid measure of classroom psychosocial environment.

Khine (2001) studied in field of the What Is happening In this Class? (WIHIC) and reported for using the WIHIC Questionnaire to Measure the Learning Environment in high school in Singapore. The questionnaire is usually administered in a class which typically consists of 20-30 students, rather than to a large group. The students are asked to provide their responses on a five-point Likert scale of Almost Never, Seldom, Sometimes, Often and Almost Always. The students answer how often they perceive a classroom practice occurring in these respective dimensions. The total score for a particular scale is simply the sum of the circled numbers for the eight items belonging to that scale. Omitted or incorrectly answered items are given a score of 3. The higher the scale score, the more a classroom practice occurs in that dimension.

Chionh and Fraser (1998) used Actual and Preferred forms of WIHIC to further validate the instrument and to investigate associations between the actual classroom environment and the outcomes of examination scores, self-esteem and attitudes. The questionnaire was administered to 2,310 students from 75 randomly selected grade 10 geography and mathematics classes in Singapore. The alpha reliability of the scales in the instrument was found to be from 0.88 to 0.97. The study revealed that better examination scores were found in geography and mathematics classrooms where students perceived the environment as being more cohesive. It was also found that self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity.

Khoo and Fraser (1997) used a modified version of the WIHIC to measure classroom environment in adult computer courses in Singapore. When the questionnaire was introduced to 250 working adults, it was found that scale alpha reliabilities ranged from 0.77 to 0.92. In investigating the differential effectiveness of computer courses for each gender, they found that males perceived significantly greater Involvement and Trainer Support. On the other hand, females perceived significantly higher levels of Equity in the computer classroom environment. In addition, it was found that older females have more positive perceptions than younger females in this context.

Methodology

Background of Differences between Student Perceptions of their Actual and Preferred Environments

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow.'

Selected Classroom Learning Environment Instrument Research

The What Is Happening In this Class (WIHIC) Questionnaire

The original 90-item nine-scale version was refined by both statistical analysis of data from 355 junior high school science students their questionnaire responses (Fraser, Fisher & McRobbie 1996). Only 54 items in seven scales survived these procedures, although this set of items was expanded to 80 items in eight scales for the field testing of the second version of the WIHIC. This led to a final form of the WIHIC containing the seven eight-item scales. The WIHIC has been used successfully in its original form or in modified form in studies involving 250 adult learners in Singapore (Khoo & Fraser 1997) and 2,310 high school students in Singapore (Chionh & Fraser 1998).

The Test of Biology-Related Attitudes (TOBRA)

To investigate of associations between students’ perceptions of their science classroom environment constructivist and their attitudes toward science learning classes for lower secondary educational students at Grade 10 in Thakhonyang Pittayakom School. This study adapted version the Test of Biology-Related Attitudes (TOBRA) that modified from the original of the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981; Santiboon, 2011, 2013) was designed to measure eight distinct classroom-related attitudes among upper secondary educational students. The eight items are suitable for group administration and all can be
administered within the duration of learning in biology laboratory environment science. Furthermore, TOBRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Steps on Assessing Students’ Perceptions with the WIHIC and TOBRA

Using the WIHIC was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOBRA on the 15th week for associating science classroom learning environments in science classroom learning environment monitoring constructivists for upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.

Each scale of the WIHIC were composed with the 8-item, minimum score is 8 and maximum score is 56 items. The first scale, Student Cohesiveness is composed the item of 1, 2, 3, 4, 5, 6, 7, 8; The second scale, Teacher Support is composed the item of 9, 10, 11, 12, 13, 14, 15, 16; The third scale, Involvement is composed the item of 17, 18, 19, 20, 21, 22, 23, 24; The fourth scale, Investigation is composed the item of 25, 26, 27, 28, 29, 30, 31, 32; The fifth scale, Task Orientation of 33, 34, 35, 36, 37, 38, 39, 40; The sixth scale, Cooperation of 41, 42, 43, 44, 45, 46, 47, 48; The seventh scale, Equity of 49, 50, 51, 52, 53, 54, 55, 56.

Data Analysis

Quantitative data were obtained using the two questionnaires (WIHIC and TOBRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. Assuming that the scaling of the items approximated a 5-point Likert scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred WIHIC Forms and the TOBRA. Factorial validity and adequacy of fit for the dimensionality of the WIHIC were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their biology laboratory learning environment classes for the Actual Form of the WIHIC with students’ attitudes to associate were analyzed.

Sample

This study is improved and developed biology laboratory classroom learning environment for upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School classes of their biology laboratory learning classroom environments to actual and preferred student’s perceptions with sample size of 102 students in 3 classes at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.

Results

Validity and Reliability of Research Instrument

B. Validity and Reliability of WIHIC

Description of quantitative data of analyzing responses for eleventh-grade biology students of Thakhonyang Pittayakom School assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the WIHIC

<table>
<thead>
<tr>
<th>Scale</th>
<th>From</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>33.88</td>
<td>4.23</td>
<td>0.15</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.47</td>
<td>5.21</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>32.13</td>
<td>4.02</td>
<td>0.22</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>34.38</td>
<td>4.91</td>
<td>0.38</td>
<td>0.62</td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>30.44</td>
<td>3.80</td>
<td>0.29</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>34.19</td>
<td>4.88</td>
<td>0.38</td>
<td>0.62</td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>30.41</td>
<td>3.80</td>
<td>0.17</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>34.53</td>
<td>4.93</td>
<td>0.31</td>
<td>0.56</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>32.31</td>
<td>4.04</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>33.06</td>
<td>4.72</td>
<td>0.21</td>
<td>0.46</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>30.75</td>
<td>3.84</td>
<td>0.23</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>31.81</td>
<td>4.54</td>
<td>0.32</td>
<td>0.56</td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>32.47</td>
<td>4.06</td>
<td>0.25</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.88</td>
<td>5.13</td>
<td>0.37</td>
<td>0.61</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the seven WIHIC scales, that they contain eight items, so that the minimum and maximum score possible on each of these scales is 7 and
56 items, respectively. Because of this difference in the number of items in the seven scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the WIHIC For the remaining all of seven scales.

Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the WIHIC.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>0.69</td>
<td>0.72</td>
<td>5.29***</td>
<td>0.37***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>0.74</td>
<td>0.72</td>
<td>2.40***</td>
<td>0.34***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>0.78</td>
<td>0.71</td>
<td>2.42***</td>
<td>0.35***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>0.60</td>
<td>0.75</td>
<td>2.44***</td>
<td>0.43***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>0.71</td>
<td>0.73</td>
<td>2.17***</td>
<td>0.40***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.80</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>0.72</td>
<td>0.72</td>
<td>2.60***</td>
<td>0.34***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>0.83</td>
<td>0.71</td>
<td>2.22***</td>
<td>0.45***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.93</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version WIHIC used in this study was determined by calculating Cronbach alpha coefficient for the 56 items of the WIHIC using both actual and preferred environmental climates’ perceptions scores. Table III reports the internal consistency of the WIHIC, which ranged from 0.69 to 0.83 when using the students’ actual climate scores and from 0.80 to 0.93 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the WIHIC, which suggests that each scale of the WIHIC was able to differentiate significantly (p<0.001). The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 2.17 to 5.29 for different scales, respectively.

B. The Circumplex Nature of the WIHIC:
To investigate the circumplex nature of the WIHIC correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale.
Table 3.
Scale Intercorelations for the WIHIC Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>TS</th>
<th>IV</th>
<th>IN</th>
<th>TO</th>
<th>CO</th>
<th>EQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>Actual</td>
<td>0.51**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.71**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>Actual</td>
<td>0.41**</td>
<td>0.67**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82***</td>
<td>0.89***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Actual</td>
<td>0.57**</td>
<td>0.58**</td>
<td>0.53**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75**</td>
<td>0.79**</td>
<td>0.78**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Actual</td>
<td>0.53**</td>
<td>0.72**</td>
<td>0.69**</td>
<td>0.62**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.73***</td>
<td>0.93***</td>
<td>0.93***</td>
<td>0.84***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TO</td>
<td>Actual</td>
<td>0.53**</td>
<td>0.79**</td>
<td>0.71**</td>
<td>0.53*</td>
<td>0.73**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.93**</td>
<td>0.82***</td>
<td>0.91***</td>
<td>0.79**</td>
<td>0.87***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.36*</td>
<td>0.69**</td>
<td>0.50**</td>
<td>0.59**</td>
<td>0.76**</td>
<td>0.66**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86**</td>
<td>0.73**</td>
<td>0.73**</td>
<td>0.75**</td>
<td>0.86***</td>
<td>0.82**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

To investigate the circumplex nature of the WIHIC, correlations between the scales were calculated. The result is presented in Table 3. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

C. Factor Loading Analysis of the WIHIC
The Actual and Preferred Forms of the WIHIC were subjected to separate principal components factor analyses (with varimax rotation) involving the individual students’ score. The Actual Form of the WIHIC was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the WIHIC. Table 4 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
Table 4. 
**Factor Loading for Items in the Actual Form of the WIHIC**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2</td>
<td>0.79</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.78</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>0.77</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.75</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.75</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.65</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.62</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.30</td>
<td>0.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>0.71</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>14</td>
<td>0.66</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>19</td>
<td>0.59</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>15</td>
<td>0.55</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>0.47</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>11</td>
<td>0.43</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>16</td>
<td>0.42</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>0.35</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>0.80</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>24</td>
<td>0.89</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>28</td>
<td>0.83</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>19</td>
<td>0.82</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>22</td>
<td>0.72</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>20</td>
<td>0.65</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>21</td>
<td>0.61</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>17</td>
<td>0.38</td>
<td>0.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>31</td>
<td>0.81</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>32</td>
<td>0.79</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>27</td>
<td>0.76</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>28</td>
<td>0.69</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>29</td>
<td>0.65</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>30</td>
<td>0.64</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>26</td>
<td>0.62</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>0.52</td>
<td>0.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>34</td>
<td>0.60</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>35</td>
<td>0.61</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>38</td>
<td>0.72</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>33</td>
<td>0.55</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>38</td>
<td>0.47</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>37</td>
<td>0.49</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>39</td>
<td>0.42</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>36</td>
<td>0.54</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>48</td>
<td>0.77</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>41</td>
<td>0.75</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>43</td>
<td>0.73</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>47</td>
<td>0.72</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>45</td>
<td>0.68</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>46</td>
<td>0.63</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>44</td>
<td>0.62</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>47</td>
<td>0.50</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>50</td>
<td>0.87</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>51</td>
<td>0.77</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>56</td>
<td>0.71</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>49</td>
<td>0.62</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>55</td>
<td>0.56</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>53</td>
<td>0.56</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>52</td>
<td>0.55</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>54</td>
<td>0.53</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 102 students*

**D. Validation of the Test Of Biology-Related Attitude (TOBRA)**

To measure biology students’ attitudes towards biology laboratory classroom learning environment subject, the present study adapted the eight-item of the TOBRA (Santiboon & Fisher, 2005; Santiboon, 2011, 2013, 2014).
Using internal consistency reliability the Attitude Scale had a value of 0.87 which was considered satisfactory for further use in this study.

**Comparisons between Student’s Perceptions of their Actual and Preferred Science Education Constructivist Class**

On comparing differences between the students’ perceptions of their actual and preferred Science Classroom Managements Class environment in Table 5 and Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Student Cohesiveness, Teacher, Involvement, Investigation, Task Orientation, Cooperation, and Equity scales than student’s actual perceptions.

The results of this study also indicate that using the WIHIC helps science educational management instructors to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the science educational management curriculum for the eleventh-grade biology students from Thakhonyang Pittayakom School management environment. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the eleventh-grade biology students from Thakhonyang Pittayakom School classes.

![Figure 1](image_url)

**Figure 1.** Significant differences between science students’ perceptions of their actual and preferred scores on the WIHIC.

**Associations between Students’ Perceptions of Actual Science Classroom Learning Educational Constructivist Environments with the TOBRA**

In this study, it was also considered important to investigate associations between science classroom learning environment constructivists for eleventh-grade biology students from Thakhonyang Pittayakom School environment classes of their science constructivist classroom learning environment with their attitude toward science. The Cronbach alpha reliability of the selected the TOBRA was 0.87, when using individual student as the unit of analysis. This suggests that the TOBRA is reliable for measuring students’ attitudes in science classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOSRA that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations ($p<0.05$) between students attitudinal outcomes and their science educational constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Science Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their science educational constructivist class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their classroom environment on all scales of the Actual Form.
Table 5.
Associations between WIHIC Scale and Attitude Scale to Biology Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From</th>
<th>Std. Regress. Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.26*</td>
<td>0.24*</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>0.41**</td>
<td>0.42**</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.21*</td>
<td>0.22*</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.20*</td>
<td>0.35**</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.26*</td>
<td>0.22*</td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.22*</td>
<td>0.24*</td>
</tr>
<tr>
<td>Equity</td>
<td>0.34 **</td>
<td>0.35**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.5865**</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.3440**</td>
<td></td>
</tr>
</tbody>
</table>

The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between students’ perceptions on each scale of the ICEQ and their attitudes towards physics laboratory classes when the effect of relationships between the scales is controlled. The multiple correlation $R$ is significant for Actual Forms of the ICEQ and shows that when the scales are considered together there is a significant ($p<0.01$) association with the TOPRA. The $R^2$ value indicates that 48% of the variance in teacher’s attitude to their school administration environment was attributable to their perceptions of their physics teachers. The beta weights (β) show that in physics laboratory environments where the teachers perceived management a more favorable attitude towards their physics laboratory environments.

CONCLUSIONS

The actual and preferred perceptions of 102 students of their biology classroom environment in Thakhonyang Pittayakom School were measured with the WIHIC. The comparisons of the Actual Form with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their biology management class. In general, students’ perceptions of their preferred classroom in biology management class to be greater than what they actually perceive to be provided. The results of this study also indicate that using the WIHIC helps Thakhonyang Pittayakom School teachers or lecturers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their biology management classes, with regard to the WIHIC, it was found that all of seven scales were positively associated with students’ attitude to science management class. The multiple correlation $R$ is significant for the WIHIC and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 48%, with actual form of the variance in students’ attitudes to their science management class was attributable to their perceptions of their science management classroom environment. The beta weights (β) show that in class where the students perceived greater than all scales in their science management learning classroom.

DISCUSSIONS AND IMPLICATIONS

Learning environment is an important aspect in education process. It is not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments What Is Happening In This Class (WIHIC) Questionnaire. This instrument provides the information of students’ perceptions on actual and preferred science educational management learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science educational management course.

Overall, this study replicated previous studies using the WIHIC, with the findings being consistent with the situation in Thakhonyang Pittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the Thakhonyang Pittayakom School, Mahasarakham Province in Thailand, interestingly.
ACKNOWLEDGMENT

Firstly, I would like to thank the 100 science students in Wapipathum school at the Grade level who understood and never
throughout this study always encouraged. Without his
development

Santiboon, T. (201)


REFERENCES


Students’ Perceptions of their Science Classroom Environments and their Attitudes Toward Science at Grade Level 7 in Wapiaputhum School

Natnaree Jaramrum¹, Wandee Rakrai², Chompoo Satchawanich³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
²Department of Science Education Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 4400
³Science Learning Group Section, Wapiaputhum School, Maha Sarakham

(*author for correspondence. E-mail: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

The purposes of this study were to determine students’ perceptions of their actual and preferred classroom environments and their attitudes toward science classes with a sample size of 100 students in 2 classes at Grade level 7 in Wapiaputhum School, Mahasarakham, Thailand. The 56-Items of What is Happening in this Class (WIHIC) questionnaire in 7 scales, adapted from the earlier version developed by Fraser, Fisher and McRobbie (1996), was used to measure students’ perceptions of their actual and preferred classroom environment. Using the Test of Science-Related Attitudes (TOSRA) was associated to measure the attitudes of students toward science. The TOSRA uses a Likert Scale and is divided into containing 8 items. Results of the correlation analysis indicated a positive correlation at the 0.01 level and the highest significant correlation was measured and this occurred between the all scales of the WIHIC and the TOSRA. The eight scales identified of the WIHIC showed a positive correlation with the TOSRA and yielded the greatest number of significant correlations and was chosen for multiple regression analysis. Associations between students’ perceptions of their attitudes toward their science classes were chosen as the dependent variable and was compared to the summary of the model and the correlation coefficient $R^2 = 0.5162$. The significant relationship noted between the WIHIC and the classroom environment measures of TOSRA should also be of interest to educators. In order to encourage the development of scientific attitudes, teachers should make sure appropriate controls are established for these classroom environmental factors.

Keyword: Wapiaputhum School, Science Classroom, Learning, Student perception

Introduction

Generally, it has been suggested that at the end of secondary schooling, a student will have spent as much as 15,000 hours in school (Fraser, 1989)[3]. Most of their time is spent interacting among themselves as well as with their teachers. Besides, they use a variety of tools and information resources in their pursuit of learning activities in the classroom. The classroom can indeed be considered a miniature society, which consists of individual students with varying interests, diverse backgrounds and wide-ranging personalities. One class may be quiet and passive, but another can be noisy and active. The nature of the classroom environment and psychosocial interactions can make a difference in how the students learn and achieve their goals. In over two past decades, the study of the classroom learning environment has been gaining momentum and making significant contributions to the improvement of teaching and learning.

In the past four decades, there are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Science (Walberg & Anderson, 1968)[4]. Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979[5]) and Trickett 1987). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986[6], Fraser & Walberg 1991[7], Moos 1979[5], Walberg 1979[8]), literature reviews (Fraser, 1994)[9] and monographs sponsored by the American Educational Research Association’s Special Interest Group (SIG) on the Study of Learning Environments.

While the above mentioned learning environment research instrument contributed to a better understanding of the socio-psychological climate of the classrooms, some researchers felt that there was a need for a single instrument which incorporated some of the best features of the instruments previously constructed. Based on past studies, Fraser, Fisher, and McRobbie (1996)[11] developed a new learning
environmental instrument named What Is Happening In This Class? (WIHIC), which incorporate scales have been used and proven to be significant predictors of learning outcomes. They also included additional scales which were designed to measure current concerns in the classrooms, such as equity issues.

Since its development, the WIHIC has been used to measure the psychosocial aspects of the classroom learning environment in various contexts. In some research, the questionnaire has been used without any modification, and in others the questionnaire was adapted to suit a specific context. To date the original questionnaire in English has been translated into the Chinese language for use with Chinese medium students in Taiwan and Singapore, and the Korean language for use in Korea.

The science classroom learning researches were developed and explored to study in terms of cultural differences was highlighted and it appears that the education system in Taiwan is examination-driven and teaching styles are adopted to suit this particular situation. It was found that in Taiwan the most important element of being a good teacher was perceived as having good content knowledge, but in Australia, having good interpersonal relations between teacher and students may be considered the most important element in the education process. Taiwanese classrooms offer a teacher-centered lesson in which students appear to play a passive role and there were only few opportunities to discuss or question. This study suggests that the WIHIC questionnaire was able to differentiate between cultural differences and therefore maybe suitable for cross-cultural studies.

Associations between perceptions of learning environment and attitudinal outcomes were reported by Hunus and Fraser (1997) when they used a modified version of WIHIC for 644 students in Year 10 chemistry classes in Brunei. In their study, reliability coefficients of 0.75 to 0.89 were found and simple and multiple correlation analyses show that there was a significant relationship between the set of environment scales and students’ attitudes towards chemistry theory classes. Using the individual student as the unit of analysis, Student Cohesiveness, Teacher Support, Involvement, and Task Orientation scales were found to be positively associated with the students’ attitudes. The results further suggested that students perceived moderately positive learning environments in chemistry theory classes in terms of Student Cohesiveness, Teacher Support, Involvement and Investigation. A highly positive environment on Task Orientation and Cooperation was also detected in the chemistry classrooms. However, the students in Brunei perceived that they had relatively little autonomy and independence in their classes.

The What is Happening in this Class (WIHIC) questionnaire, adapted from the earlier version developed by Fraser, Fisher and McRobbie (1996)[11], was used to measure students’ perceptions of their classroom environment. The five possible responses were: Almost Never; Never; Sometimes; Often; and Almost Always. The 56-Item questionnaire contained the following eight scales with seven items. The purpose of this study will be to investigate the background of the study of learning environment and to introduce a recently developed questionnaire called What is Happening in This Class? (WIHIC), that it will be used in education system in Thailand. The questionnaire will be designed to measure students’ perception of their science classroom environment in lower secondary education various school classes.

Research purposes
1. To assess student’s perceptions of their science classroom learning environment for lower secondary educational students at Grade level 7 in Wapiopathum School, Mahasarakham Province.
2. To compare between students’ perceptions of their actual and preferred science classroom learning environment for lower secondary educational students at Grade level 7 in Wapiopathum School, Mahasarakham Province.
3. To associate between students’ science attitudes and their actual perceptions toward their science classroom learning environment for lower secondary educational students at Grade level 7 in Wapiopathum School, Mahasarakham Province.

Literature Reviews
Smith and Ezeife (2010)[10] studied in Canada to determine if there was a statistically significant relationship between students’ perceptions of the classroom environment and their attitudes toward science in grade nine applied science. The following research question guided the study. What is the strength of the relationship between students’ perceptions of their classroom environment and their attitudes to science in grade nine applied science classrooms?

Perry den Brok (2006)[11] utilized the What Is Happening In this Class (WIHIC) questionnaire to examine factors that influence Californian student perceptions of their learning environment. Data were collected from 665 USA middle school science students in 11 Californian schools. Several background variables were included in the study to investigate their effects on students’ perceptions, such as student and teacher gender, student ethnic background and socio-economic status (SES), and student age. Class and school variables, such as class ethnic composition, class size and school socio-economic status were also collected. A hierarchical analysis of variance was conducted to investigate separate and joint effects of these variables.
Results from this study indicate that some scales of the WIHIC are more inclined to measure personal or idiosyncratic features of student perceptions of their learning environment whereas other scales contain more variance at the class level. Also, it was found that different variables affect different scale scores. A variable that consistently affected students’ perceptions, regardless of the element of interest in the learning environment was student gender. Generally speaking girls perceived their learning environment more positively than did boys.

Dorman (2003)[12] reported of the using The What Is happening In this Class? (WIHIC) questionnaire was validated cross-nationally with a sample of 3,980 high school students in Australia, the UK and Canada. Confirmatory factor analysis supported the seven-scale a priori structure of the instrument. Fit statistics indicated a good fit of the model to the data. While all items loaded strongly on their a priori factor, model fit indices revealed the degree of scale overlap of the whole instrument scales. The use of multi-sample analyses within structural equation modeling substantiated invariance factor structures for three grouping variables: country, grade level and student gender. This study supported the wide international applicability of the WIHIC as a valid measure of classroom psychosocial environment.

Khine (2001) studied in field of the What Is happening In this Class? (WIHIC) and reported for using the WIHIC Questionnaire to Measure the Learning Environment in high school in Singapore. The questionnaire is usually administered in a class which typically consists of 20-30 students, rather than to a large group. The students are asked to provide their responses on a five-point Likert scale of Almost Never, Seldom, Sometimes, Often and Almost Always. The students answer how often they perceive a classroom practice occurring in these respective dimensions. The total score for a particular scale is simply the sum of the circled numbers for the eight items belonging to that scale. Omitted or incorrectly answered items are given a score of 3. The higher the scale score, the more a classroom practice occurs in that dimension.

Chionh and Fraser (1998)[13] used Actual and Preferred forms of WIHIC to further validate the instrument and to investigate associations between the actual classroom environment and the outcomes of examination scores, self-esteem and attitudes. The questionnaire was administered to 2,310 students from 75 randomly selected Grade level 9 geography and mathematics classes in Singapore. The alpha reliability of the scales in the instrument was found to be from 0.88 to 0.97. The study revealed that better examination scores were found in geography and mathematics classrooms where students perceived the environment as being more cohesive. It was also found that self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity.

Khoo and Fraser (1997)[14] used a modified version of the WIHIC to measure classroom environment in adult computer courses in Singapore. When the questionnaire was introduced to 250 working adults, it was found that scale alpha reliabilities ranged from 0.77 to 0.92. In investigating the differential effectiveness of computer courses for each gender, they found that males perceived significantly greater Involvement and Trainer Support. On the other hand, females perceived significantly higher levels of Equity in the computer classroom environment. In addition, it was found that older males have more positive perceptions than younger females in this context. Student Perceptions of their Actual and Preferred Environments

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as There is a clear set of rules for students to follow' would be changed in the preferred form to There would be a clear set of rules for students to follow.

**Classroom Learning Environment Instrument for this Research Study**

The What Is Happening In This Class (WIHIC) Questionnaire

The original 90-item nine-scale version was refined by both statistical analysis of data from 355 junior high school science students their questionnaire responses (Fraser, Fisher & McRobbie 1996)[15]. Only 54 items in seven scales survived these procedures, although this set of items was expanded to 80 items in eight scales for the field testing of the second version of the WIHIC. This led to a final form of the WIHIC containing the seven eight-item scales. The WIHIC has been used successfully in its original form or in modified form in studies involving 250 adult learners in Singapore (Khoo & Fraser 1997)[14] and 2,310 high school students in Singapore (Chionh & Fraser 1998)[13].

**The Test of Science-Related Attitudes (TOSRA)**

To investigate of associations between students’ perceptions of their science classroom environment constructivist and their attitudes toward science learning classes for lower secondary educational students at Grade level 9 in Wapipatum School. This study modified from the original of the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981[15]; Santiboon, 2011[15], 2013[16], 2014[17]) was designed to measure eight distinct classroom-related attitudes among lower secondary educational students. The eight items are suitable for
group administration and all can be administered within the duration of learning in science classroom environment. Furthermore, TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Materials and Methods

Assessing Students’ Perceptions with the WIHIC and TOSRA

Using the WIHIC was followed as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating science classroom learning environments in science classroom learning environment monitoring constructivists for lower secondary educational students at Grade level 7 in Wapipathum School, Mahasarakham Province.

Each scale of the WIHIC were composed with the 8-item, minimum score is 8 and maximum score is 56 items. The first scale, Student Cohesiveness is composed the item of 1, 2, 3, 4, 5, 6, 7, 8; The second scale, Teacher Support is composed the item of 9, 10, 11, 12, 13, 14, 15, 16; The third scale, Involvement is composed the item of 17, 18, 19, 20, 21, 22, 23, 24; The fourth scale, Investigation is composed the item of 25, 26, 27, 28, 29, 30, 31, 32; The fifth scale, Task Orientation 33, 34, 35, 36, 37, 38, 39, 40: The sixth scale, Cooperation of 41, 42, 43, 44, 45, 46, 47, 48; The seventh scale, Equity of 49, 50, 51, 52, 53, 54, 55, 56.

Data Analysis

To validate actual and preferred versions of the WIHIC questionnaire for use in this study, statistical analyses in terms of factor structure, internal consistency reliability (Cronbach coefficient alpha) and discriminant validity (mean correlation of a scale with the other four scales as a convenient index) were calculated. For both actual and preferred forms of WIHIC, principal components factor analysis was used to find out whether the a priori allocation of CLEI items to the five scales was justified. For the purpose of this study, only factor loadings greater than 0.30 were omitted.

A series of analyses of variance (ANOVA) was performed on the student data obtained for the actual and preferred of the WIHIC to investigate the sensitivity of each scale to different meteorology laboratory environments. Students within the same class should perceive it relatively similarly, but the mean within-class perceptions should vary from class to class. This characteristic was examined for each scale of the WIHIC using a one-way analysis of variance, with class membership as the main effect and using the individual as a unit of analysis. The eta² statistic provides an estimate of the proportion of the variance in WIHIC scores explained by class membership.

Sample

This study is improved and developed meteorology science classroom learning environment for lower secondary educational students at Grade level 7 in Wapipathum School classes of their science learning classroom environments to actual and preferred student’s perceptions with sample size of 100 students in 2 classes at Grade level 7 in Wapipathum School, Mahasarakham Province.

Results

Validity and Reliability of Research Instrument

Administration of the WIHIC questionnaire followed by quantitative method with 100 students showed that many students have perceptions from the perspective of the class as a whole that differ from their perceptions of their personal role within the classroom. Underlying many of the responses was the idea that, because the individual student is only part of the class, interactions with an individual student (Personal form) are less frequent than the interactions with the class as a whole (Class form). Further discussion of the distinction between Personal and Class forms can be found in this study.
**Validity and Reliability of WIHIC**

Description of quantitative data of analyzing responses for eleventh-grade science students of Wapipatum School assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the WIHIC

<table>
<thead>
<tr>
<th>Scale</th>
<th>From</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>32.56</td>
<td>4.07</td>
<td>0.25</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.09</td>
<td>4.38</td>
<td>0.35</td>
<td>0.59</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>29.16</td>
<td>3.64</td>
<td>0.41</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>32.88</td>
<td>4.11</td>
<td>0.52</td>
<td>0.72</td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>27.81</td>
<td>3.48</td>
<td>0.38</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.28</td>
<td>4.41</td>
<td>0.29</td>
<td>0.53</td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>32.22</td>
<td>4.03</td>
<td>0.22</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.44</td>
<td>4.43</td>
<td>0.21</td>
<td>0.46</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>32.37</td>
<td>4.04</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.84</td>
<td>4.48</td>
<td>0.22</td>
<td>0.47</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>31.78</td>
<td>3.97</td>
<td>0.35</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.56</td>
<td>4.44</td>
<td>0.29</td>
<td>0.54</td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>30.97</td>
<td>3.87</td>
<td>0.47</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>34.66</td>
<td>4.33</td>
<td>0.42</td>
<td>0.64</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the seven WIHIC scales, that they contain eight items, so that the minimum and maximum score possible on each of these scales is from 8 to 40, respectively.

Table 2 reports typical validation data for selected classroom environment scales. Table 2 provides a summary of a limited amount of statistical information for the WIHIC research instrument that it’s considered previously. Attention is restricted to the student actual form and to the use of the individual student as the unit of analysis. Table 2 provides information about each scale’s internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms. The internal consistency reliability of the version WIHIC used in this study was determined by calculating Cronbach alpha coefficient for the 56 items of the WIHIC using both actual and preferred environmental climates’ perceptions scores.

Table 2. Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the WIHIC.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results((\eta^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>0.88</td>
<td>0.89</td>
<td>2.23*</td>
<td>0.78*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.94</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>0.88</td>
<td>0.89</td>
<td>4.25***</td>
<td>0.61***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>0.90</td>
<td>0.89</td>
<td>9.33***</td>
<td>0.65***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>0.84</td>
<td>0.90</td>
<td>4.23***</td>
<td>0.58***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>0.89</td>
<td>0.89</td>
<td>5.26***</td>
<td>0.68***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.90</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>0.91</td>
<td>0.89</td>
<td>4.62***</td>
<td>0.56***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.93</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>0.94</td>
<td>0.88</td>
<td>3.45**</td>
<td>0.62**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.96</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
To investigate the circumplex nature of the WIHIC correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale. Table 3.

**B. The Circumplex Nature of the WIHIC**

To investigate the circumplex nature of the WIHIC, correlations between the scales were calculated. The results show that the correlations between a scale and the next scale.

Table 3.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>TS</th>
<th>IV</th>
<th>IN</th>
<th>TO</th>
<th>CO</th>
<th>EQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>Actual</td>
<td>0.47**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>Actual</td>
<td>0.43*</td>
<td>0.79**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.97**</td>
<td>0.79**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Actual</td>
<td>0.96**</td>
<td>0.55**</td>
<td>0.47**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86**</td>
<td>0.77**</td>
<td>0.86**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Actual</td>
<td>0.60**</td>
<td>0.55**</td>
<td>0.55**</td>
<td>0.68**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.87**</td>
<td>0.76**</td>
<td>0.87**</td>
<td>0.99**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TO</td>
<td>Actual</td>
<td>0.72**</td>
<td>0.63**</td>
<td>0.62**</td>
<td>0.71*</td>
<td>0.80**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82**</td>
<td>0.70**</td>
<td>0.75**</td>
<td>0.83**</td>
<td>0.84**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.47**</td>
<td>0.59**</td>
<td>0.67**</td>
<td>0.53*</td>
<td>0.74**</td>
<td>0.86**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75**</td>
<td>0.63**</td>
<td>0.72**</td>
<td>0.59**</td>
<td>0.61**</td>
<td>0.63**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

To investigate the circumplex nature of the WIHIC, correlations between the scales were calculated. The result is presented in Table 3. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

**C. Factor Loading Analysis of the WIHIC**

The Actual Form of the WIHIC was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the WIHIC. Table 4 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
Table 4.
Factor Loading for Items in the Actual Form of the WIHIC

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.88</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.86</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.84</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.76</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.64</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.63</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.57</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.54</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.86</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.81</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>0.77</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.76</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.64</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.60</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.58</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.57</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0.82</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0.81</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.81</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>0.78</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>0.74</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>0.73</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>0.69</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.44</td>
<td>0.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>0.80</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0.77</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>0.75</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0.74</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>0.64</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>0.57</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.56</td>
<td>0.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>0.29</td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>0.77</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>0.67</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td></td>
<td></td>
<td>0.63</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>0.62</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td></td>
<td>0.62</td>
<td>0.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td></td>
<td></td>
<td>0.89</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>0.89</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td></td>
<td>0.85</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td></td>
<td></td>
<td>0.84</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>0.73</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td></td>
<td></td>
<td>0.71</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td></td>
<td></td>
<td>0.68</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td></td>
<td>0.57</td>
<td>0.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.65</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.57</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance
- Act.: 57.74
- Pref.: 57.74

Eigen value
- Act.: 4.62
- Pref.: 4.62

*Loading smaller than 0.30 omitted. The sample consisted of 100 students

D. Validation of the Test Of Science-Related Attitude (TOSRA)

To measure science students’ attitudes towards science classroom learning environment subject, the present study adapted the eight-item of the TOSRA (Santiboon& Fisher, 2005[18]; Santiboon, 2011[15], 2013[16].
Using internal consistency reliability the Attitude Scale had a value of 0.85 which was considered satisfactory for further use in this study.

**Comparisons between Student’s Perceptions of their Actual and Preferred Science Laboratory Classes**

On comparing differences between the students’ perceptions of their actual and preferred Science Classroom Managements Class environment in Table 5 and Figure 1, it was found that students’ preferred perceptions an environment with lower levels of Student Cohesiveness, Teacher, Involvement, Investigation, Task Orientation, Cooperation, and Equity scales than student’s actual perceptions.

![Figure 1](image_url)

*Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the WIHIC.*

The results of this study also indicate that using the WIHIC helps science educational management instructors to gain a better picture of the learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the science educational management curriculum for the seventh-grade science students from Wapiopathum School environment. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the seventh-grade science students from Wapiopathum School classes.

**Associations between Students’ Perceptions of Actual Meteorology Science Classroom Learning Environments with the TOSRA**

In this study, it was also considered important to investigate associations between science classroom learning environment constructivists for seventh-grade science students from Wapiopathum School environment classes of their science classroom learning environment with their attitude toward science. The Cronbach alpha reliability of the selected the TOSRA was 0.84, when using individual student as the unit of analysis. This suggests that the TOSRA is reliable for measuring students’ attitudes in science classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOSRA that it’s reported in Table 5.
Table 5.
Associations between WIHIC Scale and Attitude Scale to Science Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From</th>
<th>Std. Regress. Weight Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.21</td>
<td>0.22**</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>0.19</td>
<td>0.20**</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.37</td>
<td>0.40**</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.20</td>
<td>0.21**</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.29</td>
<td>0.30**</td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.25</td>
<td>0.26**</td>
</tr>
<tr>
<td>Equity</td>
<td>0.18</td>
<td>0.19*</td>
</tr>
<tr>
<td><strong>Multiple Correlation (R)</strong></td>
<td>0.7185**</td>
<td></td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.5162**</td>
<td></td>
</tr>
</tbody>
</table>

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science educational classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater of Student Cohesiveness, Teacher, Involvement, Investigation, Task Orientation, Cooperation, and Equity environments there was a more favourable attitude towards their science educational constructivist class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their classroom environment on all scales of the Actual Form. The multiple correlations R² is significant for the WIHIC and considered association with the TOSRA, and value indicates that 52% of the variance in students’ attitudes was also determined.

Conclusions and Discussion

Conclusions

The actual and preferred perceptions of 100 students of their Science classroom environment in Wapipathum School were measured with the WIHIC. The comparisons of the Actual Form with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their science management class. In general, students’ perceptions of their preferred classroom in science management class to be greater than what they actually perceive to be provided. The results of this study also indicate that using the WIHIC helps Wapipathum School teachers or lecturers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science management class, with regard to the WIHIC, it was found that all of seven scales were positively associated with students’ attitude to science management class. The multiple correlation R is significant for the WIHIC and shows that when the scales are considered together there are significant associations with the Attitude Scale. The R² values indicate that 51%, with actual form of the variance in students’ attitudes to their science management class was attributable to their perceptions of their science management classroom environment. The beta weights (β) show that in class where the students perceived greater than all scales in their science management learning classroom.

Discussion

Learning environment is an important aspect in education process. It is not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments What Is Happening In This Class (WIHIC) Questionnaire. This instrument provides the information of students’ perceptions on actual and preferred science educational management learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science educational management course.

Overall, this study replicated previous studies using the WIHIC, with the findings being consistent with the situation in Wapipatum School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the Master of Science teacher students of Wapipathum School, responsibility.
ACKNOWLEDGMENT

Firstly, I would like to thank the 100 science students in Wapipathum School at the Grade level 7 who were part of the study. Thank you to the Mr. Phisit Wannasri, Mrs. Laksamee Muangkla and Ms. Chompoon Satchawanich who allowed students to complete the questionnaire.

Secondary, I would like to my fellow Master of Science students, Atipong Phukaokaew to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


The Important Role of the World Miraculous Characters in Vietnamese Fairy Tales for Teaching Folklore Literature at Schools

Nguyen Thi Dung

Department of Inspect, University of Labour and Social, 43 - Tran Duy Hung street, Trung Hào ward, Cau Giay district, Ha Noi city, Vietnam.
E-mail: dungcamg@yahoo.com; Tel: 0904578405

Abstract

The characters miraculous world (CMW) in Vietnamese fairy tales expresses our ancestor’s original imagination. Using the miraculous characters (MC), fairy tales have a new advance in form and content of expression. At this time, the folklore literature in educational programme is very little in high school and university. Therefore, this thesis would be presented a new technique for approaching study the fairy tales of MC. The CMW was going on approaching to research interestingly, namely; the folk literature has been related particularly of the CMW and writing literature, and the relationship between the folk literature and the interdisciplinary science were also related. This research procedure was well done on management of the CMW of the passion was offered, suggestions that the cultural folk tales ought to build up and be able to discover at the well-looking local cultures and communities in Vietnam by the development and self-minding desirable learning sustainable outcomes from previous generation to modernization in the globalization era, continually. Exactly, teaching literature must be reformed on a modernization of thinking, fundamental values, and management the folk literatures to adapt and improve them for daily life of students in high school sustainable forever. Elderly people who are the folk wisdoms of fairy tales must be communicated to transfer their material wisdoms to students with the CMW were studies, administering with the CMW program in this study was deeply development of the fantasy literatures meanwhile the significantly teaching system in Vietnam’s education. Vietnamese who are able to have satisfaction of their folk wisdoms those relationships between the world of MC in Vietnamese fairy-tales and writing art of the fairy-tales.

Keywords: Characters, Miraculous, World, Fairy tales, Art conception

Introduction

Fairy tales, the world of miraculous characters (CMW) in Vietnamese expresses our ancestor’s original imagination. Using the miraculous characters (MC), fairy-tales have a new advance in form and content of expression. The CMW has become a method of thinking, and an original artistic vehicle of the ancestor in reflecting and expanding abilities controlling the reality “in imagination and by imagining”.

Controlling the reality with the CMW not only gets the reality lively and fascinatingly but also makes the MC having an original trait. Therefore, the values of the MC expresses in various ways are too high qualities, such as: the value of awareness, the value of education, and the value of aesthetics. Roles and functions of MC presented in three main dimensions that they compose with to assist folklore writers to create ideal characters, MC is symbol of morality and MC the art means for highlighting noble qualification of other characters. At the same situation presenting the art perception of ancient people on environment and people were devoted. The opinion of artists of the world, people as a main factor of an artistic whole, it’s a CMW which affects this as a whole characteristic.

A special MC reflected modality in imagination as a spirit, an interesting symbol and a special interference. The transference of MC is the cause of the beginning and impacting on the whole structure, events system of tales. (Many) The whole specific, outstanding features of the origin and function that are not seen and revealed that in the characters of the normal tales on the MC are found.

At this time, the folklore literature of educational programme at high school and university is very little. Therefore, this manuscript would present a new way for approaching to study the fairy-tale’s MC. CMW opens the approach to research, teaching folk literature particularly CMW in the relationship between folk literature with writing literature; the relationship between folk literature and the interdisciplinary science (culture study, ethnology, psychoanalysis etc...). Besides, doing research on CMW offers us the passion because, thanks to that world be able to discover the depth of cultural beauty that old generation wished to convey. Along with the reform of teaching literature in new way of thinking, the thesis selection and find a proper direction, stimulate the reader
to feel deeply and fully the fundamental values, see the many new and useful things so far in life as well as to learn folk literature.

Through the study about CMW of old people by fairy-tales materials, myth, magic (MC, fairy-tales space-time etc...), we would like to say about its deep influence on the development of CMW in the fantasy literature; This thesis not only has a real significance of teaching in education but also influence really on relationship between the world of MC in Vietnamese fairy-tales and writing art of the fairy-tales (such as content, characters, time and space, method etc…). MC play an important role, which are foundation to build the structural outlines and contents of tales, indicating the unique art of elaborating fairy-tales (such as content, characters, time and space, method…). MC has contributed to further study an aspect of poetics of the folklore, particularly the poetics of fairy-tales.

Purpose of manuscript: Survey the overall of the fairy-tales of the people of Vietnam who have MC to determine the number of stories of the ethnic minorities, the ratio and frequency of MC in the story, etc…making CMW in Vietnam fairy tales. On that basis, to understand art concepts and methods reflect the human world and folk authors.

New contributions of the manuscript: Initially built the theoretical framework includes a number of terms, the concept of the virtual world characters. Explore the art building's fairy tale folk authors via MC. If the research is completed, it would meet the political task, meet the tasks of improving the capacity and scope of scientific research, supporting the objectives for teaching in schools etc...

Materials And Methods

We have applied the methods such as: statistical methods, literature review; comparative method; systematical approach; analytical method; synthetic method; interdisciplinary approach to deploy the topic

Results

1 - Identifying Some Certain Terms, Concepts Related to CMW

In this article: The CMW in the fairy-tales of Vietnam ethnic groups, there are a few concepts that we need to clarify including: fairy-tales factors, CMW...

- Concept of fairy-tales factors:
  Fairy-tales factors are the result of the fiction in the light of fantasy and imagination of the people. In fairy-tales, including some fairy-tales factors: Fairy-tales factors (he is Buddha, he (she) Fairy, the Emperor, gods, witches, goblins...are those who participate into the stories as sub-characters, which are to cause beneficial or harmful effects on the main character of the story), objects or fantasy objects, fantasy animal, the variable fantasy objects [4, pg.104].

- Concept of CMW:
  This is the most important concept, acquiring the main goal that we want to establish the classification theory of CMW.
  CMW is the whole MC system in fairy-tales built in the author's imagination. In particular, MC is regarded as a special method to reflect the artistic conception of the world, human by old authors [3].
  CMW can be understood as follows:
  CMW includes all types of MC and related relationships (the opposite relationship; compare and contrast relationships; supporting relations etc...). MWC include the entire MC system like gods, evils, Buddhism, Buddha
  CMW appearing in the magical fairy-tales story is to perform some certain function, plays a certain role. Most of social problems and the social trends thought that they are resolved directly or indirectly by the MC.

2 – Types of MC

Normally, the minority groups of people in Vietnam read and refer all the miraculous fairy-tales have referenced to the MC. On this basis, we selected of 250 miraculous fairy-tales from 32 ethnic groups which have the most typical type of MC to act as main surveyed purposes. These MCs created to separate the believable and admirable religion of the world. The CMW consists of Gods, Fairy, Buddha, Gods, devil, witch, Dragon King, King of Ocean.... In this system, we divided into three different groups as follows:

+ Group of MC belongs to heaven (God, God family members, daughter of God, innumerable army of God, Troi, Then, Giang, etc...).
+ Group of MC belong to the palace of the river (Dragon King, King of River, princess of River King etc...).

508
+ Group of MC belongs to the earth: person with magical skills. These MC count lowest percentage in the another of MC.

In generally, there are similar sorts of MC but each people, each language – ethnology has its own expression. However, each type of MC has the same characteristic, action, and destiny, which grow in a general trend with the fairy-tales’ rules: Good over evil, justice triumphs over Injustice. All fairy-tales have a happy ending (good characters live happily forever). Through this happy ending, we realize that the human kindness, optimist behaviour and justice expecting are the most basic point of Vietnamese people. Also, they are a foundation that built a general aesthetic value for Vietnamese fairy-tales.

3 – The characters miraculous world in the art conception and the art of elaborating fairy – tales

The important role of the CMW fairy - tale Vietnam for teaching folklore at schools are best represented through a system of artistic conception that the ancients wanted to reflect about the world, human and fairy art building. It is not only profound influence Folk Literature on poetics, but also the "substance" is written literature, fantasy literature inheritance.

3.1 – The characters miraculous world - the art concept on the world and people

Through the CMW, folklorists presented a very new and profound art concept about the world and people: The CMW is the shimmery, mysterious world where people satisfy with desires and aspirations. The main purpose of man to build this world is to reach a better, fairer and more humane society. This world is not only the place where people satisfy with dreams but also have self-awareness, self-experience to realize the true meaning of the lives.

3.1.1 – The art conception on the world in the CMW

Closely related to the formation of the ancient’s art conception about the world, it is the system of thought and binary logic, the philosophy notions of human life and the universe from the past. These factors constituted the concept of art, controlled the formation of the CMW in fairy-tales of Vietnamese ethnic groups.

The ancient’s conception about the world was expressed so plentiful. In addition to Vietnamese people’s concept of the world, there are other systems of conception on three layers and four worlds of the Muong, conception on the universe of the Thai, Tay, Nung, Phu La, etc...The conception came from popular beliefs, from the concept "living beings have souls", mythology, rituals, dreams of the ancestors then developed and bloomed in fairy tales.

3.1.2 - The art conception about people in the CMW

Closely related to the art conception about the world in the CMW is the concept of the ancients about mankind. These concepts in the CMW were mixed and integrated with eachother.

The world of Gods, demons, Fairies, Buddha and other MC are traditional “materials” of fairy-tales. After all, these “materials” have turned into incantation – multiplication of people.

We may divide man’s embodiment into two forms:

At first, they embody with the same appearance. Right in MC themselves, their embodiment is divided into two parts: body and soul. Secondly, they turn into other forms. Gods, Fairies, Buddha, demons, and other MC (the Genie of water, Gods...) may transform into ragged poor old women, old men, hostile forces to try the heart of people in the earth...

MC has uncanny abilities because of their ways of simultaneous, strange appearance: MC are people and transform into other forms at the same time. MC are people of real society and idealization. Therefore, incarnation - multiplication have created a contrast between a great desire needed to be completed and a possible limit of their abilities; between the two persons inside a MC.

Each system of MC has its own conception of art:

Folklorists’ conception about Fairy, Buddha is the concept of beauty, perfection, kind, saving mankind from sufferings.

The conception about devils is related to religion and souls, which derives from the concept of "living beings have souls"...It is believed that devils symbolize evil...

The conception of deities is the concept of the higher world about "living beings have souls", the gods with supremacy...

The conception of other MC (the Genie of water, King of river…) is the conception on a wealth world where the Genie of water, King of river…manage that beautiful world.

The ancients had artistic intention to built such above the MC. Because ultimately, sub-characters are "mariculous people" in other forms of man’s embodiment who appear to help people in urgent situations and circumstances.

Characters to be researched are always put in the relationship with historical, social and economical circumstances. And as such, the ancients’ art conception on man, the world in the world of MC needs to be considered in the multi-dimensional, simultaneous appearance relationship. It means that fairy-tales reflect man through the reflective prism as the system of conception on the world. Through the system of art conception
about the CMW, folklorists expressed the profound art conception about people, for people. Man is always a beauty focus in the CMW.

3.2 – The characters miraculous world indicates the unique art of elaborating fairy-tales
The CMW is not only a prime means of art to reflect dreams and transmit the unique aesthetic conception of the ancients about man and the world but also having an effective value of organizing works of art in terms of plot, time - space, characters, etc...

3.2.1 – The cmw in the art of elaborating the plot
The CMW has an important role in organizing the works of art, especially in terms of plot. The presence of this world has opened a new form of the plot in miraculous fairy-tales, it's the plot "story in story". It is this factor that opens the mariculous space, time and helps fairy characters can travel to many places at the same time.

The CMW is surrounded by the system of MC with complex, multi-dimensional relationships. Thanks to the impact of MC, the life of fairy-tales characters is divided into two stages: In the first stage, the main characters live in poverty, unhappiness with no change in position, material and spiritual life, conception, etc...In the second stage, the characters live happily with the change in position, material and spiritual life, conception and so on. Stories’ ending is happy or not, depending on the quality, competence of characters.

3.2.2 – The CMW in the art of creating characters
One of the factors that constitute the poetic characteristics of fairy-tales in general and miraculous fairy-tales in particular is the system of characters. The character has an important role, is a basis for establishing the structure and plot of fairy-tales. Therefore, research and analysis of characters are significant work in fairy-tales.

MC appear in fairy tales and have created a system of new characters for this style: Characters capable of multilocation. These characters at the same time have transformed into many different MC. Although they belong to the system of functional characters, but they have features of man with love, concern, torment in dreaming souls.

3.2.3 – The CMW have a practical significance for the organization of space – time
There is an intimate, interactional relationship between MC and fantasy space. When MC appear the miraculous space appears. In the miraculous space, MC move most quickly to rescue people. They can cross over hundreds of springs, thousands of hills to another world...at very short time in blink. Thanks to the presence of MC in the miraculous space – time, people can realize new dreams, ambitions, ideals of a happy, wealth life.

The space–time linked with MC is not linear but simultaneous, and multi-dimensional. Types of MC such as gods, demons, fairies, Buddha... appear at the same time.

3.2.4 – The CMW in organizing events and creating the art methods
The CMW associated with numerous strange events. Each type of the MC is stucked to different systems of events. The ancients considered man to be a central factor in the relationship with other MC to manage events, incidents that made those events more fantasy. Whereby, miracles of each type of character are found in deeper layers.

The CMW not only organizes the events, but also creates the original art methods such as comparison - doubling, simultaneous, strange appearance. This is the effective art method associated with the transformation of man; with the doubling; multi-dimension and simultaneous appearance of the MC.

The CMW is the spiritual world, wonderful symbol with the nature of interference--sudden mutation. The CMW exist in the overlapping, complex relationships. These relationships could be contrast, suplemental. In spite of any relationships, contradictions and conflicts also arise among MC. The relationships of conflicts, contradictions come to climax and need to be addressed immediately. The interference--sudden mutation has made the MC change the "properties", have wonderful features according to the fantasy imagination of the ancients.

The CMW is an interesting and complicated theme due to the diversification and containing cultural strata. The CMW is a special way to reflect the world, people. It also indicates a profound the art conception about man and the world.

Conclusions and Discussion

Through magic transformation of MC, ancient people have mentioned about the characters those can play roles of different characters. They can be themselves and others. Therefore, their roles and influences are different from characters in fairy-tales. MC is the second image of people who were symbolized and idealized. It is the character who plays the important role in building plot. Thanks to the MC, we can find “stories in the
stories”, characters are transforming into different roles at the same time and freely “rule the roast” in miraculous time and space of miraculous fairy-tales using different modes of appearance and disappearance…This is the plentiful “materials” and endless “natural resources” for a number of types of folk culture to inherit and apply it in creative way to express specific nature and art implication that authors would like to include in their work.

Finally, this study was also expanded the scope of survey of the MC by comparing the fairy-tale in Vietnamese, Russian, and Germany. These fairy tales in three countries are assumed that similar and difference in classifications and building an image the MC as well as thinking about aesthetic in each local literatures and communities’ opinions. This is an interesting at trend of the research studied in terms of the CMW’s plays, literature folk wisdoms, local fairy tales, and transferring from the original status to modernization for developing the Vietnamese learning with the local wisdom, especially, the fairy tale characteristics. Moreover, an important role is not only in Vietnam country but also in international areas ought to have local folk or fairy tale throughout the world, similarly. If this study was expanded and promoted to all types of the characteristics of the fairy-tales whereas look into the educational institutes for arranging and emphasizing this local folk wisdoms to the youth or next generation, believability on self-minding of Vietnamese students, significantly. The comparisons of the CMW between fairy-tales and mythology, legend, and allegory that they are according to ancestor’s artistic logical evolutionary were assessed. However, the results of this study are accepted and stocked on specific types and versifications to find out the difference between fairy-tales of the MC and other types’ characters of artistry structure in local folklore literature for teaching as the interdisciplinary science in the educational institutes, interestingly.

Acknowledgements

Thank you so much for your invitation to attend The ICSSS 2015. I would like thank so much to the Reviewer for his/her valuable comments and for his/her correction of English error on our paper.

References

Research on Using Micro Teaching Technique in Training Physics Teachers in Vietnam

Pham Thi Phu, Vinh University
Nguyen Van Tuan, Dong Nai University

Abstract

Micro-teaching is an effective teaching technique which aims to train teachers towards approaching implementation capacity. Micro-teaching was introduced in 1963 at Stanford University (the United States), then it was brought to other countries such as Canada, Québec, England, Norway, Sweden, the Netherlands, West Germany, etc. However, Micro-teaching is quite new in Vietnam. Articles published result of research on building the theoretical basis for using micro-teaching technique in training Physics teacher. By method of theoretical research (analysis - synthesis and modeling) to achieve the following objectives: identifying the model of exercise-teaching skill structure, proposing process of training exercise-teaching skill and identifying the system of micro lessons training physics-exercise-teaching skill by micro-teaching technique.

Keywords: Micro-teaching, Teacher training, Skills, Physics assignment teaching

Introduction

Micro-teaching technique (called Microteaching) was implemented in Vietnam from 1999 in the Vietnam - Belgium educational project for teacher training. Microteaching is a teacher training technique in which each student teacher (pedagogical student) shall apply one or a few teaching skills to implement a microteaching lesson [1]. Micro-teaching lesson is a distinct element of Micro-teaching; Micro-teaching lesson is an excerpt of a teaching session conducted by a teacher or a student teacher, on a certain unit of knowledge in a short period of time (less than 15 minutes) and in a fictitious classroom consisting a group of student teachers (10-15 people) to act as students, which is videotaped and reviewed. Because micro-teaching lesson specifies the limitation on knowledge, time, types of pupils, and teaching skills to be used, this creates favorable conditions for student teachers to practice and sharpen their teaching skills.

The first advantage of micro-teaching in pedagogical skills training for student teachers is the tight connection between theory and practice, and the centralized training which forms and promotes normative constituent skills of teaching capacity. The second advantage of micro-teaching featuring the feedback circuit principle implemented during the observation of micro-teaching lesson videotapes shall provide immediate feedback to lecturers on the teaching skills obtained by student teachers in a teaching environment which is simplified and closely controlled towards normative skills.

These two key advantages of micro-teaching help overcome empiricism and academic theories which are currently relatively common in pedagogical training programs by training institutions in Vietnam. However, so far, micro-teaching has not been applied in teacher training institutions in Vietnam, stopping at a few experimental study projects. In physics teacher training in Vietnam, no study about the application of micro-teaching has been published. Assignment teaching skill is a particular skill which plays a particularly important role in the learning outcomes of the bachelor training program of Physics Pedagogy. The report presents the results of the study on application of micro-teaching in Physics assignment teaching skills training with regard to student teachers of the Pedagogical Bachelor of Physics Program.

2. Content and methodology of research

2.1. Analyzing psychological basis of micro teaching

Micro-teaching is established based on the Operant conditioning theory by B.F Skinner and the Social cognitive theory by A. Bandura.

The Operant conditioning theory is built on the basic concept of operant behavior. “Operant behavior is a behavior which is formed from a previous behavior by the subject due to the impact on the condition. It is reinforced, and acts as a stimulus” [1]. The biological basis of operant behavior is the operant conditioning. Operant conditioning responses separates itself from classical conditioning responses by two points: Operant conditioning responses satisfy the needs of the subject and demonstrates the positiveness and activeness of the subject against stimuli from the environment. Operant conditioning responses impacts the environment around the subject. These two points of difference are the basis for the teaching method adopting Operant conditioning theory.
Teaching adopting Operant conditioning theory features the following notable characteristics [1]:
- Individuals can form their own behaviors: the learners themselves form the acts of learning to satisfy their needs;
- Use of the heuristic technique: implementation of teaching based on repetition of the responses that lead to the right results; responses that do not lead to the right results shall be removed from the memory through a number of repetitions, the responses that lead to successful results shall be reinforced after paid efforts;
- The formula of Stimulus → Reinforcement → Repetition of behaviors according to the heuristic technique.

Micro-teaching is a form of teaching which adopts the Operant conditioning theory. Teaching skills are a system of operant behaviors. To form teaching skills, the lecturers should clearly determine the system of operant behaviors of teaching skills, establish demands to stimulate the student teachers to perform, reinforce and repeat the operant behaviors following the heuristic technique, reinforce and repeat behaviors under the heuristic technique (through implementation of micro-teaching lessons); implement the reinforcement principle (through direct observation or observation recorded videotapes of micro-teaching lessons) to have appropriate behavioral adjustments for the next micro-teaching lessons with the aim of skills improvement.

Social cognitive theory is not only about behavior but also cognition. According to Bandura, behaviors are formed both through direct reinforcement and observation of the behaviors of the others and the consequences of such behaviors. There are two forms of learning through observation: the first form involves observing a behavior of someone which is rewarded or penalized to adjust one’s behavior according to such reward or penalty; the second form involves imitating the behavior of the object being observed. Bandura suggested that human behaviors can be formed through observing the behaviors of others to: obtain new responses, to reinforce or weaken the existing responses, recall responses that are forgotten. He supposed that an establishment of a clear, structured and adoptable pattern after observation has an important role in shaping the behaviors [2]. This is the key point of the Bandura’s social cognitive teaching pattern which is the basis for micro-teaching. Patterns of skills (exhibition of patterns or a form similar to videotapes or oral, written descriptions) are the characteristics of micro-teaching. The patterns must have a clear structure to be adoptable. In micro-teaching, the patterns are expressed in the forms of micro-teaching lessons which involve typical teaching situations.

From the above psychological basis, the study on application of micro-teaching for skills training needs to be able to identify the system of operant behaviors of skills and establish patterns (micro-teaching lessons) of such behaviors.

2.2. Analyzing components of micro teaching technique

From [3], document analysis method shows that the micro teaching includes the following components
- A student teacher playing the role of a teacher and performing the micro-teaching lesson (preparation of a micro-teaching lesson plan and implementation of such plan);
- A group of student teachers playing the role of pupils to form a fictitious classroom (5 – 10 student teachers);
- Micro-teaching lesson plan;
- One or a group of skills to be trained;
- A instructor;
- Micro-teaching lesson observation checklists and assessment from observers;
- Group of observing student teachers (5 – 10 student teachers);
- Recorded videotape of the micro-teaching lesson.

2.3 Analyzing process of micro teaching technique

Analyzing the work of W.D. Allen [4] on the steps of micro-teaching technique, we visualize the process of implementing micro teaching in diagram 1.
3. Research results and discussion

3.1. Determining the structural model of Physics-exercise teaching skill

To practice skill under micro teaching technique, a prerequisite is to identify the structural
components of skill. Identifying component skills of exercise teaching skill is the basis for identifying the micro
lessons - a central concept of micro-teaching technique. So far no projects have yet announced about the
component skills /elements of Physics-exercise teaching skill

Based on the learning outcomes of the bachelor training program of Physics Pedagogy in a number of Physics
teacher training institutes in Vietnam, based on the standards set for high school teachers by the Ministry of
Education and Training of Vietnam in 2009, based on the order and duties to be performed by Physics teachers
to complete a specific lesson, based on the theoretical teaching functions of Physics assignments; We have
determined that there are 2 major groups of teaching skills: group of teaching planning skills and group of
teaching lesson plan implementation skills, is presented in Table 1.
Table 1. Structural model of Physics-exercise teaching skill

<table>
<thead>
<tr>
<th>The group of teaching planning skills</th>
<th>The group of teaching lesson plan implementation skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the objectives of assignments teaching</td>
<td>Introduce the assignment</td>
</tr>
<tr>
<td>Select assignments which are appropriate to the objectives</td>
<td>Instruct the pupils in assignment solving</td>
</tr>
<tr>
<td>Resolve</td>
<td>Organize active, self-reliant, creative assignment solving activities for the pupils</td>
</tr>
<tr>
<td>Raise questions to instruct the pupils in assignment solving</td>
<td>Generalize the assignments</td>
</tr>
</tbody>
</table>

Skills (based on the activities of the teacher) | Skills (based on common assignment teaching situations)
--- | ---
Introduce the assignment | Use assignments to consolidate the pupils' initiative knowledge and creating situations of problems
Instruct the pupils in assignment solving | Use assignments to help the pupils consolidate and apply new knowledge
Organize active, self-reliant, creative assignment solving activities for the pupils | Use pattern assignments to form new methods
Generalize the assignments | Train on the assignment teaching skills with the known methods and develop, improve methods
Assess the assignment teaching outcomes | Use assignments for review

In this table, the group of teaching lesson plan implementation skills is classified by two signs; Sign 1 involves the activities of the teachers when teaching each assignment, sign 2 involves common assignment teaching in practical conditions. The classification according to sign 2 is the basis for the preparation of micro-teaching lessons, while the classification of the constituent skills under sign 1 is the basis for the analysis of teachers in the micro-teaching lessons.

3.2. Determination of the skills training process for Physics assignment teaching by micro-teaching

Skills training in general should be implemented in three stages [5]: awareness of the actions (purpose, plan, and implementation methods), practice under the supervision of the instructor, and training.

Based on the general process above, simultaneously based on the characteristics of the assignment teaching structure presented in 2.2, we would like to propose the assignment teaching skills training process as presented in diagram 2.

**Diagram 2. Process of practicing structural model of Physics-exercise teaching skill**

- Stage 1. Provide orientation basis about exercise-teaching
  Purpose: Equip the student teachers with the theoretical basis of physics assignment teaching, provide them with prepared plans, videotapes of micro-teaching lessons as patterns, instruct the student teachers in observation and assessment; Means: build a website for the student teachers’ self-study and printed handouts; Methods: self-study via the website, lectures in the auditorium.
- Stage 2: Training of separate skills;
- Stage 3: Training of a combination of skills;

Stage 2 and stage 3 are implemented in accordance with the micro-teaching process presented in diagram 1.
3.3. Determination of micro-teaching lesson system Physics assignment teaching skills training

Based on common and typical situations in the practice of Physics assignment teaching, we have selected the following 7 micro-teaching lessons to train the student teachers on assignment teaching skills:

- Micro-teaching lesson 1. Use assignments to consolidate the pupils’ initiative knowledge and creating situations of problems;
- Micro-teaching lesson 2. Use assignments to help the pupils consolidate and apply new knowledge;
- Micro-teaching lesson 3. Use pattern assignments to form new method;
- Micro-teaching lesson 4. Train on the assignment teaching skills with the known methods and develop, improve methods;
- Micro-teaching lesson 5. Use assignments for review;
- Micro-teaching lesson 6. Use laboratory assignments in teaching Physics;
- Micro-teaching lesson 7. Use assignments for examination and assessment in teaching Physics.

The above-mentioned micro-teaching lessons are built in the form of patterns including plans and videotapes, we shall introduce the content in detail another occasion.

Conclusion

Teaching skill is an expression of the teaching capacity; micro teaching technique is an effective way to practice teaching skill. The results of research on structure of Physics-exercise teaching skill, process of practicing Physics-exercise teaching skill by micro teaching technique, 7 micro lessons to practice exercise teaching skill according to the micro teaching technique is the new results. Since then an innovative teaching technique for training teachers by approaching to implementation capacity will be soon given out in Physics teacher training, meet the requirements on the basic comprehensive innovation of Vietnamese education after 2015.

References

Self-Study and Research Based Physics Teaching at the High School Level

Vo Hoang Ngoc¹ and Vo Van Thong²

¹High School Principal- Le Loi Str, Vinh City, Nghe An Province, Viet Nam
E-mail: vhnhoc1@yahoo.com
²NgheAn College of Education, Viet Nam
E-mail: vothong.cdsp@gmail.com

Abstract

Based on the steps of implementing the research by the scientists (theoretically and practically), which have been made public by documents, by the institutes of research or even by Universities in Vietnam, we have translated them into the self-study and research based teaching method. The research paper has clarified the concept, the typical activities of the teachers and students, stages of the self-study and research based teaching method and at the same time, it has compared this method to other positive teaching methods, which have been included in the materials, teaching materials of the Institute of research, the schools such as problem solving, experiment based, project based teaching methods, hand-on teaching in order to point out the similarities, the differences in structure, the extent of participating in the activities of students and the extent of use of the above mentioned methods.

Keywords: Self-study, Physics, Teaching method, High school

Introduction

Over the past years, the Vietnamese education system has been changing primarily from the “knowledge acquisition” to “the capacity developing” of the learners [3]. Students shall be activated in the activities of self-learning in order to grasp the knowledge and master at the implementing method. Students shall be active to apply on how to solve the practical problems. In the course of teaching the physics subject at the High School, many positive teaching methods have been applied such as teaching aimed at the problem solving, experiment based teaching, project based teaching, creative teaching, hand-on teaching and so on. Each method has its advantages in the implementation of the orientations, but it is just able to solve a certain aspect, which is not characteristic of the generality; So, there should be a general teaching method, which can cover more aspects than each one, which we mentioned above;

For this paper, we have based on the steps of implementation of research by the scientists (theoretically and practically), which have been made public by documents, by the institutes of research or even by Universities in Vietnam. We have translated them into the self-study and research based teaching method. We have clarified the concept, the typical activities of students and students, stages of self-studies and research based teaching method and compared this method to other active teaching methods, which have been included in the materials, teaching materials of the Institute of Research, the schools such as problem solving, experiment based, project based teaching methods, hand-on teaching in order to point out the similarities, the differences in structure, the extent of participating in the activities of students and the extent of use of the above mentioned methods.

We do hope that this research shall play a decisive role in orienting towards a good education for Vietnam.

Materials and Methods

Based on the steps of implementing the research by the scientists (theoretically and practically), which have been made public by documents, by the institutes of research or even by Universities in Vietnam, we have translated them into the self-study and research based teaching method.
Results

1. Concept on self-study and research based teaching

According to the Vietnamese Dictionary [1]: “self-study means spending a lot of time with great effort to discover and to brainstorm”. “Think and study in order to raise the initiative”. “Research means review, thorough fact-findings aimed at mastering the problem, settling the problem, or drawing the new insights”.

According to Creswel’s definition: “Research involves a process of collecting and analyzing the information in order to increase knowledge of a subject or a problem”. It includes three steps: raise the question, collect the data for replying a question and give presentation in order to answer that question”.

Also according to online Merriam-Webster dictionary: Research means the careful question or investigation; especially, the investigation and the fact-finding targeting at the outcomes and expected deductions for the purpose of changing the theories or the rules, which have been accepted based on the new data, and applying the theories and new concepts in practice”.

It can be understood that “self-study and research” means spending a lot of time with great effort on reviewing, studying, collecting the data and information, thinking, analyzing, summarizing etc in order to settle an issue, acquiring new insights and new applications.

Self-study and research based teaching is a method, which approaches the research method by the Scientists.

Self-study and research based teaching pay heed to the two following principal issues:

- Teacher raises the problem, supports the students to identify the problem so that students not only can understand it but also such problem must be appealing enough to students; as a result, students shall have the demand to act, to study, to settle and to find out the new ideas.

- Teacher shall support the students to conduct the self-study and research based activities (such as making the tests, observing, studying the documents, doing the survey etc), to settle the problem themselves, to collect the knowledge and new experience [5].

Self-study and research based teaching method means that teachers shall organize for students to participate in the logical cognition activities of the scientific research process, facilitate for them to have such a real experience during the course of scientific studies.

By comparing the two following charts, we shall observe the metabolism in the fundamental stages of the course of the scientific studies (chart 1) [5, page 14] into the steps of the self-study and research based process (chart 2) [5, page 22].
2. Structure of the self-study and research based teaching activity

2.1. Typical activities of the teachers and students during the self-study and research based teaching

Typical activities of the teacher: self-study and research based teaching
- Encourage and facilitate so that students shall put questions for new issue;
- Orientate and facilitate to enable the students to collect the data for questions;
- Support to enable the students to provide the correct, accurate, clear answers;

Typical activities of the learners/students: learn how to practise the self-study and research.
- Propose for scientific theories/forecasting
- Propose for the alternatives to conduct the examination of the scientific theories/forecasting;
- Find the materials, perform the tests, collect the data, address and discuss in order to find the answer to the question.
- Give the answer, debate, correct the answer;

2.2. Stages of the self-study and research based teaching process
There are 5 stages of the self-study and research based teaching process.
Stage 1: raising the matter of research (give the scientific questions):
Teacher shall create a topic by asking students to observe an experiment, a scientific footage, a picture video, a table of data, a chart flow etc or to tell a phenomenon, a scientific process, a scientific story and then ask them to put question why or how?

Stage 2: To propose for a hypothesis/a scientific forecasting (as the basis for answer to a scientific question).
Teacher shall orientate, support for phenomenon, data analysis and assumption development/scientific forecasting.

Stage 3: Teacher shall verify a scientific hypothesis/forecasting (make the outcome deduction, search for reasoning, phenomenon, repeated processes, images and data etc in order to confirm such scientific hypothesis/forecasting).
Teacher shall orientate, facilitate, support for students how to make the outcome deduction that can be verified and checked, how to establish the verification and inspection option, how to search for documents, means and how to deal with the data etc.

Stage 4: draw the scientific conclusion (answer for scientific questions).
Teacher shall ask students to have group discussions in order to ascertain whether the scientific hypothesis/forecasting is true or wrong, to arrange the reasoning, data as the basis for verification of such scientific hypothesis/forecasting and to draw the scientific conclusion.

Stage 5: Report, defend the research results and formalize knowledge
Teacher shall organize for the groups of students to present and defend the research results, to give the remarks by themselves, to evaluate the activities that their group involves, to get involved in giving the evaluations and remarks of the outcome and the activities of the other groups.

Students (a representative of the group) shall give a presentation before the class on the research results, reply the questions related to the content of research raised by the teacher and the students of the other groups in order to defend the correctness of the scientific conclusion, which has been drawn. Students shall provide their remarks and evaluation of the activities of their group by themselves, participate in giving evaluations and remarks of the planning making, searching for data, events in order to help confirm the scientific hypothesis/forecasting of the other group of students.

Teacher shall summarize the research results of the student groups, confirm the results, announce the content of new knowledge, provide remarks and evaluations and draw the experience through the process of research by students.

Role of teachers and activities of students can be summarized as follows:
3. Compare the self-study and research based teaching to some active teaching methods

3.1. Compare the self-study and research based teaching methods to the problem solving teaching method

Problem solving based teaching method includes 3 steps: [4]
- Create the topic with issue: Teacher shall create a topic with issue. Then, the issue that needs to be settled shall be determined. (Students can participate together).
- Problem solving: Teacher shall settle the problem or shall allow the students to participate together for settlement at the different levels to draw new knowledge.
- Application of knowledge: Teacher shall give the assignment to each student so that new knowledge shall be acquired.

Problem solving based teaching method is divided into 3 levels:
- Raise the problem: Teacher shall raise the problem, settle the problem. The students shall observe.
- Partial self-study and research: Students shall be allowed to participate into some parts of the problem solving processes (handling of the outcome and the conclusion, conducting the experiment on date collection, establishment of the settlement option).
- Creative self-study and research: Teacher shall give the tasks and orientate. Students shall have to determine the problems, find out the options, settle the problem and draw the conclusion.

As to the structure: Stage 1 of the problem solving teaching matches with the stage 1 and the stage 2 of the self-study and research based teaching. Stage 2 of the problem solving based teaching corresponds to the stage 3,4,5 of the self-study and research based teaching, but what is different here is that the self-study and research based teaching states clearly that in the stage 5, students shall be allowed to present and defend the research results.

As to the degree of participation of activities by students: Self-study and research based teaching corresponds to the degree of creative discovery/research and to the high degree of partial research discovery of the problem solving based teaching. Self-study and research based teaching does not have the level corresponding to the level of issue demonstration and expression.

3.2. Compare the self-study and research based teaching method to the experiment based teaching one.

Experiment based teaching has 5 stages:
- Teacher shall raise the problem that needs testing for verification.
- Teacher and students shall establish the scientific hypothesis and forecasting.
- Teacher and students shall make the logic deduction in order to deduce the outcome.
- Teacher and students shall establish the options and conduct the tests to confirm the outcome.
- Teacher shall give assignments, students shall apply new knowledge for settlement.
Depending on the fact that teacher allows the students to participate more or less in the process of each stage, 3 levels per stage shall be divided.

It can be said that with regard to the extent of use, the self-study and research based teaching is in the form of the lessons aimed at new knowledge intake by the means of research, material searching, collection of actual information, but not for only the experiment based lessons.

As to the structure: the stage 1 and stage 2 of the experiment based teaching are correlative to the stage 1,2 of the self-study and research based teaching . The stage 3 and stage 4 of the experiment based teaching are correlative to the stage 3,4,5 of the self-study and research based teaching , however, the difference is that the self-study and research based teaching clearly states that in the stage 5, students shall be allowed to give presentation on defending the research results.

With regard to the extent of activities of the students: the similarities of both approaches is that depending on the content of the lesson, the capacity of students, condition of documents and material, teacher shall allow the students to get involved more or less in the process of the problem solving.

3.3. Compare the self-study and research based teaching to the project based learning

Project based learning has 3 stages:

- Plan making: Teacher shall organize for students to participate in proposing, selecting the topic, identifying the target and expected products, the method of implementation, the time of project implementation.
- Execution of the project: Teacher shall use the set of orienting questionnaires to help students have the group activities by themselves to collect, handle and summarize information and develop the products.
- Acceptance of the products and formalization of new knowledge: Teacher shall organize for students to make reports, to give the presentation on products, to draw experience and to acquire the key knowledge through the implementation of the project.

As to the extent of use, the self-study and research based teaching shall be in the form of many lessons aimed at developing new knowledge while the project based teaching is suitable for the kind of lessons, which apply the scientific and technical knowledge to the life with relatively long period.

As to the structure: the stage 1 of the project based teaching is correlative to the stage 1, 2 of self-study and research based teaching . Stage 2 of the project based teaching is correlative to the stage 3, 4 of the self-study and research based teaching . Stage 3 of the project based teaching is correlative to the stage 5 of the self-study and research based teaching .

With reference to the extent of participation by students: For project based teaching, teacher shall provide the distance instruction, which requires students to be active and try their best in all aspects. This also necessitates that students should know how to allocate their internal team work under the positive manner with the view to accomplishing the task of manufacturing, fabrication. This is equivalent to the high level of the self-study and research based teaching.

3.4. Compare the self-study and research based teaching to the hand on-teaching (La main à la pâte)

Hand-on teaching has 5 steps:

- Raise the problem: Teacher shall raise the problem or create a situation with problem;
- Propose for theories/hypothesis: Teacher and students shall collaborate.
- Determine the method of handling the problem: Teacher shall instruct the students to find out the testing options and the technical design options etc.
- Implement the research for problem solving: The students shall conduct an experiment to observe the process, to collect the data and make the technical design to comply with the requirements etc.
- Discuss, exchange about the obtained results, formalize knowledge: Teacher shall ask the students to implement. Then, teacher shall give the final conclusion.

The hand-on teaching method is appropriate for the experiment based lesson, the lesson, which practises and applies the knowledge to the technical and production area.

As to the structure: step 2 and 2 of the hand-on teaching method are correlative to the stage 1 and the stage 2 of the self-study and research based teaching . Step 3 and step 4 of the hand-on teaching method are correlative to the stage 3 of the self-study and research based teaching method. Step 5 of the hand-on teaching method is correlative to the stage 4 and the stage 5 of the self-study and research based teaching method.

The participation of students in the problem solving process, the mutual cooperation in the group activities, the instructing and controlling role of the teacher in the two methods are nearly the same.
Conclusions and Discussion

The self-study and research based teaching has a lot of things in common with the active teaching, which has been applied, however, this method has the wider extent of use in the types of lessons. Self-study and research based teaching, thus, both helps the students master knowledge, improve many learning skills, turn into the better moral quality, develop the action skills, the team work skills, communication skills, presentation skills, debate skills, self-evaluating and evaluating skills, increase the confidence and accountability for students.

We highly appreciate to get the contributions from local and overseas scientists to this research works for the purpose of making it perfect;

Implementing, researching and applying to the practice of teaching the physics at the High School level in Vietnam.

Acknowledgements

We would like to express the gratitude to the Seminar organizing Board for the support so that we have the opportunity to present the studying results. We also look forwards to receiving the sincere comments from gifted scientists to enable us to finalize and put the results of research into practice.

References

Conducting Institute Research for Developing International Quality Assurance of Secondary Schools in the Central of Northeast of Thailand using Basic Educational Standard

Siri Thee-asana* et.al.

Educational Management Administration Program, Faculty of Education, Maha Sarakham Rajabhat University, Thailand.

(*author for correspondence, E-mail: SRTHSN@hotmail.com; Fax: 043-722554)

Abstract

The aims of this research were to: 1) study the state of knowledge, understanding and need for conducting institutional research of personnel in Secondary schools, 2) develop the knowledge, understanding and attitude in conducting higher institute research, and 3) study the results of personnel development. There were two target groups for studying as following: The samples were 588 key persons and 17 research participants. The instruments were two questionnaires, a focus group recording form of the training guidelines, and a satisfaction questionnaire form. The basic statistics used for analyzing quantitative data and also content analysis for qualitative data.

The results of founded that the personnel had a moderate level of knowledge regarding the procedure for conducting institute research. The needs improving themselves were high. The schools had done the institute research 8.77% only. The results of the development revealed that the efficiency/effectiveness were 95.88/88.24. The effectiveness index (E.I.) was 0.779. Overall the trainees’ satisfaction was at a high level. The target group, research participants, did 69 the institute research proposals and institute research reports. Most of all were good level. For reflection and recommendation were found that they were a very satisfied. They needed the researchers re-training them because they missed in several method concepts of institute research and needed supporting in conducting the institute research further.

Keywords: Education, Secondary schools, Knowledge, Assurance

Introduction

Education was very necessary and important for National Development to be continuously progressed. In addition, it should be established with quality. According to current His Majesty the King’s speech during his birthday on the 4th of December 2003, a part of important statement as “..... The Educational Knowledge stated that the Education had to be improved because if the Education had to be improved, the people would not be able to work. The Education needed to be in every level.....”[1] Therefore, the Educational Management had to have quality and standardized. The persons who were responsible for Educational Management, had to emphasize on the Educational Management into quality and standard. As a result, the Education was powerful to develop quality in the population continuously.[2] However, there were various problem and obstacles in implementation of Internal Quality Assurance based on these approaches, for instance, the persons’ misunderstanding, the evaluation was separated from real practice, the evaluative findings were not used for making the management plan for school development and improvement as it should be, the students had low learning achievement. There were no sufficient development in students’ analytical thinking, continuous learning and knowledge searching, and ethics as well as morality as it should be.[3]

Moreover, the researchers viewed that the development of Institute Research was a very important part for promoting the Internal Quality Assurance in schools to be strong system. It was congruent with Roong Kaewdang’s[4] statement that the strategy for developing the body of knowledge which would cause the Educational Management Quality to be successful because the Institute Research was one’s self-study to be useful in learning and teaching as well as management.[5]

Therefore, the researcher team were interested and wanted to help the schools under jurisdiction of The Office of Secondary Educational Service Area 24-27 which situated near Mahasarakam Rajabhat University in province group as the integrative form of province group in the Northeastern Region (Roi-kaen-san-sin) to be able to improve the Educational Quality Management in higher level by using the Research-based.
Materials and Methods

Objectives

1. To study the state of knowledge, comprehension, and need for Institute Research of school staffs, under jurisdiction of The Office of Secondary Educational Service Area 24-27.
2. To develop the staffs’ higher level of knowledge, comprehension, and good attitude towards conducting the Institute Research based on Basic Educational Standard.
3. To study the findings of school staff development.

Scope of Research

The delimitation of population and samples.
1. The population consisted of 234 schools, under jurisdiction of Office of Secondary Educational Service Area 24-27 in Roi-kan-sarasin Province Group (Roi-ed, Khon Kaen, Mahasarakam, Kalasin ), 4 persons each school including: the school director, the assistant school directors, the representatives of work group heads, and the teacher representatives who were the heads of Learning Substances, total of 936 persons. The were sampled into the samples of 147 schools, 4 persons each school, total of 588 persons.
2. The research participants were the schools under jurisdiction of Office of Secondary Educational Service Area 24-27 in Roi-kan-sarasin Province Group (Roi-ed, Khon Kaen, Mahasarakam, Kalasin ), who volunteered to attend the staff development in conducting the Institute Research for developing the Internal Quality Assurance based on framework of Basic Education Standard of Office of Secondary Educational Service Area, 1 school from each Office of Secondary Educational Service Area, 17 persons from different schools as follows:
   1) Pan-sa-weuy School, Office of Secondary Educational Service Area 24, Kalasin.
   2) Sri-nong-gao-wittaya School, Office of Secondary Educational Service Area 25, Khon Kaen.
   3) Po-pan-pittayakom Rachamangkala-pisek School, Office of Secondary Educational Service Area 26, Mahasarakam.
   4) Chiengmai-pittayanuson School, Office of Secondary Educational Service Area 27, Roi-ed.

Delimitation in the studied variables
1. The phases for conducting the Institute Research consisted of 7 major activities including:
   1) the problem and determination of research problem issues,
   2) the title leading to key words, the question and objective,
   3) the delimitation of operational definition and research conceptual framework,
   4) the expected usefulness and research literature review,
   5) the research methodology,
   6) the reference and bibliography writing, and
   7) the extra activities as Action Research: AR, Classroom Action Research: CAR, writing in Key Performance Indicators : KPI, and establishing the Proposal.
2. The Basic Education Standard consisted of 5 aspects ( 15 Standards, 65 Indicators) including (Ministry of Education, 2011)
   1) Aspect 1: The Standard of Students’ Quality. (Standard 1-6)
   2) Aspect 2: The Standard of Educational Management. (Standard 7-12)
   3) Aspect 3: The Standard of Learning Society Development. (Standard 13)
   4) Aspect 4: The Standard of Uniqueness of School. (Standard 14)
   5) Aspect 5: The Standard of Promotion Measure. (Standard 15)
3. The components of Institute Research for Evaluation consisted of:
   1) Title, 2) Background,
   3) Objective, 4) Research Delimitation,
   5) Operational Definition, 6) Expected Usefulness,
   7) Theoretical Approach and Reference, 8) Research Methodology and Instrument,
   9) Steps of Data Analysis,
   10) Work Schedule, and 8 lists of supplementary including:
   11) Quantitative Data Analysis, 12) Qualitative Data Analysis,
   13) Appropriate Presentation of Information Technology,
   14) Discussions, 16) Recommendations,
17) Bibliographies, and
18) Appendix as the clue or evidence.

**Delimitation of place**
1. The schools under jurisdiction of Office of Secondary Educational Service Area 24-27, 147 schools, and the additional 4 schools for Focus Group.
2. The 6th floor Conference Room, the Instructional Resource Building, Mahasarakam Rajabhat University, was the place for training.

**Delimitation of duration**
1. Phase 1, during May 2013-September 2013.

**Method**

The research methodology was concluded as follows:

<table>
<thead>
<tr>
<th>Phases of Research</th>
<th>Implementation Technique</th>
<th>Target Group</th>
<th>Research Instruments</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong>, the knowledge, comprehension, and Need for Institute Research were studied.</td>
<td>1) Document Study 2) The studied variables were synthesized. 3) The research instruments were constructed. 4) The instruments were validated. 5) The data were collected. 6) The data were analyzed. 7) The research findings were interpreted, concluded, and written for research report.</td>
<td>- 588 Samples - 17 Key Informants</td>
<td>• Questionnaire  • Focus Group Record</td>
<td>- percentage S.D. - Content Analysis</td>
</tr>
<tr>
<td><strong>Phase 2</strong>, the school staff development was provided for conducting the Institute Research.</td>
<td>1) The experimental schools were selected. 2) The conference was held for related persons. 3) The workshop plan was established. 4) The workshop was held. 5) The data were collected. 6) The data were investigated and analyzed. 7) The findings of development were concluded. The research report was written.</td>
<td>- 17 research participants from 4 schools.</td>
<td>• Workshop Guidelines  • MoU Form  • The Satisfaction Questionnaire  • The Practice Score Form</td>
<td>- percentage S.D. - Content Analysis</td>
</tr>
<tr>
<td><strong>Phase 3</strong>, the findings of school staff development in conducting the Institute Research, were followed up and evaluated.</td>
<td>1) The theoretical approaches of evaluation, were studied. 2) The evaluation techniques were synthesized. 3) The instruments were constructed. 4) The instruments were validated. 5) The evaluators were appointed. 6) The conference was held for preparing the workshop. 7) The evaluation was performed based on specified schedule. 8) The school staffs presented their performances. 9) The quality of research proposal, was evaluated. 10) The conclusions were searched in order to lead to real practice further. 11) The final research report was concluded and written. 12) The research study was disseminated in different forms both of inside and outside the country.</td>
<td>-Seventeen research participants from 4 schools. -Three evaluators.</td>
<td>• The Evaluation Form of proposal.  • The Record Form of Focus Group.</td>
<td>- percentage S.D. - Content Analysis</td>
</tr>
</tbody>
</table>
Results

The research findings of the State of Teachers and Staff’s Knowledge, Comprehension, and Need for Conducting the Institute Research, the overall Mean Value was in “Moderate” level. Their need for self-development, was in “High” level. The research findings from Focus Group, most of research participants accepted that they never heard the word “Institute Research,” before. Most of them thought that they were not clear in every Phase of research methodology. The wanted to obtain self-development in knowledge for Institute Research from the real experts. They also wanted to utilize the findings of Institute Research in both of personal and public usefulness. For personal usefulness, they wanted to present their performances by conducting the Institute Research as important document for being promoted in higher position. For public usefulness, it was Information Technology for schools to be used in decision making for establishing the Plan for developing the Educational Management Quality in higher level.

The findings of school staff development in conducting the Institute Research, the Mean Value of pretest score was = 24.87 point. The Mean Value of posttest score = 46.90 point. Every trainee obtained development score. The scores of Efficiency/Effectiveness of Workshop (E1/E2) were = 95.88/88.24. The Effectiveness Index of Workshop (EI) was = 0.7792. The participants or trainees’ overall satisfaction based on project of teacher and staff development, was in “High” level.

The findings of following up and evaluation in school staff development for conducting the Institute Research, found that the teachers and school staffs were able to establish 69 research proposals of Institute Research for supporting the Internal Quality Assurance based on framework of Basic Education. The quality of 16 proposals were in “Very Good” level, 48 proposals were in “Good” level, 5 proposals were in “Fair” level. Moreover, the Institute Research Studies which were implementing, and the complete studies could be specified that every study could support the implementation of Internal Quality Assurance in schools based on framework of Basic Education Standard. The teachers and Educational Staffs who participated in this workshop for development, had satisfaction in the project very much because it was a new one, and systematic work. Furthermore, the consultants being competent in Research, were recommended to be appointed for helping in conducting the Institute Research. In addition, the researcher teams were recommended to be contacted in many channels.

Discussion

The research findings of the State of Teachers and Staff’s Knowledge, Comprehension, and Need for conducting the Institute Research of schools under jurisdiction of Office of Basic Education Commission 24-27, found that the overall Mean Value was in “Moderate” level. The researcher viewed that the obtained answers might be real state. It was possible that the teachers’ knowledge and comprehension in research were not high enough. It was supported by Wittayakon Chiengkoon’s [6] viewpoint that a problem of Thai Education, was the teacher’s quality. Since the unqualified teachers were employed. Moreover, the quantitative expansion of Education during the past 20-30 years, was a lot. It was congruent with Tanawad Chin-na-chote’s [7] perspective that the teachers as well as Educational Staffs still lacked of knowledge and process in conducting the classroom research. Besides, Suchat Someprayoon and Wanne Someprayoon [8] viewed that the research was high level of Science and complex. One had to have critical thinking and considering thoroughly. Consequently, the samples’ knowledge and comprehension in this aspect were in “Moderate” level. For the level of need for self-development in conducting the Institute Research, the overall Mean Value was in “High” level. It was supported by Kasem Wattanachai’s [9] statement that the research studies were very important in the present because the research could make changes in one’s lifestyle, daily life, and livelihood which would lead to the policy determination as well as new ways of practice, and development of better working system.

The findings of school staff development in conducting the Institute Research for developing the Internal Quality Assurance of schools based on framework of Basic Education Standards, found that it was successful in rather high level. It might be due to the systematically good preparation for development. The problems and real need assessment of the persons who would perform development, were studied. Then, the development was performed by establishing the guidelines for training based on the situation, problem, and need according to Suwimon Wongwanich’s [10] approach. In addition, it would be possible that most of teachers and Educational Staffs who volunteered to attend the development, were key persons in schools as the school directors, the assistant school directors, the academic teachers, the teacher heads of Learning Substances who had good background in Educational Administration and Management in one level. So, the development could be implemented easily. Their development was performed through the training process. Prajak Sap-udom [11] and Scott B. Parry (2004 cited in Sukanya Dhrama-chote [12] suggested that the staff development by Workshop, could be highly successful.
For the following up and evaluation in research proposal/Institute Research Report, found that the target group of teachers and Educational Staffs were able to establish the research proposal/Institute Research Report into the issue. Furthermore, most of the research proposal/Institute Research Report had overall quality in “Good” level. This work implementation was congruent with the process of Action Research. Since the implementation in each place, made plan for following up and evaluation. The following up and evaluation in field work, the observation, and the data collection were implemented by Focus Group as well as Reflection by research participants including the researcher, co-researchers, and school staffs in all of 4 schools. As a result, it was confident that the Action Research Technique could lead to success as the expectation based on principles of this kind of research. O’Brien, R [13] stated the major approach and usefulness of Action Research that the principle of reflection by situation observation and document study, would help the reality of organization to be clearer which would lead to the problem solving very well.

**Recommendation**

Each school should establish the project for teacher and staff development in Institute Research regarding to the research dissemination, the abstract writing in English, the evaluation in major competency based on curriculum for students’ development activity enhancing and serving the students’ need, competency, aptitude, and interest. The students were given the advice as well as consultation and problem solving in learning and quality of life. Furthermore, the Policy Research should be conducted in order to develop the policy recommendations in Institute Research of schools with best practice for the schools under jurisdiction of Office of the Basic Education Commission throughout the country. Moreover, the Institute Research Studies of various schools under jurisdiction of Office of The Basic Education Commission in order to study the body of knowledge from Institute Research for Internal Quality Assurance of schools based on framework of Basic Education. The data would be obtained as foundation for developing the Educational Quality of schools in higher level.

**Acknowledgement**

This research obtained budget support from the Government Budget cooperated by The Office of Research and Development, Mahasarakham Rajabhat University. We would like to thank you very much

**References**


Factors Influencing Teacher Interpersonal Behaviours on Students Perceptions in Biology Classroom Learning Environments in Sarakham Pittayakom School

Kornkanok Khaokaew¹, Arreewan Taddee², Somsanguan Passago¹, and Toanskul Santiboon*,¹

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Science Learning Group Section, Srinakarindra the Princess Mother Somdej Roi-En, Patronage of Her Royal Highness Maha Chakri Sirindhorn School, Thailand 45280
(Corresponding E-mail address: toansakul35@yahoo.com.au)

Abstract

The purpose of the study was to investigate and associate biology teacher international behaviours in 8 scales of the actual and preferred of the 48-Item Questionnaire on Teacher Interaction (QTI) with a sample of 134 biology upper secondary educational students at Grade 11 in Sarakham Pittayakom School in Mahasarakham. Relationships between actual students’ perceptions of their teacher interpersonal behaviours toward their Test Of Biology-Related Attitude (TOBRA) to their biology laboratory classes were associated with the Test of Science-Related Attitude (TOSRA). The reliability of the QTI scales ranged from 0.60 to 0.83 of the actual from and ranged from 0.71 to 0.87. The preferred teachers could be identified as those whose students’ perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, Understanding, and Student Responsibility and Freedom and less than one standard deviation below the mean on the Uncertainty, Dissatisfied, Admonishing, and Strict scales. The QTI may thus provide a basis for systematic attempts to improve one’s own teaching practice. Statistically significant differences were found between the students’ perceptions of actual and preferred teacher interpersonal behaviours of their biology classes also were found, while confirmatory factor analyses provided support for the theoretical framework behind the questionnaire (0.41-0.93 omitted). The multiple correlations $R^2$ was significant for the QTI and considered associations with the TOBRA, and value indicates that 44% of the variance in students’ attitude of actual chemistry classed was also determined.

Keyword: Actual forms, Biology classroom, Learning, Student perception

Introduction

Research which originated in The Netherlands focuses on the nature and quality of interpersonal relationships between teachers and students (Créton, Hermans & Wubbels 1990; Wubbels, Brekelmans & Hooymayers 1991; Wubbels & Levy 1993). Drawing upon a theoretical model of proximity (cooperation-opposition) and influence (dominance-submission), the QTI was developed to assess student perceptions of eight behaviour aspects. Each item has a five-point response scale ranging from Never to Always. Typical items are 'She/he gives us a lot of free time' (Student Responsibility and Freedom behaviour) and 'She/he gets angry' (Admonishing behaviour).

A Western Australian study (Tobin & Fraser 1988) focused on case studies of classroom practices employed by 'exemplary' teachers. The project was explicitly framed within constructivist principles, which are claimed to lead to greater value being placed on higher order cognitive learning (Tobin & Fraser 1990). The project reported considerable diversity in the methods these teachers used, but nevertheless produced four assertions concerning exemplary science teachers (Tobin & Fraser 1988, 1990).

This study was thus decided to build on this past research and focus this study on the identification and description of exemplary biology teachers. However, the study is distinct in that it uses the perceptions of students in the identification of these teachers. Because this was our first investigation of the use of the QTI in such a way, this study has been preferred to use the term better to describe these biology schooling teachers in Sarakhampittayakom School in Mahasarakham Province, Thailand.

Science Education Classroom Learning Environments

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of
whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currently trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment).

**Educational Science Learning Environments**

Using students’ perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterizing the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgments about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits of combining quantitative methods when studying educational environments (Fraser & Tobin 1991).

**Historical Classroom Learning Environment Instruments**

In the past four decades, there are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used *Learning Environment Inventory* (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of *the Classroom Environment Scale* (CES) (Moos 1979, Moos & Trickett 1987). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley 1990; von Saldern 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).

**Instruments for Assessing Classroom Environment**

Focused on contemporary instruments: *Learning Environment Inventory* (LEI); *Classroom Environment Scale* (CES); *Individualized Classroom Environment Questionnaire* (ICEQ); *My Class Inventory* (MCI); *College and University Classroom Environment Inventory* (CUCEI); *Questionnaire on Teacher Interaction* (QTI); *Science Laboratory Environment Inventory* (SLEI); *Constructivist Learning Environment Survey* (CLES); and *What Is Happening In This Class* (WIHIC) questionnaire, the name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos's (1974) scheme for classifying human environments.

**Actual and Preferred Form Scales**

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

**Materials and Methods**

The aim of this study was to use the QTI to identify and describe the better biology teachers. These better teachers were identified through very favourable scores on particular scales of the Questionnaire on Teacher Interaction (QTI). Associations between students’ perceptions and their attitude toward biology classroom learning environments were determined with students.

**Research Purposes**

1. To analyze a valid and reliable the actual and preferred forms of the Questionnaire on Teacher Interaction instrument when used in this study.
2. To investigate the factors influencing student’s perceptions of their teacher interpersonal behaviours in biology classroom learning environments in Sarakhampittayakhom School classes.
3. To compare between students’ perceptions of their actual and preferred teacher interpersonal behaviours in biology classroom learning environments in Sarakham Pittayakhom School classes.

4. To associate between students’ perceptions of their science attitudes to their actual teacher interpersonal behaviours toward biology classroom learning environments in Sarakham Pittayakhom School classes.

**Literature Review**

The Questionnaire on Teacher Interaction (QTI) was constructed as a set of 77 items describing teacher interpersonal behavior in terms of the eight scales or sectors of the MITB, thus representing the two (interpersonal) dimensions. The QTI has become a popular instrument in research on teaching, teacher education and learning environments, has been translated into more than 15 languages and has been the focus of well over 120 (learning environment) studies in many countries since its development (den Brok et al., 2004). The Australian version of the QTI has 48 items which are arranged in cyclic order in blocks of four to facilitate hand scoring by teachers. Items 1 to 24 assess the four scales called Leadership, Understanding, Uncertain and Admonishing behaviours, and Items 25 to 48 assess the scales called Helping/Friendly, Student Responsibility/Freedom, Dissatisfied and Strict behaviours. The questionnaire items are given in Table 1. Students respond on a five-point scale ranging from “Never” to “Always”. Current experience indicates that students can complete the QTI in about 30 minutes. These studies confirmed the reliability and validity of the QTI and noted that generally, the dimensions of the QTI were found to be significantly associated with student attitude scores. In particular, students' attitude scores were higher in classrooms in which students perceived greater leadership, helpful/friendly, and understanding behaviours in their teachers.

Results of past studies with the QTI usually demonstrated the importance of students’ perceptions of their teachers’ behavior for both cognitive and affective student outcomes, den Brok and his colleagues (2004) reported positive relations of both dimensions to cognitive and affective students’ outcomes. In another study, higher students’ perceptions on the Influence dimension were associated with higher student outcomes on a Physics test (Brekelmans, Wubbels, & den Brok, 2002). Although not always straightforward, relationships between Proximity and cognitive outcomes were determined in many studies (for an overview see Wubbels et., al., 2006), some of which have also been reported in the Journal of Classroom Interaction (den Brok, Fisher, & Koul, 2005a; den Brok, Levy, Brekelmans, & Wubbels, 2005; Kyriakides, 2005). While positive effects of both dimensions on affective outcomes were found in most studies, stronger effects have been reported for Proximity than for the Influence dimension (e.g. den Brok et al., 2004; Wubbels et al., 2006).

The aim of this study was to use the QTI to identify and describe the better biology teachers. These better teachers were identified through very favourable scores on particular scales of the Questionnaire on Teacher Interaction (QTI). Associations between students’ perceptions and their attitude toward biology classroom learning environments were determined with students.

**Research Procedure**

Using the QTI instrument was followed as for assessing students’ perceptions of their actual form on the 10th - 12th week, and preferred form on the 14th week and the TOCRA on the 15th week for associating biology classroom learning environments in upper secondary education students at Grade 11 level in 4 classes in Sarakham Pittayakhom School classes.

Each scale of the QTI were composed with 6-item, minimum scoring is 0 and maximum score is 24. The first scale, Leadership behaviour is composed the item of 1, 5, 9, 13, 17 and 21; the second scale, Helpfulness and Friendly behaviour is composed the item of 2, 6, 10, 14, 18 and 22; the third scale, Uncertain behaviour is composed the item of 3, 7, 11, 15, 19 and 23; the forth scale, Dissatisfied behaviour is composed the item of 4, 8, 16, 20 and 24; the fifth, Student Responsibility and Freedom scale is composed the item of 25, 29, 33, 37, 41 and 45; the sixth, Understanding behavior is composed the item of 26, 30, 34, 38, 42 and 46; the seventh, Admonishing behaviour is composed the item of 27, 31, 35, 43 and 47; the eighth, Strict behavior is composed the item of 28, 32, 35, 44 and 48.

**Research Instruments**

**Questionnaire on Teacher Interaction (QTI)**

Research which originated in The Netherlands focuses on the nature and quality of interpersonal relationships between teachers and students (Creton, Hermans & Wubbels 1990; Wubbels, Brekelmans & Hooymayers 1991; Wubbels& Levy 1993). Drawing upon a theoretical model of proximity (cooperation-opposition) and influence (dominance-submission), the QTI was developed to assess student perceptions of eight behaviour aspects. Each item has a five-point response scale ranging from Never to Always. Typical items are 'She/he gives us a lot of free time' (Student Responsibility and Freedom behaviour) and 'She/he gets angry' (Admonishing behaviour).
Figure 1. An influence dimension and a proximity dimension of the QTI (a), and Leary model of interpersonal behavior (Wubbels, Creton, Levy & Hooymayers, 1993, p.15) and Model for administrator interpersonal behavior characteristics (Wubbels, 1993) (b).

Although research with the QTI began at the senior high school level in The Netherlands, cross-validation and comparative work has been completed at various grade levels in the USA (Wubbels& Levy 1993), Australia (Fisher, Henderson & Fraser 1995), Singapore (Goh& Fraser 1996) and Brunei (Riah, Fraser & Rickards 1997), and a more economical 48-item version has been developed and validated (Goh & Fraser 1996). Also, Cresswell and Fisher (1997) modified the QTI to form the Principal Interaction Questionnaire (PIQ) which assesses teachers' or principals' perceptions of the same eight dimensions of a principal's interaction with teachers. Further information about research involving the QTI can be found in Wubbels and Brekelmans (1997).

An instrument to measure these perceptions in terms of the MITB, the Questionnaire on Teacher Interaction (QTI), the interpersonal behavior of a teacher is described along two dimensions - an influence dimension and a proximity dimension. The influence dimension describes the degree of control of the teacher over the communication process, the proximity dimension the degree of cooperation or opposition between the teacher and the students. The two dimensions can be depicted in a two-dimensional plane that can be further subdivided into eight categories or sectors of behavior: Leadership (DC), Helpful/Friendly (CD), Understanding (CS), Student Freedom (SC), Uncertain (SO), Dissatisfied (OS), Admonishing (OD) and Strictness (DO). Each sector can be described in terms of the two dimensions: Leadership, for example, contains a high degree of Influence and some degree of Cooperation; Helpful/Friendly behavior some degree of dominance and a high degree of cooperation (see Figure 1). Each sector can be described in terms of the two dimensions: Leadership, for example, contains a high degree of Influence and some degree of Cooperation; Helpful/Friendly behavior some degree of dominance and a high degree of cooperation (see Figure 2). Classroom environment research has involved students in Western countries; Turkey is a relatively new participant in this domain.

**The Test Of Biology-Related Attitude (TOBRA)**

In addition to the main questionnaires QTI, and the Test Of Biology-Related Attitudes (TOBRA), this adapted version from the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981a). The TOBRA questionnaire was selected to use with the aim of investigating any possible relationships with students' perceptions about their biology teacher's interpersonal behaviour in management on biology classroom learning environments in upper secondary educational school classes of classroom's administration environments. The TOBRA consists of eight items.

**Data Analysis**

Quantitative data were obtained using the two questionnaires (QTI and TOBRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual QTI scale to investigate whether students have significant different perceptions of their actual and preferred teacher interpersonal behaviours.
Sample
The main study involved, improved and developed the upper secondary educational students’ biology classroom learning environments of their actual and preferred perceptions with a sample size of 134 students in 4 biology classes in Sarakhampittayakom School, Muang District in Mahasarakham province, Thailand.

Results

Validity and Reliability of Research Instrument

A. Validation of the QTI
Description of quantitative data of analyzing responses for students’ perceptions Master of Science teacher student’s assessments is reported in Table 1.

The results given in Table 1 shows that on average item means for each of the five QTI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 0 and 24, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the QTI. For the remaining eight scales, namely; Leadership, Helpful/Friendly, Understanding, Student Responsibility and Freedom, Dissatisfied, Uncertain, Admonishing, and Strict scales.

Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>22.10</td>
<td>3.68</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>23.11</td>
<td>3.85</td>
<td>0.08</td>
<td>0.28</td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>Actual</td>
<td>21.81</td>
<td>3.64</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>23.23</td>
<td>3.87</td>
<td>0.07</td>
<td>0.27</td>
</tr>
<tr>
<td>Understanding</td>
<td>Actual</td>
<td>21.23</td>
<td>3.54</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>23.57</td>
<td>3.93</td>
<td>0.08</td>
<td>0.29</td>
</tr>
<tr>
<td>Student Responsibility and Freedom</td>
<td>Actual</td>
<td>16.96</td>
<td>2.82</td>
<td>0.12</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>18.32</td>
<td>3.05</td>
<td>0.02</td>
<td>0.17</td>
</tr>
<tr>
<td>Uncertain</td>
<td>Actual</td>
<td>7.34</td>
<td>1.22</td>
<td>0.16</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>6.32</td>
<td>1.05</td>
<td>0.06</td>
<td>0.26</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>Actual</td>
<td>8.56</td>
<td>1.43</td>
<td>0.19</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>6.18</td>
<td>1.03</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td>Admonishing</td>
<td>Actual</td>
<td>8.06</td>
<td>1.34</td>
<td>0.28</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>7.82</td>
<td>1.30</td>
<td>0.15</td>
<td>0.38</td>
</tr>
<tr>
<td>Strict</td>
<td>Actual</td>
<td>13.90</td>
<td>2.32</td>
<td>0.30</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>11.04</td>
<td>1.84</td>
<td>0.38</td>
<td>0.62</td>
</tr>
</tbody>
</table>

In Table 2 the internal consistency reliability of the version QTI used in this study was determined by calculating Cronbach alpha coefficient for the 48 items of the QTI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the QTI, which ranged from 0.58 to 0.68 when using the students’ actual climate scores and from 0.83 to 0.85 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the QTI, which suggests that each scale of the QTI was able to differentiate significantly (p<0.001) between students’ perceptions in my school and my dream school environmental climates in the same school.
Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the QTI.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>ANOVA results</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>0.73</td>
<td>0.72</td>
<td>7.57</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.83</td>
<td>0.51</td>
<td>7.27</td>
<td>0.000***</td>
</tr>
<tr>
<td>Helpful/friendly</td>
<td>Actual</td>
<td>0.70</td>
<td>0.74</td>
<td>2.49</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.75</td>
<td>0.63</td>
<td>3.29</td>
<td>0.000***</td>
</tr>
<tr>
<td>Understanding</td>
<td>Actual</td>
<td>0.60</td>
<td>0.76</td>
<td>15.34</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.71</td>
<td>0.68</td>
<td>5.54</td>
<td>0.000***</td>
</tr>
<tr>
<td>Student responsibility/freedom</td>
<td>Actual</td>
<td>0.72</td>
<td>0.75</td>
<td>0.51</td>
<td>0.000***</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>Actual</td>
<td>0.73</td>
<td>0.73</td>
<td>9.41</td>
<td>0.000***</td>
</tr>
<tr>
<td>Admonishing</td>
<td>Actual</td>
<td>0.73</td>
<td>0.74</td>
<td>21.74</td>
<td>0.000***</td>
</tr>
<tr>
<td>Strict</td>
<td>Actual</td>
<td>0.73</td>
<td>0.74</td>
<td>29.22</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76</td>
<td>0.63</td>
<td>31.33</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 0.63 to 31.33 for different scales, respectively.

B. The Circumplex Nature of the ICEQ:

To investigate the circumplex nature of the QTI correlations between the scales were calculated in the sample Table 3. To investigate the circumplex nature of the QTI, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 3.
Scale Intercorelations for the QTI Using the Actual Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Lea</th>
<th>Hfr</th>
<th>Und</th>
<th>Stu</th>
<th>Unc</th>
<th>Dis</th>
<th>Adm</th>
<th>Stc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>0.81***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.93***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hfr</td>
<td>Actual</td>
<td>0.84***</td>
<td>0.72**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.73***</td>
<td>0.76**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Und</td>
<td>Actual</td>
<td>0.55**</td>
<td>0.37*</td>
<td>0.47*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.27*</td>
<td>0.50**</td>
<td>0.39*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stu</td>
<td>Actual</td>
<td>-0.33*</td>
<td>-0.35*</td>
<td>-0.23*</td>
<td>-0.37*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.34*</td>
<td>-0.49**</td>
<td>-0.44*</td>
<td>-0.42*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unc</td>
<td>Actual</td>
<td>-0.37*</td>
<td>-0.36*</td>
<td>-0.40*</td>
<td>-0.39*</td>
<td>0.39*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.82***</td>
<td>-0.82***</td>
<td>-0.73***</td>
<td>-0.26*</td>
<td>0.65**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dis</td>
<td>Actual</td>
<td>0.64**</td>
<td>0.65*</td>
<td>0.37*</td>
<td>-0.24*</td>
<td>0.48*</td>
<td>0.50*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.39*</td>
<td>0.57**</td>
<td>0.82***</td>
<td>-0.38*</td>
<td>0.43*</td>
<td>0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adm</td>
<td>Actual</td>
<td>-0.43*</td>
<td>-0.62*</td>
<td>-0.36*</td>
<td>0.36*</td>
<td>0.68**</td>
<td>0.50**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.39*</td>
<td>-0.57**</td>
<td>-0.82***</td>
<td>-0.6**</td>
<td>0.43*</td>
<td>0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stc</td>
<td>Actual</td>
<td>-0.33*</td>
<td>-0.35*</td>
<td>-0.31*</td>
<td>-0.28*</td>
<td>0.40*</td>
<td>0.30*</td>
<td>0.58**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.40*</td>
<td>-0.45*</td>
<td>-0.29*</td>
<td>-0.48*</td>
<td>0.52**</td>
<td>0.30*</td>
<td>0.45**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
Validation of the TOBRA

To measure Master of Science teacher students’ attitudes towards science educational management class, the present study adapted the eight-item the Test Of Biology-Related Attitude (TOBRA) (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005, Santiboon & Fisher, 2004; Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014; Sittikosol & Malone, 2008), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the Attitude Scale had a value of 0.84 which was considered satisfactory for further use in this study.

Factor loading Analysis of the QTI

The Actual Form of the QTI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the QTI. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

Table 4.

Factor Loading for Items in the Actual Form of the QTI

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>21</td>
<td>0.77</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.76</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.76</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>6.5</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0.61</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.49</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>0.83</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.78</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.77</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.73</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.65</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.52</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>0.95</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>0.93</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>0.77</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.60</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>0.60</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.90</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>0.88</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>0.81</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.78</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.55</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.90</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>0.76</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>0.72</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>0.61</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>0.60</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>0.58</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.86</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.83</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>0.72</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>0.77</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>0.72</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>0.57</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>0.93</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>0.93</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>0.80</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>0.56</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>0.52</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>0.47</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>0.83</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>0.78</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>0.77</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>0.72</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>0.41</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>0.36</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance | Act. | Pref. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>57.98</td>
<td>63.34</td>
<td></td>
</tr>
<tr>
<td>45.91</td>
<td>45.91</td>
<td></td>
</tr>
<tr>
<td>34.44</td>
<td>34.42</td>
<td></td>
</tr>
<tr>
<td>36.51</td>
<td>36.51</td>
<td></td>
</tr>
<tr>
<td>72.6</td>
<td>72.6</td>
<td></td>
</tr>
<tr>
<td>49.43</td>
<td>55.16</td>
<td></td>
</tr>
<tr>
<td>52.0</td>
<td>54.27</td>
<td></td>
</tr>
<tr>
<td>43.02</td>
<td>53.15</td>
<td></td>
</tr>
</tbody>
</table>

536
Figure 1 indicates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the chemistry laboratory educational management classes.

**Comparisons between Student’s Perceptions of Their Actual and Preferred Forms in Chemistry Classroom Learning Environment**

On comparing differences between the students' perceptions of their actual and preferred chemistry teacher interpersonal behaviour at Grade 11 level in Figure 1. Each student in the sample responded to the QTI and the results for each class were calculated as scores on each scale of the QTI. The better teachers were identified as those, whose students' perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied, Admonishing, and Strict scales.

The results of this study also indicate that using the QTI helps chemistry teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the chemistry classroom learning environment for upper secondary education students at Grade 11.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the QTI

**Associations between Master of Science Teacher Students’ Perceptions of Science Educational Management Learning Environment with the TOBRA**

In this study, it was also considered important to investigate associations between chemistry students’ perceptions of their chemistry classroom learning environment with their attitude toward chemistry classes. The Cronbach alpha reliability of the selected the TOBRA was 0.84, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in chemistry classroom learning environments. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOBRA that it’s reported in Table 5.
Table 5
Associations between QTI Scale and TOBRA to Chemistry Classroom Learning Environments Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple Correlate Attitude (r)</td>
<td>Standard Regress. Weight Attitude(β)</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>0.22**</td>
<td>0.22**</td>
<td></td>
</tr>
<tr>
<td>Helpful/friendly</td>
<td>0.18*</td>
<td>0.18*</td>
<td></td>
</tr>
<tr>
<td>Understanding</td>
<td>0.19*</td>
<td>0.20**</td>
<td></td>
</tr>
<tr>
<td>Student responsibility/freedom</td>
<td>0.22**</td>
<td>0.23**</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td>-0.21**</td>
<td>-0.22**</td>
<td></td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>-0.17*</td>
<td>-0.18*</td>
<td></td>
</tr>
<tr>
<td>Admonishing</td>
<td>-0.22**</td>
<td>-0.22**</td>
<td></td>
</tr>
<tr>
<td>Strict</td>
<td>-0.19*</td>
<td>-0.20**</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6664**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.4441**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N =134, *ρ< .05, **ρ < .01, *** ρ < .001

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science educational management classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their science educational management class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their biology laboratory classroom environment on all scales of the Actual and Preferred Forms.

Table 5 is compared to investigate associations between students’ perceptions of their biology classroom learning environments with their attitude toward biology classes. Using the QTI instrument in the upper secondary education level, Sarakham Pittayakom School, Thailand, will help teachers to evaluate their learning environments in biology classroom learning environmental management in order to improve their education process. Furthermore, the information from the QTI could be useful as the guide to enhance the effectiveness of biology classes. The effectiveness in biology classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of the biology classroom learning management of their teaching is for improving and developing students’ learning achievement successfully.

Conclusions and Discussions

The actual and preferred perceptions of 134 biology students at Grade 11 of their biology classroom learning environments were measured with the QTI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their science educational management class. In general, students’ perceptions of their preferred classroom science environment in science educational management class to be greater than what they actually perceive to be provided. The results of this study also indicate that using the QTI helps Sarakham Pittayakom School teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science educational management class, with regard to the QTI, it was found that all of five scales were positively associated with students’ attitude to science educational management class. The multiple correlation R is significant for the QTI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The R² values indicate that 44%, with actual and preferred forms of the variances in students’ attitudes to their biology classroom learning environments was attributable to their perceptions of their biology classroom learning environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their biology classroom learning environment lessons.

As described in the results section, Sarakhampittayakom’s students show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the QTI questionnaire. Overall, Sarakhampittayakom’s students show relatively favourable perceptions of their science educational
management lessons, with the lowest score occurring for the Differentiation scale. It seems that biology classroom learning environments lesson activities related to biology classes are operated rather as supplementary to theory classes rather than being independently important in their own right.

Overall, this study replicated previous studies using the QTI, with the findings being consistent with the situation in Sarakhampittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the biology upper secondary education level at Grade 11, interestingly.

References


Assessments of Individual Chemistry Classroom Learning Environments for Students’ Individual Outcomes at the Tenth-Grade Level in Thakhonyang Pittayakom School

Kanthima Sawangwong¹, Panpilai Chomchid², Jiranant Janthayouth³ and Toansakul Santiboon¹*¹

¹, ²Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
³Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand

Abstract

Using the economical short forms of the actual and preferred questionnaires of the My Class Inventory (MCI) that contain only approximately 25 items which as amenable to easy hand scoring was compared. When this instrument was administered to a small sample size of 92 upper secondary educational students at Grade 10 level in Thakhonyang Pittayakom School in Mahasarakham was used. Data was supported each scale's internal consistency reliability, discriminant validity, and ability to differentiate between the perceptions of students in chemistry classroom learning environments. Actual students’ perceptions of their classes to their attitudes with a short the Test Of Chemistry-Related Attitude (TOCRA) that they were translated into Thai language for administrating research methodology was associated. Statistically significant were differentiated the students’ perceptions of actual and preferred chemistry classroom environments of their attitude toward their chemistry classroom learning environments also were found. The factors were analyzed to appear to be affecting students’ perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients for the scales were adequate (0.61-0.78), while confirmatory factor analyses provide support for the theoretical framework behind the questionnaire (0.51-0.92 omitted). The multiple correlations R² is significant for the MCI and considered associations with the TOCRA, and value indicates that 34% of the variance in students’ attitude was also determined. The interesting finding was that significant improvements occurred for the students’ perception of their attitudes on actual dimension on which change had been attempted of students’ learning achievements with their chemistry classroom learning environments.

Keywords: Assessment, My Class Inventory (MCI), Chemistry, Environment, Educational

Introduction

Over the last five years, several new initiatives have been implemented in the Singapore education system. These include National Education, Information Technology (IT), Thinkin Programme (TP) and Project Work (PW). These initiatives aim to prepare our students for the challenges in the 21st century and to achieve our vision of Thinking Schools and a Learning Nation. In particular, the Project Work (PW) initiative aims to provide students with opportunities to explore the inter-relationships and inter-connectedness of subject-specific knowledge (Jacobs, 1989) [1]. Using the PW approach to learning, students will be able to apply creative and critical thinking skills, improve communication skills (both oral and written), foster collaborative learning skills, and develop self-directed inquiry and life long learning skills. With the teachers as facilitators, the students work collaboratively in groups of 4-5 over a period of about 25 hours of curriculum time to complete the learning task. Since students spend much of their curriculum time in completing the project, they would be the best judges as to what they have experienced in carrying out project work. Focusing on the early 2001, the Ministry of Education began developing new national curricula in an endeavor to model the system of education on child, or student-centered learning methods. The years from 2001 to 2009 showed some of the greatest improvements in education, experiments had also been tried with restructuring the administrative regions for education or partly decentralizing the responsibility of education to real change and many attempts to establish a clear form inappropriate or mismatched syllabus in the schools that it should be followed as the Thai policy government. The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Thakhonyang Pittayakom School at Grade 10 in Mahasarakham Province for demonstrating the reliability and
validity of the My Class Inventory (MCI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Chemistry-Related Attitude (TOSRA), the instruments need to be thoroughly analyzed psychometrically.

**International Classroom Learning Environment**

Using students’ and teachers’ perceptions to study educational environments can be contrasted with the external observer's direct observation and systematic coding of classroom communication and events (Brophy & Good 1986). Murray (1938) introduced the term *alpha press* to describe the environment as assessed by a detached observer and the term *beta press* to describe the environment as perceived by milieu inhabitants. Another approach to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, case study or interpretive research. Defining the classroom or school environment in terms of the shared perceptions of the students and teachers has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data which the observer could miss or consider unimportant. Students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if teachers are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this chapter, discussion focuses on the merits of combining quantitative and qualitative methods when studying educational environments (Fraser, 1991)\(^2\).

**Science Education Classroom Learning Environment**

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currents trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998)\(^3\).

**Studying Educational Environments**

Using students’ perceptions to study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits quantitative method when studying educational environments (Fraser & Tobin 1991).

**Science Education Learning Environment**

In the past three decades, There are educational researchers (Walberg & Moos, 2011) began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used *Learning Environment Inventory* (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the *Classroom Environment Scale* (CES) (Moos 1979; Moos & Trickett 1984). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley, 1990; von Salderen, 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).

**Actual and Preferred Environments**

An investigation of differences between students and teachers in their perceptions of the same actual classroom environment and of differences between the actual environment and that preferred by students or teachers was reported by Fisher and Fraser (1983) using the ICEQ with a sample of 116 classes for the comparisons of student actual with student preferred scores and a subsample of 56 of the teachers of these
classes for contrasting teachers' and students' scores. Students preferred a more positive classroom environment than was actually present for all five ICEQ dimensions. Also, teachers perceived a more positive classroom environment than did their students in the same classrooms on four of the ICEQ's dimensions. These results replicate patterns emerging in other studies in school classrooms in the USA (Moos 1979), Israel (Hofstein & Lazarowitz, 1986), The Netherlands (Wubbers, Brekelmans & Hooymayers 1991) and Australia (Fraser & McRobbie 1995), and in other settings such as hospital wards and work milieus (Moos 1974).

**Instrument for Assessing Classroom Environment**

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974) scheme for classifying human environments.

**Using Classroom Learning Environment Instrument for this Study**

*My Class Inventory (MCI)*

The *My Class Inventory (MCI)* was the major instrument used in the present study (Abdul Majeed, Barry J. Fraser & Jill M. Aldridge, 2001). The initial development and validation of the *Learning Environment Inventory (LEI)* began in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements in 15 scales (seven per scale) descriptive of typical school classes. However, because the LEI was designed for the senior high school level, it is too long and too difficult to read for students at lower grade levels (e.g., junior high school students for whom English is not their first language, as in the present research).

The *My Class Inventory (MCI)* is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O’Brien, 1985). Although the MCI was developed originally for use at the primary school level, it also has been found to be useful with students in the junior high school, especially those with limited reading skills in English (e.g., the sample in the present study). The MCI differs in five important ways, in order to minimize fatigue among younger children; the MCI contains only five of the LEI's original 15 scales. Second, item wording is simplified to enhance readability. Third, the LEI's four-point response format is reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire itself instead of on a separate response sheet to avoid errors in transferring responses from one place to another. The final form of the MCI contains 38 items altogether, although Fraser and O'Brien (1985) developed a short 25-item version. Typical items are "Children are always fighting with each other" (Friction) and "Most children can do their school work without help" (Difficulty).

To obtain a quick and easy assessment of their classroom environments, teachers can use the MCI. It satisfies two basic criteria (Fraser & Fisher, 1983a). First, the total number of items is small, thus providing economy in testing and scoring time. Second, because many teachers do not have ready access to computerized scoring methods, the MCI is suitable for easy hand scoring. Table 1 provides a scale description and sample item for the original form of the MCI.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>Extent of enjoyment of class work</td>
<td>The pupils enjoy their school work in my class.</td>
</tr>
<tr>
<td>Friction</td>
<td>Amount of tension and quarrelling among students</td>
<td>Many children in our class like to fight.</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Emphasis students competing with each other</td>
<td>Most children want their work to be better than their friend's work.</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Extent to which students find difficulty with the work of the class.</td>
<td>Most children can do their school work without help.</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Extent to which students know, help and are friendly towards each other</td>
<td>Some pupils in my class are not my friends.</td>
</tr>
</tbody>
</table>
Because the MCI provides the lowest reading level of all existing classroom environment instruments, it was the natural choice for the present study which involved students for whom English was not the first language. Nevertheless, the original form of the MCI (which was developed more than 20 years ago) still has some important shortcomings that needed to be taken into consideration in the present study.

**The Test Of Chemistry-Related Attitude (TOCRA)**

This study investigated associations between Actual and Preferred students’ perceptions of their chemistry laboratory environment classes in Thakhonyang Pittayakom School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected to the Test Of Chemistry-Related Attitude (TOCRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in Thakhonyang Pittayakom School students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their chemistry laboratory environment classes. Furthermore, the TOCRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Actual and Preferred Forms of Scales**

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

**Research Objectives**

1. To assess student’s perceptions of their chemistry laboratory environment classes at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.
2. To compare between student’s perception of their actual and preferred chemistry laboratory environment classes at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.
3. To associate student’s attitudes of their perceptions to their actual chemistry laboratory environment classes at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.

**Materials and Methods**

**Research procedure**

Using the MCI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating chemistry laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 10 in Thakhonyang Pittayakom School, Mahasarakham Province.

Each scale of the MCI were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3, 8, 13, 18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 14, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, 20 and 25.

**Data Analyses**

Total the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred MCI forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the MCI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the MCI with students’ attitudes to associate were analyzed.

**Sample**

This study is improved and developed students’ chemistry laboratory classroom environment with actual and preferred student’s perceptions with a sample size 92 upper secondary educational students at Grade level 10 in 3 classes in Thakhonyang Pittayakom School, Mahasarakahm Province, in the second semester in academic year 2014.
Results

Validity and Reliability of Research Instruments

A. Validation of the MCI

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 2. To provide a summary of a limited amount of statistical information for the MCI instrument considered previously. Attention is restricted to the student actual and preferred forms to the use of the individual student as the unit of analysis. The information about each scale; Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the MCI: a scale to differentiate between the perceptions of students in different classrooms for the MCI.

Table 2.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>23.03</td>
<td>4.61</td>
<td>0.06</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>23.42</td>
<td>4.67</td>
<td>0.05</td>
<td>0.23</td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>22.75</td>
<td>4.55</td>
<td>0.09</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>23.03</td>
<td>4.59</td>
<td>0.09</td>
<td>0.30</td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>22.88</td>
<td>4.56</td>
<td>0.06</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>23.16</td>
<td>4.63</td>
<td>0.06</td>
<td>0.25</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>22.28</td>
<td>4.46</td>
<td>0.09</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>22.68</td>
<td>4.52</td>
<td>0.09</td>
<td>0.30</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>23.03</td>
<td>4.61</td>
<td>0.07</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>23.36</td>
<td>4.65</td>
<td>0.08</td>
<td>0.28</td>
</tr>
</tbody>
</table>

The results given in Table 2 shows that on average item means for each of the five MCI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the MCI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.

The internal consistency reliability of the version MCI used in this study was determined by calculating Cronbach alpha coefficient for the 25 items of the MCI using both actual and preferred environmental climates’ perceptions scores. Table 3 reports the internal consistency of the MCI, which ranged from 0.62 to 0.80 when using the students’ actual climate scores and from 0.67 to 0.87 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the MCI, which suggests that each scale of the MCI was able to differentiate significantly ($p<0.001$) between students’ perceptions in my school and my dream school environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.55 to 11.50 for different scales, respectively.
Table 3: Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the MCI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results ($\eta^2$)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>Actual</td>
<td>0.78</td>
<td>0.58</td>
<td>7.76</td>
<td>0.25</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>Actual</td>
<td>0.80</td>
<td>0.59</td>
<td>11.12</td>
<td>0.28</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>Actual</td>
<td>0.64</td>
<td>0.68</td>
<td>5.94</td>
<td>0.14</td>
<td>0.01**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.67</td>
<td>0.62</td>
<td>10.13</td>
<td>0.21</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.84</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Actual</td>
<td>0.62</td>
<td>0.68</td>
<td>12.59</td>
<td>0.18</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

B: The Circumplex Nature of the MCI:
To investigate the circumplex nature of the MCI, correlations between the scales were calculated. The result is presented in Table 4. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 4. Scale Intercorelations for the MCI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>CO</th>
<th>FR</th>
<th>DI</th>
<th>SA</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR</td>
<td>Actual</td>
<td>0.71**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.59**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI</td>
<td>Actual</td>
<td>0.51*</td>
<td>0.36*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.72**</td>
<td>0.45**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>Actual</td>
<td>0.67**</td>
<td>0.84**</td>
<td>0.40*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78**</td>
<td>0.86**</td>
<td>0.79**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.41*</td>
<td>0.61**</td>
<td>0.61**</td>
<td>0.50**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.69**</td>
<td>0.49**</td>
<td>0.64**</td>
<td>0.72**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

C. Factor Loading Analysis of the MCI
The Actual and Preferred Forms of the MCI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

The factor loading analysis of the MCI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s scores? The factor structure that emerged replicated to a large extent, the structure reported previously for the MCI. Table 5 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
The Actual Form of the MCI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the MCI. Table 5 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

D. Validation of the TOCRA

To measure Master of Science teacher students’ attitudes towards English Graduate Studies II classroom learning Environment course, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005, Santiboon & Fisher, 2005; Santiboon, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOPRA) (Fraser, 1981). Using internal consistency reliability the TOCRA had a value of 0.78 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the MCI helps chemistry laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the chemistry laboratory classroom learning environment curriculum for the Thakhonyang Pittayakom School students in chemistry classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in chemistry laboratory classroom learning environments.
Associations between Students’ Perceptions of their Actual and Preferred Chemistry Laboratory Classroom Learning Environments toward their Attitude (TOCRA)

In this study, it was also considered important to investigate associations between students’ perceptions of their chemistry laboratory classroom learning environments with their attitude toward chemistry laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOCRA was 0.76, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in chemistry laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOCRA that it’s reported in Table 6.

In Table 6, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations ($p<0.05$) between students attitudinal outcomes and their chemistry laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their chemistry laboratory classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their chemistry laboratory classroom learning environments on all scales of the Actual Form.

Table 6. Associations between MCI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient ($\beta$)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple Correlation Attitude ($r$)</td>
<td>Standard Regress Weigh Attitude ($\beta$)</td>
<td></td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>0.22*</td>
<td>0.31*</td>
<td></td>
</tr>
<tr>
<td>Friction</td>
<td>0.44***</td>
<td>0.59***</td>
<td></td>
</tr>
<tr>
<td>Difficulty</td>
<td>0.26**</td>
<td>0.26**</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0.19*</td>
<td>0.22**</td>
<td></td>
</tr>
<tr>
<td>Competitiveness</td>
<td>0.23**</td>
<td>0.23**</td>
<td></td>
</tr>
</tbody>
</table>

$R^2$ = 0.3383**

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

***Correlation is significant at the 0.001 level (2-tailed)
The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between students’ perceptions on each scale of the ICEQ and their attitudes towards physics laboratory classes when the effect of relationships between the scales is controlled.

The multiple correlation $R$ is significant for Actual Forms of the ICEQ and shows that when the scales are considered together there is a significant ($p<0.01$) association with the TOPRA. The $R^2$ value indicates that 39% of the variance in teacher’s attitude to their school administration environment was attributable to their perceptions of their physics teachers. The beta weights (β) show that in physics laboratory environments where the teachers perceived management a more favorable attitude towards their physics laboratory environments.

**Discussion and Implementations**

Table 6 is compared to investigate associations between chemistry students’ perceptions of their chemistry laboratory classroom learning environments with their attitude toward chemistry laboratory classes. Using the MCI instrument in the higher education level, Thakhonyang Pittayakom School, Thailand, will help teachers to evaluate their learning environments in chemistry laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the MCI could be useful as the guide to enhance the effectiveness of chemistry laboratory classes. The effectiveness in chemistry laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of chemistry laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 92 student of their chemistry laboratory classroom learning environments were measured with the MCI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their chemistry laboratory classroom learning environments. In general, students’ perceptions of their preferred chemistry laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the MCI helps chemistry teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their chemistry laboratory classroom learning environments with regard to the MCI, it was found that all of five scales were positively associated with students’ attitude to chemistry laboratory classroom learning environments. The multiple correlation $R$ is significant for the MCI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 64%, with actual form of the variance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their chemistry laboratory classroom learning environments.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (MCI). This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in chemistry laboratory classroom learning environments.

Overall, this study replicated previous studies using the MCI, with the findings being consistent with the situation in Thakhonyang Pittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the chemistry laboratory classroom learning environments, interestingly.

**Acknowledgements**

Firstly, I would like to thank the 41 chemistry students in Thakhonyang Pittayakom Schoo lat Tenth-Grade Level who were part of the study. Thank you to the Mr. Phisit Supansri, Mr. Phajub Butsad, and Miss Jiran Janthayouth who allowed students to complete the questionnaire.

Secondary, I would like to my fellow Master of Science students, Miss Utumporn Anamart to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Thirdly, I must thank you my supervisor; Dr. Panpilai Chomchidand my co-supervisor; they understood and never pushed me to build up of my research that it was going on work, completely.
Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


[23] Santiboon, T. (2010). “Developing learning achievement with controlled activities by the forms of learning administration plans onto students’ center in geology course in Udon Thani Rajabhat University”.  

550


Adaptation of the Questionnaire on Teacher Interaction (QTI) for Biology Classroom Learning Environments in Rajabhat Maha Sarakham University Demonstration School

Preeyaporn Prabobserm¹, Somsanguan Passago², Wilailak Thuenkhamsean³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Department of Biology Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
³Science Learning Group Section, Rajabhat Mahasarakham University Demonstration School, Maha Sarakham, Thailand 44000

(¹author for correspondence, E-mail: toansakul35@yahoo.com.au)

Abstract

Using the Questionnaire on Teacher Interaction (QTI) international classroom learning instrument was to develop and improve with a sample size of 126 upper secondary educational students in biology laboratory classes in 3 classes at Grade 11 in Rajabhat Maha Sarakham University Demonstration School in Mahasarakham, Thailand. Administrations of teachers’ international behaviours by students’ perceptions on the QTI instrument (original modified from the QTI) (Wubbles & Levy, 1993) was used, the QTI was selected with actual (assesses the class as it actually is) and preferred (asks the students what they would prefer their class to be like – the ideal situation) forms. Associations between students’ perceptions to their science attitudes toward biology classroom learning managements were determined. Students’ attitudes were assessed with a short version of the Test Of Biology-Related Attitude (TOBRA) (original modified form the Test Of Science-Related Attitude) (Fraser, 1981) that they were translated into Thai language for administering research methodology. It has found that statistically significant differences between the students’ perceptions of actual and preferred biology classroom environments were revealed and shown that student’s attitudes to their teacher interaction behaviours in biology laboratory classes also were found. The factors were analyzed to appear to be affecting student perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients for the scales were adequate (0.69-0.86), while confirmatory factor analyses provide support for the theoretical framework behind the questionnaire (0.47-0.92 omitted). The multiple correlations $R^2$ is significant for the QTI and considered associations with the TOBRA, and value indicates that 31% of the variance in students’ attitude was also impacted of developing and improving students’ achievements to their biology classes and teacher interpersonal behaviours.

Keyword: Questionnaire on Teacher Interaction (QTI), Biology classroom, Learning, Teacher

Introduction

A wide variation in the beliefs and practices of teachers has been observed from classroom observations and interviews. Van den Akker (1998, p. 436) in describing schools that had productive primary science, revealed that these schools had: ‘a high level of student involvement and enthusiasm; increased student initiative in the learning process; a lot of group work and interaction; teaching involving stimulation and facilitation; increased variety of resources (materials and objects) and experiences; extensive integration of science topics with project-oriented activities over a long period; and a lot of emphasis on process skills for exploration, learning to learn, and attitudinal goals such as curiosity, precision and perseverance’. Other attempts to delineate teacher standards lie in the description of a set of skills and techniques that good teachers embrace in their practice. These standards define, for instance, the skills and knowledge required for teachers to achieve registration, or to be promoted to master teachers. In science teaching, these standards could describe the knowledge of science content, planning and management strategies, assessment processes, utilisation of science resources. Researches on teacher-student interpersonal behaviours reported on results of research from a 25-year program of studies investigating teacher–student relationships in secondary classrooms (Wubbels, Brekelmans, den Brok, & Tartwijk, 2006). Starting in the Netherlands, this line of research now has developed too many other countries such as Australia, Canada, Israel, Slovenia, Turkey, Korea, Taiwan, Singapore and the US. In our research we analyze teaching from an interpersonal perspective; that means in terms of the relationship between teacher and students. Two elements are central to this perspective: the communicative systems approach and a model to describe teacher–student relationships in terms of teacher behavior. We will discuss these two elements before turning to measurement instruments developed to map teacher–student relationships. The remainder of the paper
reviews studies on diverse issues covering teacher–student relations and student outcomes, non-verbal behavior and the spatial position of the teacher in the class, differences between teacher and student perceptions of the relationship, and interventions to improve relationships in class.

A Western Australian study (Tobin & Fraser 1988) focused on case studies of classroom practices employed by 'exemplary' teachers. The project was explicitly framed within constructivist principles, which are claimed to lead to greater value being placed on higher order cognitive learning (Tobin & Fraser 1990). The project reported considerable diversity in the methods these teachers used, but nevertheless produced four assertions concerning exemplary science teachers (Tobin & Fraser 1988, 1990).

**International classroom learning environment**

Using students' and teachers' perceptions to study educational environments can be contrasted with the external observer's direct observation and systematic coding of classroom communication and events (Brophy & Good 1986). Murray (1938) introduced the term alpha press to describe the environment as assessed by a detached observer and the term beta press to describe the environment as perceived by milieu inhabitants. Another approach to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, case study or interpretive research. Defining the classroom or school environment in terms of the shared perceptions of the students and teachers has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data which the observer could miss or consider unimportant. Students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if teachers are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this chapter, discussion focuses on the merits of combining quantitative and qualitative methods when studying educational environments (Fraser & Tobin 1991).

**Classroom Learning Environment Instrument Background**

In the past four decades, there are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Biology (Walberg & Anderson 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979, Moos & Trickett 1987). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley 1990; von Saldern 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).

**International Instruments for Assessing Classroom Environment**

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualized Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCIEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. the name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos's (1974) scheme for classifying human environments.

**Actual and Preferred Form Scales**

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

This study was thus decided to build on this past research and focus this study on the identification and description of exemplary Biology teachers. However, the study is distinct in that it uses the perceptions of students in the identification of these teachers. Because this was our first investigation of the use of the QTI in such a way, this study has been preferred to use the term better to describe these Biology school teachers in Sarakhampittayakom School in Mahasarakham Province, Thailand.
Research Purposes
1. To analyze a valid and reliable the actual and preferred forms of the Questionnaire on Teacher Interaction instrument when used in this study.
2. To investigate the factors influencing student’s perceptions of their teacher interpersonal behaviours in biology classroom learning environments at Grade 11 in Rajabhat Maha Sarakham University Demonstration School classes.
3. To compare between students’ perceptions of their actual and preferred teacher interpersonal behaviours in biology classroom learning environments at Grade 11 in Rajabhat Maha Sarakham University Demonstration School classes.
4. To associate between students’ perceptions of their science attitudes to their actual teacher interpersonal behaviours toward biology classroom learning environments at Grade11 in Rajabhat Maha Sarakham University Demonstration School classes.

Literature Review
This study discusses the biology classroom learning environment instrument selected for use in this research. The rationale for the selection of the Questionnaire on Teacher Interaction (QTI) is followed by a discussion of the climate of classroom environments including how administering is one of unique features of educational reform with in science classroom environment and therefore, the selection of the Test Of Biology-Related Attitude (TOBRA). Because students’ perceptions of Biology classroom environment have been favourably associated with student’s attitude to Biology classroom environment’s management, it was decided to select an appropriate measure of students’ attitudes. Recent reviews (Fraser 1998, Fraser & Walberg 1991) show that science education researchers have led the world in the field of classroom environment over the last four decades, and that this field has contributed much to understanding and improving science education. For example, classroom environment assessments provide a means of monitoring, evaluating and improving science teaching and curriculum. The QTI has been shown to be a valid and reliable instrument when used in The Netherlands (Wubbels & Levy, 1993). When the 64-item USA version of the QTI was used with 1,606 students and 66 teachers in the USA, the cross-cultural validity and usefulness of the QTI were confirmed. Using the Cronbach alpha coefficient, Wubbels and Levy (1993) reported acceptable internal consistency reliabilities for the QTI scales ranging from 0.76 to 0.84 for student responses and from 0.74 to 0.84 for teacher responses. Regarding students’ cognitive outcomes, the more those teachers demonstrated strict, leadership and helping/friendly behaviour, the higher were cognitive outcomes scores. Conversely, student responsibility and freedom, uncertain and dissatisfied behaviours were related negatively to achievement. Wubbels and Brekelmans (1998) stated that student outcomes are related to student perceptions of teacher behaviours with affective outcomes displaying a greater association than cognitive outcomes. In fact, studies into student teacher interactions suggest that teachers ‘using open teaching styles are able to control student input and procedures in class in order to avoid disorder (Wubbels & Brekelmans 1998). Wubbels and Levy (1993) claimed that student perceptions of interpersonal teacher behaviour appear to account for 70 percent of the variability in student achievement and 55 percent for attitude outcomes. The QTI has become a popular instrument in research on teaching, teacher education and learning environments, has been translated into more than 15 languages and has been the focus of well over 120 (learning environment) studies in many countries since its development (den Brok et al., 2004). The Australian version of the QTI has 48 items which are arranged in cyclic order in blocks of four to facilitate hand scoring by teachers. Items 1 to 24 assess the four scales called Leadership, Understanding, Uncertain and Admonishing behaviours, and Items 25 to 48 assess the scales called Helping/Friendly, Student Responsibility/Freedom, Dissatisfied and Strict behaviours. Waldrip and Fisher (2002) reported of their purpose of the study described in this paper was to identify and describe exemplary science teachers using the Questionnaire on Teacher Interaction (QTI). With a sample of 493 science students, the reliability of the QTI scales ranged from 0.69 to 0.87. Results of past studies with the QTI usually demonstrated the importance of students’ perceptions of their teachers’ behavior for both cognitive and affective student outcomes, den Brok and his colleagues (2004) reported positive relations of both dimensions to cognitive and affective students’ outcomes. In another study, higher students’ perceptions on the Influence dimension were associated with higher student outcomes on a Biology test (Brekelmans, Wubbels, & den Brok, 2002). Although not always straightforward, relationships between Proximity and cognitive outcomes were determined in many studies (for an overview see Wubbels et. al., 2006), some of which have also been reported in the Journal of Classroom Interaction (den Brok, Fisher, & Koul, 2005a; den Brok, Levy, Brekelmans, & Wubbels, 2005; Kyriakides, 2005). While positive effects of both dimensions on affective outcomes were found in most studies, stronger effects have been reported for Proximity than for the Influence dimension (den Brok et al., 2004; Wubbels et al., 2006).
Methodology

The aim of this study was to use the QTI to identify and describe the better Biology teachers. These better teachers were identified through very favourable scores on particular scales of the Questionnaire on Teacher Interaction (QTI). Associations between students’ perceptions and their attitude toward Biology classroom learning environments were determined with students.

Research Instruments

**Questionnaire on Teacher Interaction (QTI)**

Research which originated in The Netherlands focuses on the nature and quality of interpersonal relationships between teachers and students (Creton, Hermans & Wubbels 1990; Wubbels, Brekelmans & Hooymayers, 1991; Wubbels & Levy, 1993). Drawing upon a theoretical model of proximity (cooperation-opposition) and influence (dominance-submission), the QTI was developed to assess student perceptions of eight behaviour aspects. Each item has a five-point response scale ranging from Never to Always.

![Diagram of QTI](image)

(b) Leary model of interpersonal behaviour (Wubbels, Creton, Levy & Hooymayers, 1993, p.15) and Model for administrator interpersonal behaviour characteristics (Wubbels, 1993).

Although research with the QTI began at the senior high school level in The Netherlands, cross-validation and comparative work has been completed at various grade levels in the USA (Wubbels& Levy 1993), Australia (Fisher, Henderson & Fraser 1995), Singapore (Goh& Fraser 1996) and Brunei (Riah, Fraser & Rickards 1997), and a more economical 48-item version has been developed and validated (Goh & Fraser 1996). Also, Cresswell and Fisher (1997) modified the QTI to form the Principal Interaction Questionnaire (PIQ) which assesses teachers’ or principals’ perceptions of the same eight dimensions of a principal’s interaction with teachers. Further information about research involving the QTI can be found in Wubbels and Brekelmans (1997).

An instrument to measure these perceptions in terms of the MITB, the Questionnaire on Teacher Interaction (QTI), the interpersonal behavior of a teacher is described along two dimensions - an influence dimension and a proximity dimension. The influence dimension describes the degree of control of the teacher over the communication process, the proximity dimension the degree of cooperation or opposition between the teacher and the students. The two dimensions can be depicted in a two-dimensional plane that can be further subdivided into eight categories or sectors of behavior: Leadership (DC), Helpful/Friendly (CD), Understanding (CS), Student Freedom (SC), Uncertain (SO), Dissatisfied (OS), Admonishing (OD) and Strictness (DO). Each sector can be described in terms of the two dimensions: Leadership, for example, contains a high degree of Influence and some degree of Cooperation; Helpful/Friendly behavior some degree of dominance and a high degree of cooperation (see Figure 1). Each sector can be described in terms of the two dimensions: Leadership, for example, contains a high degree of Influence and some degree of Cooperation; Helpful/Friendly behavior some
degree of dominance and a high degree of cooperation (see Figure 2). Classroom environment research has involved students in Western countries; Turkey is a relatively new participant in this domain.

**The Test Of Biology-Related Attitude (TOBRA)**

In addition to the main questionnaires QTI, and the Test Of Biology-Related Attitudes (TOBRA), this adapted version from the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981a). The TOBRA questionnaire was selected to use with the aim of investigating any possible relationships with students' perceptions about their Biology teacher's interpersonal behaviour in management on Biology classroom learning environments in upper secondary educational school classes of classroom’s administration environments. The TOBRA consists of eight items.

**Research Procedure**

Using the QTI instrument was followed as for assessing students’ perceptions of their actual form on the 10th -12th week, and preferred form on the 14th week and the TOCRA on the 15th week for associating Biology classroom learning environments in upper secondary education students at Grade 11 level in 3 classes in Rajabhat Maha Sarakham University Demonstration School classes. Each scale of the QTI were composed with 6-item, minimum scoring is 0 and maximum score is 24. The first scale, Leadership behaviour is composed the item of 1, 5, 9, 13, 17 and 21; the second scale, Helpful and Friendly behaviour is composed the item of 2, 6, 10, 14,18 and 22; the third scale, Uncertain behaviour is composed the item of 3, 7, 11, 15, 19 and 23; the forth scale, Dissatisfied behaviour is composed the item of 4, 8, 16, 20 and 24; the fifth, Student Responsibility and Freedom scale is composed the item of 25, 29, 33, 37,41 and 45; the sixth, Understanding behavior is composed the item of 26, 30, 34,38, 42 and 46; the seventh, Admonishing behaviour is composed the item of 27, 31, 35, 43 and 47; the eighth, Strict behavior is composed the item of 28, 32, 35, 44 and 48.

**Data Analysis**

Quantitative data were obtained using the two questionnaires (QTI and TOBRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual QTI scale to investigate whether students have significant different perceptions of their actual and preferred teacher interpersonal behaviours.

**Sample**

The main study involved, improved and developed the upper secondary educational students’ Biology classroom learning environments of their actual and preferred perceptions with a sample size of 126 students in 3 Biology classes at Grade 11 in Sarakhampittayakom School, Muang District in Mahasarakham province, Thailand.
Results

Validity and Reliability of Research Instrument

D. Validation of the QTI

Description of quantitative data of analyzing responses for students’ perceptions Master of Science teacher student’s assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the QTI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>21.18</td>
<td>3.53</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.14</td>
<td>3.69</td>
<td>0.10</td>
<td>0.31</td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>Actual</td>
<td>20.64</td>
<td>3.44</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.44</td>
<td>3.74</td>
<td>0.09</td>
<td>0.30</td>
</tr>
<tr>
<td>Understanding</td>
<td>Actual</td>
<td>22.08</td>
<td>3.68</td>
<td>0.13</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.80</td>
<td>3.80</td>
<td>0.08</td>
<td>0.29</td>
</tr>
<tr>
<td>Student Responsibility and Freedom</td>
<td>Actual</td>
<td>21.78</td>
<td>3.58</td>
<td>0.13</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>21.48</td>
<td>3.63</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td>Uncertain</td>
<td>Actual</td>
<td>3.98</td>
<td>0.66</td>
<td>0.42</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>2.16</td>
<td>0.36</td>
<td>0.10</td>
<td>0.32</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>Actual</td>
<td>2.08</td>
<td>0.34</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>1.70</td>
<td>0.29</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td>Admonishing</td>
<td>Actual</td>
<td>2.47</td>
<td>0.41</td>
<td>0.18</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>2.55</td>
<td>0.43</td>
<td>0.19</td>
<td>0.43</td>
</tr>
<tr>
<td>Strict</td>
<td>Actual</td>
<td>8.76</td>
<td>1.46</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>11.05</td>
<td>1.84</td>
<td>0.18</td>
<td>0.43</td>
</tr>
</tbody>
</table>

The results given in Table 1 show that on average item means for each of the five QTI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 0 and 24, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the QTI. For the remaining eight scales, namely; Leadership, Helpful/Friendly, Understanding, Student Responsibility and Freedom, Dissatisfied, Uncertain, Admonishing, and Strict scales.

This characteristic was explored using a series of one-way analyses of variance on the scales of the QTI, which suggests that each scale of the QTI was able to differentiate significantly \((p<0.05)\) between students’ perceptions in my school and my dream school environmental climates in the same school.

In Table 2 the internal consistency reliability of the version QTI used in this study was determined by calculating Cronbach alpha coefficient for the 48 items of the QTI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the QTI, which ranged from 0.53 to 0.79 when using the students’ actual climate scores and from 0.78 to 0.92 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the QTI, which suggests that each scale of the QTI was able to differentiate significantly \((p<0.05)\) between students’ perceptions in my school and my dream school environmental climates in the same school.

The \(t\)-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 2.21 to 36.80 for different scales, respectively.
Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the QTI.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>ANOVA results t-test</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Actual</td>
<td>0.79</td>
<td>0.65</td>
<td>11.11</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helpful/friendly</td>
<td>Actual</td>
<td>0.62</td>
<td>0.68</td>
<td>4.34</td>
<td>0.003**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding</td>
<td>Actual</td>
<td>0.53</td>
<td>0.70</td>
<td>14.29</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.70</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student responsibility/freedom</td>
<td>Actual</td>
<td>0.58</td>
<td>0.68</td>
<td>3.48</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td>Actual</td>
<td>0.68</td>
<td>0.63</td>
<td>2.21</td>
<td>0.005***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>Actual</td>
<td>0.75</td>
<td>0.66</td>
<td>7.67</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.79</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admonishing</td>
<td>Actual</td>
<td>0.58</td>
<td>0.68</td>
<td>11.81</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.67</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strict</td>
<td>Actual</td>
<td>0.70</td>
<td>0.66</td>
<td>36.80</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.82</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Factor loading Analysis of the QTI
The Actual and Preferred Forms of the QTI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the QTI. Table 4 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
### Table 4.

#### Factor Loading for Items in the Actual Form of the QTI

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>0.89</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>21</td>
<td>0.81</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0.79</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>0.67</td>
<td>0.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>9</td>
<td>0.63</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>17</td>
<td>0.48</td>
<td>0.45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>14</td>
<td></td>
<td>0.66</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td></td>
<td>0.64</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>22</td>
<td></td>
<td>0.64</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td></td>
<td>0.63</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>10</td>
<td></td>
<td>0.80</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td></td>
<td>0.47</td>
<td>0.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td></td>
<td>0.76</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>19</td>
<td></td>
<td>0.76</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td></td>
<td>0.74</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>7</td>
<td></td>
<td>0.74</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td></td>
<td>0.58</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>23</td>
<td></td>
<td>0.52</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td></td>
<td>0.90</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>24</td>
<td></td>
<td>0.72</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td></td>
<td>0.68</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td></td>
<td>0.64</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>8</td>
<td></td>
<td>0.65</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td></td>
<td>0.23</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>29</td>
<td></td>
<td>0.92</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>41</td>
<td></td>
<td>0.86</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>45</td>
<td></td>
<td>0.82</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>33</td>
<td></td>
<td>0.77</td>
<td>0.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>37</td>
<td></td>
<td>0.70</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>25</td>
<td></td>
<td>0.49</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>42</td>
<td></td>
<td>0.89</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>34</td>
<td></td>
<td>0.87</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>26</td>
<td></td>
<td>0.82</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>30</td>
<td></td>
<td>0.79</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>46</td>
<td></td>
<td>0.77</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>38</td>
<td></td>
<td>0.59</td>
<td>0.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>39</td>
<td></td>
<td>0.85</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>31</td>
<td></td>
<td>0.82</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>43</td>
<td></td>
<td>0.82</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>27</td>
<td></td>
<td>0.80</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>35</td>
<td></td>
<td>0.51</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>47</td>
<td></td>
<td>0.26</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>40</td>
<td></td>
<td>0.87</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>36</td>
<td></td>
<td>0.83</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>28</td>
<td></td>
<td>0.77</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>32</td>
<td></td>
<td>0.76</td>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>44</td>
<td></td>
<td>0.57</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>48</td>
<td></td>
<td>0.17</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**% of variance**

<table>
<thead>
<tr>
<th></th>
<th>Act.</th>
<th>37.98</th>
<th>35.32</th>
<th>44.44</th>
<th>46.51</th>
<th>72.61</th>
<th>49.32</th>
<th>52.09</th>
<th>43.78</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pref.</td>
<td>43.34</td>
<td>36.36</td>
<td>45.63</td>
<td>47.35</td>
<td>75.32</td>
<td>55.66</td>
<td>54.45</td>
<td>53.35</td>
<td></td>
</tr>
</tbody>
</table>

**Eigenvalue**

<table>
<thead>
<tr>
<th></th>
<th>Act.</th>
<th>3.23</th>
<th>2.75</th>
<th>2.06</th>
<th>2.19</th>
<th>4.36</th>
<th>2.86</th>
<th>3.12</th>
<th>2.58</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pref.</td>
<td>3.92</td>
<td>3.79</td>
<td>3.78</td>
<td>3.29</td>
<td>4.48</td>
<td>3.31</td>
<td>3.29</td>
<td>3.48</td>
<td></td>
</tr>
</tbody>
</table>

*loading smaller than 0.30 omitted. The sample consisted of 126 students*

### The Circumplex Nature of the QTI

To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.
Table 3.
Scale Intercorelations for the QTI Using the Actual and Preferred Forms.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Lea</th>
<th>Hfr</th>
<th>Und</th>
<th>Stu</th>
<th>Unc</th>
<th>Dis</th>
<th>Adm</th>
<th>Stc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hfr</td>
<td>Actual</td>
<td>0.72**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.96**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Und</td>
<td>Actual</td>
<td>0.71**</td>
<td>0.76**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76**</td>
<td>0.80**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stu</td>
<td>Actual</td>
<td>0.76**</td>
<td>0.64**</td>
<td>0.86**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.84**</td>
<td>0.80**</td>
<td>0.77**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unc</td>
<td>Actual</td>
<td>-0.32</td>
<td>-0.19</td>
<td>-0.25</td>
<td>-0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.20</td>
<td>-0.45</td>
<td>-0.37*</td>
<td>-0.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dis</td>
<td>Actual</td>
<td>-0.35</td>
<td>-0.32</td>
<td>-0.30</td>
<td>-0.19</td>
<td>0.82**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.61**</td>
<td>-0.65**</td>
<td>-0.64**</td>
<td>-0.51**</td>
<td>0.67**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adm</td>
<td>Actual</td>
<td>-0.39*</td>
<td>-0.30</td>
<td>-0.24</td>
<td>-0.20</td>
<td>0.79**</td>
<td>0.79**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.23</td>
<td>-0.30</td>
<td>0.53**</td>
<td>-0.19</td>
<td>0.70**</td>
<td>0.55**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stc</td>
<td>Actual</td>
<td>-0.13</td>
<td>-0.14</td>
<td>-0.09</td>
<td>-0.18</td>
<td>0.44**</td>
<td>0.47**</td>
<td>0.56**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>-0.32</td>
<td>0.35*</td>
<td>-0.42*</td>
<td>-0.41*</td>
<td>0.55</td>
<td>0.44*</td>
<td>0.54**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Validation of the TOBRA
To measure Master of Science teacher students’ attitudes towards science educational management class, the present study adapted the eight-item the Test Of Biology-Related Attitude (TOBRA) (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005, Santiboon & Fisher, 2004; Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014; Sittikosol & Malone, 2008), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the Attitude Scale had a value of 0.79 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of Their Actual and Preferred Forms in Chemistry Classroom Learning Environment
On comparing differences between the students' perceptions of their actual and preferred chemistry teacher interpersonal behaviour at Grade 11 level in Figure 1. Each student in the sample responded to the QTI and the results for each class were calculated as scores on each scale of the QTI. The better teachers were identified as those, whose students' perceptions were more than one standard deviation above the mean on the scales of Leadership, Helping/Friendly, and Understanding and more than one standard deviation below the mean on the Uncertainty, Dissatisfied, Admonishing, and Strict scales.

![Figure 1](image_url)

*Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the QTI.*
The results of this study also indicate that using the QTI helps chemistry teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the chemistry classroom learning environment for upper secondary education students at Grade level 11.

**Associations between Master of Science Teacher Students’ Perceptions of Science Educational Management Learning Environment with the TOBRA**

In this study, it was also considered important to investigate associations between chemistry students’ perceptions of their chemistry classroom learning environment with their attitude toward chemistry classes. The Cronbach alpha reliability of the selected the TOBRA was 0.81, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in chemistry classroom learning environments. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOBRA that it’s reported in Table 5.

Table 5

**Associations between QTI Scale and TOBRA to Chemistry Classroom Learning Environments Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlate Attitude (r)</th>
<th>Standard Regress. Weight Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td></td>
<td>0.13*</td>
<td>0.16*</td>
</tr>
<tr>
<td>Helpful/friendly</td>
<td></td>
<td>0.21**</td>
<td>0.24**</td>
</tr>
<tr>
<td>Understanding</td>
<td></td>
<td>0.22**</td>
<td>0.23*</td>
</tr>
<tr>
<td>Student responsibility/freedom</td>
<td></td>
<td>0.25**</td>
<td>0.26**</td>
</tr>
<tr>
<td>Uncertain</td>
<td></td>
<td>-0.26**</td>
<td>-0.25**</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td></td>
<td>-0.22**</td>
<td>-0.23**</td>
</tr>
<tr>
<td>Admonishing</td>
<td></td>
<td>-0.23**</td>
<td>-0.22***</td>
</tr>
<tr>
<td>Strict</td>
<td></td>
<td>-0.22**</td>
<td>-0.22*</td>
</tr>
</tbody>
</table>

Multiple Correlation (R) 0.5563**

| R²                           | 0.3095**    |

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<.05) between students attitudinal outcomes and their science educational management classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their science educational management class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their Biology laboratory classroom environment on all scales of the Actual and Preferred Forms.

Table 5 is compared to investigate associations between students’ perceptions of their Biology classroom learning environments with their attitude toward Biology classes. Using the QTI instrument in the upper secondary education level, Rajabhat Maha Sarakham University Demonstration School, Thailand, will help teachers to evaluate their learning environments in Biology classroom learning environmental management in order to improve their education process. Furthermore, the information from the QTI could be useful as the guide to enhance the effectiveness of Biology classes. The effectiveness in Biology classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of the Biology classroom learning management of their teaching is for improving and developing students’ learning achievement successfully.

**Discussions and Implementations**

The actual and preferred perceptions of 126 Biology students at Grade 11 of their Biology classroom learning environments were measured with the QTI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their science educational management class. In general, students’ perceptions of their preferred classroom science environment in science educational management class to be greater than what they actually
perceive to be provided. The results of this study also indicate that using the QTI helps teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science educational management class, with regard to the QTI, it was found that all of five scales were positively associated with students’ attitude to science educational management class. The multiple correlation $R$ is significant for the QTI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 31%, with actual and preferred forms of the variance in students’ attitudes to their Biology classroom learning environments was attributable to their perceptions of their Biology classroom learning environments. The beta weights ($β$) show that in classes where the students perceived greater than all scales in their Biology classroom learning environment lessons.

As described in the results section, Rajabhat Maha Sarakham University Demonstration School’s students show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the QTI questionnaire. Overall, Rajabhat Maha Sarakham University Demonstration School students show relatively favourable perceptions of their science educational management lessons, with the lowest score occurring for the Differentiation scale. It seems that Biology classroom learning environments lesson activities related to Biology classes are operated rather as supplementary to theory classes rather than being independently important in their own right.

Overall, this study replicated previous studies using the QTI, with the findings being consistent with the situation in Rajabhat Maha Sarakham University Demonstration School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the Biology upper secondary education level at Grade 11, interestingly.

References


http://espace.library.curtin.edu.au/R/?func=bin-jump-full&object_


Measuring Students’ Perception of Actual Individualized Classroom Environment in Physics Laboratory Classes in Borabu Wittayakhan School at Twelfth-Grade Level

Piyanoot Chaiyaphon1, Kamol Ponkham2, Weeranoot Saijhan3 and Toansakul Santiboon*1
1Departmentof Master of Science Education, Faculty of Education Rajabhat Maha Sarakham University Maha Sarakham, Thailand 44000
2Departmentof Physic program, Faculty of Science and Technology Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
3Science Learning Group Section, Borabu Wittayakhan School Maha Sarakham, Thailand 44000
Corresponding Author E-mail: toansakul35@yahoo.com.au

Abstract

Adapting the Individualized Classroom Environment Questionnaire (ICEQ) is designed to measure student perceptions of actual classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This study reports data analyses which provide information about the validity of the ICEQ, factor loading analysis with item difference scores on actual form of the ICEQ, relationships between the five scales correlation of the ICEQ, and associations between student perceptions of their attitudes and perceptions of classroom individualization with a sample size of size 66 upper secondary educational students at Grade level 12 in 2 classes in Borabu Wittayakhan School, Maha Sarakham Province. Associations between student perceptions of the actual ICEQ and their attitude with the Test Of Physics-Related Attitude (TOPRA) toward physics classes were analyzed. The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all five ICEQ scales were found. Statistically significant proportions of variance were attributable to the physics class variable. Suggestions that the ICEQ may be considered to be a relatively good measure of physics classroom environment are provided. The multiple correlation $R$ is significant for the Actual Form of the ICEQ and shows that when the five scales are considered together there is significant ($\rho < 0.05$) association with the TOPRA, the $R^2$ value indicates that 39% of the variance in students’ attitude to their physics class was attributable to their perceptions of their individual classroom learning environment in physics classes.

Keywords: Physics classroom, Secondary education, Individualized instruction, Questionnaires, Student Attitudes, Borabu Wittayakhan School

Introduction

Comprehensive reviews of prior research in the field of classroom environment are available elsewhere in several books, a meta-analysis, a guest-edited journal issue, and numerous reviews. These sources indicate that the strongest tradition in past research has involved investigation of the predictability of students’ cognitive and attitudinal outcomes from their perceptions of classroom learning environment. In fact, a large number of studies conducted in numerous countries have provided consistent and strong support for the incremental predictive validity of students’ classroom perceptions in accounting for appreciable amounts of learning outcome variance, often beyond that attributable to student entry characteristics such as pretest performance and general ability. Examples of studies supporting the predictive validity of student perceptions of their science classroom environments include those conducted in the United States, India, Singapore, Korea, Taiwan, Malaysia, Indonesia, Nigeria, Japan, Netherlands, England, Vietnam, New Zealand, and Thailand. Moreover, this pattern of results is illustrated in the consistent findings of a recent meta-analysis of 12 studies of environment-outcome relationships involving more than 100,000 students in more than 30 national countries. Student learning was found consistently to be positively related to the levels of the five ICEQ scales. Moreover, having distinct actual and preferred forms allows use of these instruments in several interesting new lines of research discussed below. One advantage of having actual and preferred forms of classroom environment scales is that it permits investigation of actual forms. In fact, several studies have involved samples of students and teachers in responding to actual and preferred scales in order to investigate differences between student and teacher perceptions of the same actual classroom environment, and of discrepancies between preferred and actual environment. These interesting questions were explored using the CES in classes studying various subjects in the United States, using the ICEQ in science and social science classes in Australia, and
using both the CES and ICEQ in science classes in Australia. These studies provided two main patterns of consistent and fascinating results. First, students tended to prefer a more favorable classroom environment than they perceived as being actually present. Second, teachers tended to perceive the actual classroom environment more favorably than did their students in the same classroom. Another use of actual and preferred forms of classroom environment scales is in person environment fit studies of whether students achieve better when in their preferred environment. This research rests on the intuitively plausible idea that students’ preferences for classroom environment could mediate relationships between learning outcomes and actual environment. The ICEQ has been used in two separate person environment fit studies, one involving science and social science students and one involving science classes (Fraser, 1980b). These studies compared the achievement of students who do prefer classroom individualization with those who do not prefer individualization, when in classrooms with various levels of actual individualization. Evidence from both studies suggested that higher actual individualization was associated with higher learning levels only among students who preferred individualization. It tended to retard learning among students with opposite preferences. The important practical implication of this research is that students are likely to achieve better in classrooms in which there is similarity between the actual environment and that preferred by students. The long form of the ICEQ contains 50 items, with each of the five dimensions being assessed by 10 items. Each item is scored on a five-point scale with responses of Almost Never, Seldom, Sometimes, Often, and Very Often. The scoring direction is reversed for approximately half of the items. Typical items are “The teacher considers students’ feelings” (Personalization) and “Students choose their partners for group work” (Independence). Normative and validation data for the ICEQ is a fairly new instrument, a number of interesting research applications have been reported recently. These include predictive validity studies of relationships between students’ cognitive or affective outcomes and their perceptions of classroom environment, a study of differences between students and teachers in their perceptions of actual and preferred environment, a person-environment fit study of relationships between learning outcomes and the congruence between actual and preferred classroom environment, an investigation of association between classroom-level and school level environment, and the use of the preferred form of the instrument in an investigation of changes in and predictors of attitudes toward classroom individualization among beginning teachers in their first year of teaching. This study is adapted the Individualized Classroom Environment Questionnaire (ICEQ), a relatively new instrument developed to measure perceptions of classroom environment along dimensions which differentiate conventional classrooms from ones referred to as open or individualized (Rentoul & Fraser, 1979; Fraser 1980b). The name of the ICEQ’s five scales are Personalization, Participation, Independence, Investigation, and Differentiation. Also, the ICEQ has been used in previous studies to measure students’ or teachers’ perceptions and to assess both actual physics classroom environment.

**The Institute for the Promotion of Teaching Science and Technology (IPST)**

There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as; curricula, teaching/learning process, media and materials then publicize them to all relevant organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner’s development, To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations (IPST, 2011).

**Instruments for Assessing Classroom Environment**

Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCIEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos's (1974) scheme for classifying human environments. Moos’s three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur) and System Maintenance and
System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Context in Borabu Wittayakhan School
Focused on Borabu Wittayakhan School is a rural or government school located in downtown Nongsim Subdistrict, Borabu district, Maha Sarakham Province, Thailand. It admits from lower to upper secondary students (Grade level at of 7-12) and has the largest yearly enrolment in Nongsim District in Borabu Province (the country. Founded in 1974 as a 59 Chao Sanit road, Nong sim Subdistrict, Borabu District, Maha Sarakham Province for supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. Borabu Wittayakhan School as among the development, enhancement, and improvement entry rates for local Thai schools. The school has 10 buildings, 61 classrooms, 5 laboratory classes. This school composes with 2330 students, 100 senior professional teachers, a schooling administrator is Manolchai Tapjarean ,Weeranoot Saijhan is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

Materials and Methods

Research Objectives
1. To describe and investigate of actual students’ perceptions in physic classroom learning environments for using the ICEQ in Borabu Wittayakhan School at Grade level 12
2. To analyzes of reliability and validity of the ICEQ and the TOPRA research instrument will use in Borabu Wittayakhan School at Grade level 12
3. To associate between students’ perception of their actual individual physic classroom learning environments and their physical attitudes.

Previous Researches
A series of other studies has used student perceptions of classroom environment as dependent variables in investigating factors affecting classroom environment. For example, studies of science classrooms have revealed interesting relationships between the nature of the learning environment and teacher personality (Walberg 1968), class size (Walberg, 1998), wait-time (Cohen, 1978, 2000), grade level (Welch, 1979, 2001), and type of school (Hofstein et al., 1980, 1997, 2003). Also, other studies involving samples of students in a variety of subject areas have established associations between the nature of the classroom environment and the school subject matter (Anderson, 1971; Hear & Moos, 1978, 1999; Kuert, 1979, 2001) and characteristics of the school-level environment (Fraser & Rentoul, 1981, 2000, 2008).

Fraser (2005) used dull classroom environments, poor students’ attitudes and inhibited conceptual development led to the creation of an innovative mathematics program, the Class Banking System (CBS), which enables teachers to use constructivist ideas and approaches. To assess the effectiveness of the CBS, the Individualized Classroom Environment Questionnaire (ICEQ), Constructivist Learning Environment Survey (CLES), Test of Mathematics-Related Attitudes (TOMRA), and concept map tests were administered to two groups of fifth-grade students as pretests and posttests over an academic year. To enrich the data collected from those questionnaires, three case studies (one for the experimental group and two for the control group) were undertaken based on observations and interviews of selected students. Relative to non-CBS students, CBS students experienced more favorable changes in terms of mathematics concept development, attitudes to mathematics, and perceived classroom environments on several dimensions of the CLES (e.g., Personal Relevance, Shared Control) and the ICEQ (e.g., Participation and Differentiation). Qualitative information based on classroom observations and student interviews reinforced and enriched the patterns of results obtained from the concept test and questionnaires.

Research Procedures
Using the ICEQ was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOPRA on the 7-8th week for associating Physical classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 12 in Borabu Wittayakhan School, Maha Sarakham Province
Each scale of the ICEQ were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16 and 21; the second scale, Friction is composed the item of 2, 7, 12, 17 and 22; the third scale, Difficulty is composed the item of 3, 8, 13, 18 and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 14, 19 and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, 20 and 25.
Data Analyses
Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred ICEQ forms and the Attitude scale as specified in Santiboon (2014). Factorial validity and adequacy of fit for the dimensionality of the ICEQ were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the ICEQ with students’ attitudes to associate were analyzed.

Sample
This study is explored and described based on the developing students’ Physical classroom environment with actual and preferred student’s perceptions with a sample size 66 upper secondary educational students at Grade level 12 in 2 classes in Borabu Wittayakhan School, Maha Sarakham Province, in the first semester in academic year 2015.

Research Instruments
The Individual classroom Environments Questionnaire (ICEQ)
The ICEQ assesses those dimensions which distinguish individualized classrooms from conventional ones. The initial development of the ICEQ was guided by: the literature on individualized, open and inquiry-based education; extensive interviewing of teachers and secondary school students; and reactions to draft versions sought from selected experts, teachers and junior high school students. The final published version of the ICEQ (Fraser, 1990) contains 50 items altogether, with an equal number of items belonging to each of the five scales. Each item is responded to on a 5-point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items. Typical items are “The teacher considers students’ feelings” (Personalization) and “Different students use different books, equipment and materials” (Differentiation). The copyright arrangement gives permission to purchasers to make an unlimited number of copies of the questionnaires and response sheets.

The Test of Physics-Related Attitude (TOPRA)
This study investigated associations between actual students’ perceptions of their Physical classroom environment classes in Borabu Wittayakhan School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) and Santiboon (2014) was modified, adapted, and selected to the Test Of Physics-Related Attitude (TOPRA) was associated. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOPRA is designed to measure ten distinct science-related attitudes among physics laboratory environment classes in Borabu Wittayakhan School’s students. The ten items are suitable for group administration and all can be administered within the duration of actual students’ perceptions of their chemistry laboratory environment classes. Furthermore, the TOPRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Results
Validation and Reliability of Research Instruments

Validation of the ICEQ
Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean score</th>
<th>Mean variance</th>
<th>Standard validation</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>24.20</td>
<td>4.53</td>
<td>0.18</td>
<td>1.26</td>
<td>0.81</td>
<td>0.71</td>
</tr>
<tr>
<td>Participation</td>
<td>24.24</td>
<td>4.81</td>
<td>0.15</td>
<td>1.35</td>
<td>0.77</td>
<td>0.72</td>
</tr>
<tr>
<td>Independence</td>
<td>24.32</td>
<td>4.75</td>
<td>0.14</td>
<td>1.25</td>
<td>0.76</td>
<td>0.71</td>
</tr>
<tr>
<td>Investigation</td>
<td>23.92</td>
<td>4.78</td>
<td>1.48</td>
<td>1.28</td>
<td>0.74</td>
<td>0.71</td>
</tr>
<tr>
<td>Differentiation</td>
<td>25.11</td>
<td>4.91</td>
<td>1.02</td>
<td>0.98</td>
<td>0.78</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Table 1 provides information about each scale’s internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms.
The Circumplex Nature of the ICEQ

To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next to a scale generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 2
Scale Intercorelations for the ICEQ Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.68**</td>
<td>0.84**</td>
<td>0.82**</td>
<td>0.77**</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.87**</td>
<td>0.85**</td>
<td>0.79**</td>
<td>0.88**</td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.73**</td>
<td>0.82**</td>
<td>0.79**</td>
<td>0.85**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Factor loading Analysis of the ICEQ
The Actual Form of the ICEQ was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the ICEQ. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

Table 3.
Factor Loading for Items in the Actual Form of the ICEQ.

<table>
<thead>
<tr>
<th>Item</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>0.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.90</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.89</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.46</td>
</tr>
<tr>
<td>% of variance</td>
<td>72.61</td>
<td>41.73</td>
<td>45.32</td>
<td>42.53</td>
<td>52.93</td>
</tr>
<tr>
<td>Eigen value</td>
<td>3.04</td>
<td>2.08</td>
<td>1.85</td>
<td>2.44</td>
<td>2.58</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 88 students
Associations between Student Attitudes and Physics Classroom Environments
The strongest tradition in past classroom environment research has involved investigation of associations between students’ cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics.

In this study, it was also considered important to investigate associations between students’ perceptions of their physics classroom learning environments with their attitudes toward physics. The selection of an evaluation and assessment instrument suitable for confirming the third research purpose was required. The internal consistency of the selected TOPRA was 0.79, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in physics classes.

Two main methods of data analysis were used to investigate this environment attitude relationship. These involved: simple correlational analyses of relationships between students’ perceptions of actual physics laboratory classroom environments with their attitude toward physics; and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOPRA. The summary of the result of this analysis is reported in Table 4.

The simple correlation values (r) are reported in Table 4 which show significant correlations (p<0.01) between students’ attitudinal outcomes and physics laboratory classes on all of five scales. These associations are positive for all of scales of Personalization, Participation, Independence, Investigation and Differentiation scales. That is, in physics laboratory class environment where the teachers perceived a more favorable attitude towards their physics laboratory environment.

Table 4.
Associations between ICEQ scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form Simple Correlate Attitude (r)</th>
<th>Std. Regress Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.21**</td>
<td>0.28**</td>
</tr>
<tr>
<td>Participation</td>
<td>0.23**</td>
<td>0.26**</td>
</tr>
<tr>
<td>Independence</td>
<td>0.27**</td>
<td>0.28**</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.22**</td>
<td>0.23**</td>
</tr>
<tr>
<td>Differentiation</td>
<td>0.26**</td>
<td>0.28**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6207**</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.3853**</td>
<td></td>
</tr>
</tbody>
</table>

The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between students’ perceptions on each scale of the ICEQ and their attitudes towards physics laboratory classes when the effect of relationships between the scales is controlled. The multiple correlation R is significant for Actual Forms of the ICEQ and shows that when the scales are considered together there is a significant (p<0.01) association with the TOPRA. The $R^2$ value indicates that 39% of the variance in teacher’s attitude to their school administration environment was attributable to their perceptions of their physics teachers. The beta weights (β) show that in physics laboratory environments where the teachers perceived management a more favorable attitude towards their physics laboratory environment.

Conclusions and Discussions
The results of this study have described the development and validation of short forms of the Individualized Classroom Environment Questionnaire (ICEQ). In addition to a short form of each instrument measuring perceptions of actual environment, a short form of the ICEQ and CES measuring preferred environment was also developed. The short form of each instrument contains 25 items, provides a rapid and economical assessment of student perceptions of psychosocial characteristics of classroom learning environment, and can be used to provide reliable information about class mean perceptions (rather than individual student perceptions).

Support for the validity of the short forms of the ICEQ was obtained by using the class mean as the unit of analysis in a variety of analyses based on samples of less than 100 science classes. In particular, for each
scale in each of the short forms developed, it was found that the correlation actual form was very large, and that the internal consistency reliability and discriminant validity were satisfactory.

Other analyses performed for the actual form of the short version of each instrument attested to each short scale’s ability to differentiate between the perceptions of students in different classrooms, and to its predictive validity (i.e., its ability to predict cognitive and affective outcomes). The ICEQ is likely to be used by researchers, curriculum evaluators, and teachers to replicate, consolidate, and extend the traditions of past research which involved use of the form of these scales and which were discussed in greater detail earlier in this article. Further studies of the predictive validity of the short forms of association between learning outcomes and environment perceptions) could be pursued for a variety of student ages and cultures and using various cognitive, affective, and psychomotor outcome criteria. Similarly, there is scope for employing classroom environment characteristics as criterion variables in studies into factors influencing the classroom environment.

In particular, curriculum evaluators and teachers have not used classroom environment criteria nearly as much as they might have when evaluating educational innovations, new curricula, or teaching approaches. Similarly, the short forms could be used in research analogous to prior studies which have investigated various factors (e.g., class size, grade level, subject matter, type of school) which affect the classroom environment. This article also identified several promising new research directions which are based on the use of both actual and preferred forms of classroom environment scales. These include investigations of differences between student and teacher perceptions of actual and preferred environment, person environment fit studies of whether students achieve cognitive and affective aims better when in their preferred environment, and practical attempts by teachers to make use of environment assessments in facilitating improvements in their classrooms. It is hoped that the existence of the economical and reliable short forms of the classroom environment instruments described in this article will assist researchers and teachers wishing to follow some of these promising directions.

This study evidences confirmation of the research studies at the four past decades, for example; using the ICEQ, associations with students' cognitive and affective outcomes have been established for a sample of approximately 68 senior high school chemistry classes in (Fraser & McRobbie 20035; McRobbie & Fraser 2005), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 2007) and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser 2006). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (2005a) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the QTI, associations between student outcomes and perceived patterns of teacher—student interaction were reported for samples of 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 2005), 3,994 high school science and mathematics students in Australia (Fisher, Fraser & Rickards 2007) 1,512 primary school mathematics students in Singapore (Goh, Young & Fraser 2005) and 2,256 lower secondary science dream school project students in Thailand (Santiboon, 2013).

Acknowledgments

Firstly, I would like to thank the 72 students in Borabu Wittayakhan School at the Grade level 12 who were part of the study. Thank you to the Manolchai Tapjarean, Ratirhat Khammoon and Pattana Wongdorkmai who allowed students to complete the questionnaire.

Second, I must thank you my supervisor; Dr. Kamol Polkham and Assist. Prof. Dr. Toansakul Santiboon; my co-supervisor, they understood and never pushed me to build up of my research that it was going on work, completely.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra editor and reviewer, he has understood my professional and personal commitments throughout the this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Students’ Perceptions of their Science Classroom Environments and their Attitudes toward Science Classes

Piyarat Tumtard¹, Somsanguan Passago², Sukanya Chaemmo³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
²Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
³Science Learning Group Section, Burapha Pittayakhan Municipal School, Maha Sarakham, Thailand 44000

(*author for correspondence, E-mail: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

The aims of this study are to determine students’ perceptions of their actual and preferred classroom learning environments and their attitudes toward science classes of What is Happening in this Class (WIHIC) questionnaire, from the earlier version developed by Fraser, Fisher and McRobbie (1996), was used. Relationships between students’ attitude and actual perceptions of science classroom learning environments. The 8-Items Test Of Science-Related Attitudes (TOSRA), was used to measure the attitudes of students toward science. The original test, produced Cronbach alpha coefficient values, indicating that TOSRA had good internal consistency reliability. It has found that the correlation analysis indicated a positive correlation at the 0.01 level between the all scales of the WIHIC associate with the TOSRA. The highest significant correlation was measured and this occurred between the scales of the WIHIC and the TOSRA. The eight scales identified of the WIHIC showed a positive correlation and yielded the greatest number of significant correlations and was chosen for multiple regression analysis. Associations between students’ perceptions of their attitudes toward their meteorology classes were chosen as the dependent variable and associated to the summary of the model to the correlation coefficient significant for the WIHIC and considered associations with the TOSRA at 42% of the variance in students’ attitude were also provided. Recommendations, to serve the needs of grade 7, science students better, lower secondary school educators and administrators should pay particular attention to the findings recorded in the descriptive statistics of this study.

Keyword: Science classroom, Learning environment, Student, Perceptions

Introduction

Background of Classroom Learning Environment Research

A recent and comprehensive review of international work on the conceptualization, assessment, and investigation of student perceptions of psychosocial characteristics of the learning environment of science classrooms highlights the considerable growth in interest in this area (Fraser & Walberg, 1981) [2]. Three important instruments which have been used in prior research are the Individualized Classroom Environment Questionnaire (ICEQ) (Rentoul & Fraser, 1979) [3], the My Class Inventory (MC1) which is a simplified version of the more widely, used Learning Environment Inventory (Anderson, Walberg, & Fraser, 1982) [4], and the Classroom Environment Scale (CES) (Moos & Trickett, 1974) [5]. Despite the proven general usefulness of these instruments, however, a sizable number of researchers and teachers have found that they would prefer a more rapid and economical method of assessing classroom environment than is afforded by these instruments. Consequently, the present study was undertaken for the purpose of developing and validating short forms of the ICEQ, MC1, and CES. Prior to discussing these short forms, however, important background information is provided in the following two sections which are devoted to, respectively, a brief review of prior classroom environment research and a description of the long forms of the ICEQ, MC1, and CES.

While the above mentioned learning environment research instrument contributed to a better understanding of the socio-psychological climate of the classrooms, some researchers felt that there was a need for a single instrument which incorporated some of the best features of the instruments previously constructed. Based on past studies, Fraser, Fisher, and McRobbie (1996) [1] developed a new learning environmental instrument named What Is Happening In This Class? (WHIC), which incorporate scales have been used and proven to be significant predictors of learning outcomes. They also included additional scales which were designed to measure current concerns in the classrooms, such as equity issues.
Since its development, the WIHIC has been used to measure the psychosocial aspects of the classroom learning environment in various contexts. In some research, the questionnaire has been used without any modification, and in others the questionnaire was adapted to suit a specific context. To date the original questionnaire in English has been translated into the Chinese language for use with Chinese medium students in Taiwan and Singapore, and the Korean language for use in Korea.

The science classroom learning researches were developed and explored to study in terms of cultural differences was highlighted and it appears that the education system in Taiwan is examination-driven and teaching styles are adopted to suit this particular situation. It was found that in Taiwan the most important element of being a good teacher was perceived as having good content knowledge, but in Australia, having good interpersonal relations between teacher and students may be considered the most important element in the education process. Taiwanese classrooms offer a teacher-centered lesson in which students appear to play a passive role and there were only few opportunities to discuss or question. This study suggests that the WIHIC questionnaire was able to differentiate between cultural differences and therefore maybe suitable for cross-cultural studies.

Associations between perceptions of learning environment and attitudinal outcomes were reported by Hunus and Fraser (1997) [6] when they used a modified version of WIHIC for 644 students in Year 10 chemistry classes in Brunei. In their study, reliability coefficients of 0.75 to 0.89 were found and simple and multiple correlation analyses show that there was a significant relationship between the set of environment scales and students’ attitudes towards chemistry theory classes. Using the individual student as the unit of analysis, Student Cohesiveness, Teacher Support, Involvement, and Task Orientation scales were found to be positively associated with the students’ attitudes. The results further suggested that students perceived moderately positive learning environments in chemistry theory classes in terms of Student Cohesiveness, Teacher Support, Involvement and Investigation. A highly positive environment on Task Orientation and Cooperation was also detected in the chemistry classrooms. However, the students in Brunei perceived that they had relatively little autonomy and independence in their classes.

The What Is Happening In this Class (WIHIC) questionnaire, from the earlier version developed by Fraser, Fisher and McRobbie (1996) [1], was used to measure students’ perceptions of their classroom environment. The five possible responses were: Almost Never; Never; Sometimes; Often; and Almost Always. The 56-Item questionnaire contained the following eight scales with seven items. The purpose of this study will be to investigate the background of the study of learning environment and to introduce a recently developed questionnaire called What is Happening in This Class (WIHIC), that it will be used in education system in Thailand. The questionnaire will be designed to measure students’ perception of their science classroom environment in lower secondary education various school classes.

**Research Purposes**

16. To assess student’s perceptions of their science classroom learning environment for lower secondary educational students at Grade 8 in Burapha Pittayakharn Municipal School, Maha Sarakham Province.
17. To compare between students’ perceptions of their actual and preferred science classroom learning environment for lower secondary educational students at Grade 8 in Burapha Pittayakharn Municipal School, Maha Sarakham Province.
18. To associate between students’ science attitudes and their actual perceptions toward their science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 8 in Burapha Pittayakharn Municipal School, Maha Sarakham Province.

**Literature Reviews**

Smith and Ezeife (2010) [7] studied in Canada to determine if there was a statistically significant relationship between students’ perceptions of the classroom environment and their attitudes toward science in grade nine applied science. The following research question guided the study. What is the strength of the relationship between students’ perceptions of their classroom environment and their attitudes to science in grade nine applied science classrooms?

Aldridge, Fraser and Ntuli (2009) [8] examined the viability of using feedback from a learning environment instrument to guide improvements in the teaching practices of in-service teachers undertaking a distance-education programme. The 31 teachers involved administered a primary school version of the What Is Happening In this Class? (WIHIC–Primary) questionnaire to their 1,077 learners in order to determine preferred and actual classroom environments. Feedback about discrepancies between learners’ actual preferred learning environments were used to formulate teaching strategies to reduce discrepancies over a 12-week intervention period. In-service teachers’ reports, contact sessions, interviews between teachers and researchers, and three case studies based on classroom visits (one of which is reported here) provided thick descriptions of teachers’ reactions to utilizing the learning environment instrument. Our research provided the first learning environment study at the primary school level in South Africa, cross-validated an IsiZulu version of the WIHIC when used
for the first time in South Africa, and supported the success of teachers’ use of a learning environment questionnaire in guiding improvements in their teaching.

Perry den Brok (2006) [9] utilized the What Is Happening In this Class (WIHIC) questionnaire to examine factors that influence Californian student perceptions of their learning environment. Data were collected from 665 USA middle school science students in 11 Californian schools. Several background variables were included in the study to investigate their effects on students’ perceptions, such as student and teacher gender, student ethnic background and socio-economic status (SES), and student age. Class and school variables, such as class ethnic composition, class size and school socio-economic status were also collected. A hierarchical analysis of variance was conducted to investigate separate and joint effects of these variables. Results from this study indicate that some scales of the WIHIC are more inclined to measure personal or idiosyncratic features of student perceptions of their learning environment whereas other scales contain more variance at the class level. Also, it was found that different variables affect different scale scores. A variable that consistently affected students' perceptions, regardless of the element of interest in the learning environment was student gender. Generally speaking girls perceived their learning environment more positively than did boys.

Dorman (2003) [10] reported of the using The What Is happening In this Class? (WIHIC) questionnaire was validated cross-nationally with a sample of 3,980 high school students in Australia, the UK and Canada. Confirmatory factor analysis supported the seven-scale a priori structure of the instrument. Fit statistics indicated a good fit of the model to the data. While all items loaded strongly on their a priori factor, model fit indices revealed the degree of scale overlap of the whole instrument scales. The use of multi-sample analyses within structural equation modeling substantiated invariant factor structures for three grouping variables: country, grade level and student gender. This study supported the wide international applicability of the WIHIC as a valid measure of classroom psychosocial environment.

Chionh and Fraser (1998) [11] used Actual and Preferred forms of WIHIC to further validate the instrument and to investigate associations between the actual classroom environment and the outcomes of examination scores, self-esteem and attitudes. The questionnaire was administered to 2,310 students from 75 randomly selected Grade 9 geography and mathematics classes in Singapore. The alpha reliability of the scales in the instrument was found to be from 0.88 to 0.97. The study revealed that better examination scores were found in geography and mathematics classrooms where students perceived the environment as being more cohesive. It was also found that self-esteem and attitudes were more favourable in classrooms perceived as having more teacher support, task orientation and equity.

Khoo and Fraser (1997) [12] used a modified version of the WIHIC to measure classroom environment in adult computer courses in Singapore. When the questionnaire was introduced to 250 working adults, it was found that scale alpha reliabilities ranged from 0.77 to 0.92. In investigating the differential effectiveness of computer courses for each gender, they found that males perceived significantly greater Involvement and Trainer Support. On the other hand, females perceived significantly higher levels of Equity in the computer classroom environment. In addition, it was found that older females have more positive perceptions than younger females in this context.

Materials and Methods

Student Perceptions of their Actual and Preferred Classroom Learning Environments

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow.

Selected Classroom Learning Environment Instruments

The What Is Happening In This Class (WIHIC) Questionnaire

The original 90-item nine-scale version was refined by both statistical analysis of data from 355 junior high school science students their questionnaire responses (Fraser, Fisher & McRobbie 1996) [1]. Only 54 items in seven scales survived these procedures, although this set of items was expanded to 80 items in eight scales for the field testing of the second version of the WIHIC. This led to a final form of the WIHIC containing the seven eight-item scales. The WIHIC has been used successfully in its original form or in modified form in studies involving 250 adult learners in Singapore (Khoo & Fraser 1997) [12] and 2,310 high school students in Singapore (Chionh & Fraser 1998) [11].

Materials and Methods

Student Perceptions of their Actual and Preferred Classroom Learning Environments

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow.

Selected Classroom Learning Environment Instruments

The What Is Happening In This Class (WIHIC) Questionnaire

The original 90-item nine-scale version was refined by both statistical analysis of data from 355 junior high school science students their questionnaire responses (Fraser, Fisher & McRobbie 1996) [1]. Only 54 items in seven scales survived these procedures, although this set of items was expanded to 80 items in eight scales for the field testing of the second version of the WIHIC. This led to a final form of the WIHIC containing the seven eight-item scales. The WIHIC has been used successfully in its original form or in modified form in studies involving 250 adult learners in Singapore (Khoo & Fraser 1997) [12] and 2,310 high school students in Singapore (Chionh & Fraser 1998) [11].
The Test of Science-Related Attitudes (TOSRA)

To investigate associations between students’ perceptions of their science classroom environment constructivist and their attitudes toward science learning classes for lower secondary educational students at Grade 8 in Burapha Pittayakharn Municipal School. This study modified from the original of the Test of Science-Related Attitudes (TOSRA) (Santiboon, 2011[13], 2013[14], 2014[15]) was designed to measure eight distinct classroom-related attitudes among lower secondary educational students. The eight items are suitable for group administration and all can be administered within the duration of learning in science environment science. Furthermore, TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Steps on Assessing Students’ Perceptions with the WIHIC and TOSRA

Each scale of the WIHIC were composed with the 8-item, minimum score is 8 and maximum score is 56 items. The first scale, Student Cohesiveness is composed the item of 1, 2, 3, 4, 5, 6, 7, 8; The second scale, Teacher Support is composed the item of 9, 10, 11, 12, 13, 14, 15, 16; The third scale, Involvement is composed the item of 17, 18, 19, 20, 21, 22, 23, 24; The fourth scale, Investigation is composed the item of 25, 26, 27, 28, 29, 30, 31, 32; The fifth scale, Task Orientation of 33, 34, 35, 36, 37, 38, 39, 40; The sixth scale, Cooperation of 41, 42, 43, 44, 45, 46, 47, 48; The seventh scale, Equity of 49, 50, 51, 52, 53, 54, 55, 56.

Using the WIHIC was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating science classroom learning environments in science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 8 in Burapha Pittayakharn Municipal School, Mahasarakham Province.

Data Analysis

Quantitative data were obtained using the two questionnaires (WIHIC and TOSRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A t-test for correlated samples was used for each individual WIHIC scale to investigate whether students have significant different perceptions of their actual and preferred classroom learning. The multiple correlations were significant of students’ perceptions of their science classes learning environment classes for the Actual Form of the WIHIC with students’ attitudes to associate were analyzed.

Sample

This study is improved and developed science classroom learning environment for lower secondary educational students at Grade 8 in Burapha Pittayakharn Municipal School classes of their science learning classroom environments to actual and preferred student’s perceptions with sample size of 64 students in 2 classes at Grade 8 in Burapha Pittayakharn Municipal School, Mahasarakham Province.
Results

Validity and Reliability of Research Instrument

C. Validity and Reliability of WIHIC

Description of quantitative data of analyzing responses for eight-grade science students of Burapha Pittayakharn Municipal School assessments is reported in Table 1.

Table 1.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the WIHIC

<table>
<thead>
<tr>
<th>Scale</th>
<th>From</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>33.56</td>
<td>4.20</td>
<td>0.23</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>36.00</td>
<td>4.50</td>
<td>0.25</td>
<td>0.50</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>31.38</td>
<td>3.92</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>34.09</td>
<td>4.26</td>
<td>0.38</td>
<td>0.61</td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>29.72</td>
<td>3.71</td>
<td>0.37</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>32.81</td>
<td>4.10</td>
<td>0.43</td>
<td>0.66</td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>27.97</td>
<td>3.50</td>
<td>0.35</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>32.66</td>
<td>4.08</td>
<td>0.41</td>
<td>0.64</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>32.22</td>
<td>4.03</td>
<td>0.31</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.63</td>
<td>4.45</td>
<td>0.34</td>
<td>0.58</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>33.03</td>
<td>4.13</td>
<td>0.28</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>35.00</td>
<td>4.38</td>
<td>0.31</td>
<td>0.55</td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>32.03</td>
<td>4.00</td>
<td>0.39</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>34.78</td>
<td>4.35</td>
<td>0.38</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the WIHIC.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>0.83</td>
<td>0.86</td>
<td>3.84***</td>
<td>0.54***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.92</td>
<td>0.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Support</td>
<td>Actual</td>
<td>0.81</td>
<td>0.87</td>
<td>3.51***</td>
<td>0.68***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.93</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>0.87</td>
<td>0.86</td>
<td>4.36***</td>
<td>0.74***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.94</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>0.83</td>
<td>0.87</td>
<td>5.38***</td>
<td>0.84***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89</td>
<td>0.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>0.90</td>
<td>0.85</td>
<td>5.70***</td>
<td>0.70***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.95</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>Actual</td>
<td>0.86</td>
<td>0.86</td>
<td>3.13**</td>
<td>0.70**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.95</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>Actual</td>
<td>0.92</td>
<td>0.85</td>
<td>3.62***</td>
<td>0.67***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.95</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The results given in Table 2 shows that on average item means for each of the seven WIHIC scales, they contain eight items, so that the minimum and maximum score possible on each of these scales is 7 and 56 items, respectively. Because of this difference in the number of items in the seven scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the WIHIC. For the remaining seven scales, Personalization, Participation, Independence, Investigation, and Differentiation scales.
The internal consistency reliability of the version WIHIC used in this study was determined by calculating Cronbach alpha coefficient for the 56 items of the WIHIC using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the WIHIC, which ranged from 0.85 to 0.87 when using the students’ actual climate scores and from 0.93 to 0.94 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the WIHIC, which suggests that each scale of the WIHIC was able to differentiate significantly \((p<0.001)\) between students’ perceptions in my school and my dream school environmental climates in the same school. The \(t\)-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.13 to 5.70 for different scales, respectively.

**B. The Circumplex Nature of the WIHIC:**

To investigate the circumplex nature of the WIHIC correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale. In Table 3, the internal consistency reliability of the version WIHIC used in this study was determined by calculating Cronbach alpha coefficient for the 56 items of the WIHIC using both actual and preferred environmental climates’ perceptions scores. Table 3 reports the internal consistency of the WIHIC, which ranged from 0.02 to 0.85 when using the students’ actual climate scores and from 0.62 to 0.93 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the WIHIC, which suggests that each scale of the WIHIC was able to differentiate significantly \((p<0.001)\) between students’ perceptions in my school and my dream school environmental climates in the same school. The \(t\)-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.13 to 5.70 for different scales, respectively.

*Table 3.*

**Scale Intercorelations for the WIHIC Using the Actual and Preferred Forms**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>TS</th>
<th>IV</th>
<th>IN</th>
<th>TO</th>
<th>CO</th>
<th>EQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>Actual</td>
<td>0.60**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.79**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>Actual</td>
<td>0.76**</td>
<td>0.65**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76**</td>
<td>0.89**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Actual</td>
<td>0.02</td>
<td>0.37**</td>
<td>0.76**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.66**</td>
<td>0.74**</td>
<td>0.82**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Actual</td>
<td>0.45**</td>
<td>0.31</td>
<td>0.49**</td>
<td>0.35*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89**</td>
<td>0.68**</td>
<td>0.69**</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TO</td>
<td>Actual</td>
<td>0.59**</td>
<td>0.50**</td>
<td>0.50**</td>
<td>0.41*</td>
<td>0.73**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88**</td>
<td>0.74**</td>
<td>0.76**</td>
<td>0.68**</td>
<td>0.90**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.41**</td>
<td>0.41**</td>
<td>0.57**</td>
<td>0.66**</td>
<td>0.79**</td>
<td>0.85**</td>
<td>0.93**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.76**</td>
<td>0.67**</td>
<td>0.69**</td>
<td>0.69**</td>
<td>0.85**</td>
<td>0.93**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)  
** Correlation is significant at the 0.01 level (2-tailed)  
*** Correlation is significant at the 0.001 level (2-tailed)  

To investigate the circumplex nature of the WIHIC, correlations between the scales were calculated. The result is presented in Table 3. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

**C. Factor Loading Analysis of the WIHIC**

The Actual Form of the WIHIC was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the WIHIC. Table 4 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
Table 4.
Factor Loading for Items in the Actual Form of the WIHIC

<table>
<thead>
<tr>
<th>Item</th>
<th>Act.</th>
<th>Pref.</th>
<th>SC</th>
<th>TS</th>
<th>Pref.</th>
<th>IV</th>
<th>Pref.</th>
<th>IN</th>
<th>Pref.</th>
<th>TO</th>
<th>Pref.</th>
<th>CO</th>
<th>Pref.</th>
<th>EQ</th>
<th>Pref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>8</td>
<td>0.77</td>
<td>0.86</td>
<td></td>
<td>3</td>
<td>0.76</td>
<td>0.84</td>
<td></td>
<td>2</td>
<td>0.70</td>
<td>0.82</td>
<td></td>
<td>1</td>
<td>0.69</td>
<td>0.80</td>
</tr>
<tr>
<td>13</td>
<td>15</td>
<td>0.84</td>
<td>0.94</td>
<td></td>
<td>10</td>
<td>0.79</td>
<td>0.91</td>
<td></td>
<td>13</td>
<td>0.69</td>
<td>0.90</td>
<td></td>
<td>14</td>
<td>0.68</td>
<td>0.89</td>
</tr>
<tr>
<td>24</td>
<td>20</td>
<td>0.87</td>
<td>0.83</td>
<td></td>
<td>17</td>
<td>0.80</td>
<td>0.81</td>
<td></td>
<td>24</td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td>18</td>
<td>0.70</td>
<td>0.74</td>
</tr>
<tr>
<td>25</td>
<td>31</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td>27</td>
<td>0.80</td>
<td>0.82</td>
<td></td>
<td>26</td>
<td>0.80</td>
<td>0.82</td>
<td></td>
<td>25</td>
<td>0.71</td>
<td>0.80</td>
</tr>
<tr>
<td>39</td>
<td>35</td>
<td>0.73</td>
<td>0.86</td>
<td></td>
<td>36</td>
<td>0.67</td>
<td>0.86</td>
<td></td>
<td>39</td>
<td>0.66</td>
<td>0.81</td>
<td></td>
<td>36</td>
<td>0.57</td>
<td>0.76</td>
</tr>
<tr>
<td>47</td>
<td>42</td>
<td>0.89</td>
<td>0.83</td>
<td></td>
<td>45</td>
<td>0.84</td>
<td>0.83</td>
<td></td>
<td>46</td>
<td>0.84</td>
<td>0.83</td>
<td></td>
<td>44</td>
<td>0.79</td>
<td>0.81</td>
</tr>
<tr>
<td>56</td>
<td>54</td>
<td>0.79</td>
<td>0.87</td>
<td></td>
<td>55</td>
<td>0.78</td>
<td>0.87</td>
<td></td>
<td>51</td>
<td>0.71</td>
<td>0.82</td>
<td></td>
<td>52</td>
<td>0.65</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of variance of Act.</td>
<td>50.08</td>
<td>43.98</td>
<td>53.28</td>
<td>46.69</td>
<td>59.46</td>
<td>51.85</td>
<td>63.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eigen value Pref.</td>
<td>62.86</td>
<td>66.32</td>
<td>70.86</td>
<td>57.60</td>
<td>73.31</td>
<td>72.85</td>
<td>74.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 64 students

D. Validation of the Test Of Science-Related Attitude (TOSRA)

To measure Master of Science teacher students’ attitudes towards Seminar on Science Education Classroom Learning Environment course, the present study adapted the eight-item of the TOSRA (Santiboon,
Comparisons between Student’s Perceptions of their Actual and Preferred Science Classes

On comparing differences between the students’ perceptions of their actual and preferred Science Classroom Managements Class environment in Table 5 and Figure 1, it was found that students’ preferred perceptions an environment with lower levels of Personalization, Participation, Independence, Investigation, and Differentiation scales than student’s actual perceptions.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the WIHIC.

The results of this study also indicate that using the WIHIC helps science educational management instructors to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the science educational management curriculum for the eight-grade science students from Burapha Pittayakharn Municipal School environment. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the eight-grade science students from Burapha Pittayakharn Municipal School classes.

Associations between Students’ Perceptions of Actual Science Classroom Learning Environments with the TOSRA

In this study, it was also considered important to investigate associations between science classroom learning environment constructivists for eight-grade science students from Burapha Pittayakharn Municipal School environment classes of their science classroom learning environment with their attitude toward science. The Cronbach alpha reliability of the selected the TOSRA was 0.84, when using individual student as the unit of analysis. This suggests that the TOSRA is reliable for measuring students’ attitudes in science classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOSRA that’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science educational constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Science Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their science educational constructivist class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their classroom environment on all scales of the Actual Form. The multiple correlations R^2 is significant for the WIHIC and considered association with the TOPRA, and value indicates that 42% of the variance in students’ attitudes was also determined.
### Table 5.
**Associations between WIHIC Scale and Attitude Scale to Science Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From Simple Correlate. Attitude (r)</th>
<th>Std. Regress. Weight Attitude(β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.18</td>
<td>0.17*</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>0.40</td>
<td>0.39**</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.17</td>
<td>0.20*</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.11</td>
<td>0.13*</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.17</td>
<td>0.18*</td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.15</td>
<td>0.12*</td>
</tr>
<tr>
<td>Equity</td>
<td>0.19</td>
<td>0.20*</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.6484*</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.4204*</td>
<td></td>
</tr>
</tbody>
</table>

### CONCLUSIONS

The actual and preferred perceptions of 64 students of their science classroom environment in Burapha Pittayakharn Municipal School were measured with the WIHIC. The comparisons of the Actual Form with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their science management class. In general, students’ perceptions of their preferred classroom in science management class to be greater than what they actually perceive to be provided. The results of this study also indicate that using the WIHIC helps Burapha Pittayakharn Municipal School teachers or lecturers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science management classes, with regard to the WIHIC, it was found that all of seven scales were positively associated with students’ attitude to science management class. The multiple correlation $R$ is significant for the WIHIC and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 42%, with actual form of the variance in students’ attitudes to their science management class was attributable to their perceptions of their science management classroom environment. The beta weights (β) show that in class where the students perceived greater than all scales in their science management learning classroom.

### DISCUSSIONS AND IMPLICATIONS

Learning environment is an important aspect in education process. It is not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments What Is Happening In This Class (WIHIC) Questionnaire. This instrument provides the information of students’ perceptions on actual and preferred science educational management learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science educational management course.

Overall, this study replicated previous studies using the WIHIC, with the findings being consistent with the situation in Burapha Pittayakharn Municipal School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from Burapha Pittayakharn Municipal School, Mahasarakham Province in Thailand.

### ACKNOWLEDGMENT

Firstly, I would like to thank the 64 students in science classroom in Burapha Pittayakharn Municipal School who allowed students to complete the questionnaire. My greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my supervisor, who understood my professional and personal commitments throughout the study and never pushed but always encouraged. Without his support, I would never have achieved the completion of my manuscript of full paper. Finally, I would like to thank Dr. Panwilai Chomchid, as the co-advisor too. This work was supported in part by a grant from Rajabhat Maha Sarakham University, Thailand.
References


The Study of Development Method of Morality and Ethic Learning and Teaching Models for Education of Expansion Schools

Somthawin Pheanglap¹,*, Prasopsuk Rittidet², Prapatporn Pree-iam² and Panida Sitthihakote²

¹Doctoral student, Department of Educational Management for Local Development, Faculty of Education, Rajabhat Maha sarakham University
²Department of Educational Management for Local Development, Rajabhat Maha sarakham University Thailand

(*) author for correspondence, E-mail: Theestar_99@hotmail.com

Abstract

This research aimed at 1) study the problem features of morality and ethic learning and teaching models in education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsahan District and 2) to study the develop the Teaching model method of morality ethic learning in education expansion schools, employing mixed research methodology; qualitative and quantitative methodologies. The research tools of the study were 1) a questionnaire of problem features of morality and ethic learning and teaching models of schools under UbonRatchathani Primary Education Service Area Office 3, 2) a questionnaire of the needs of morality and ethic learning and teaching models under UbonRatchathani Primary Education Service Area Office 3, 3) guideline questions for focus group discussion and 4) focus group discussion record. This study was conducted with a sample of 30 teachers responsible for learning area of content social, religion and culture course mathayom sueksa 1 for students and their 30 parents. The sample was chosen by using simple random sampling technique through drawing. The target population was chosen by using purposive sampling technique, employing for grouping the focus group discussion, with the from the teachers subject social responsible for learning area of matthayom sueksa 1 students’ parents. Descriptive analysis was employed for research presentation.

The result of the research

1) The results of the study of the problem features of morality and ethic learning and teaching models in education expansion schools, it found that there were 4 types of morality and ethic issues which were all at the highest level. However, when considering each category of morality and ethic, the problem of morality and ethic based on the Core Curriculum B.E. 2551 found that there were the issues regarding the students’ diligence, economical, honesty and discipline in terms of eight morals. Concerning the eleven principles of Buddhism, the highest-level problems were about the fear of evil, remembrance and abstaining from fraud. The moral issues of grade matthayom sueksa 1 students were in line with the discussion group among teachers, parents and students, finding that the most found problems were about the students’ diligence towards their study as a result from their preference on playing online games.

2) The study of development method of morality and ethic learning and teaching models in education expansion schools found that parents preferred the students to participate in the events held in any Buddhist holy days and let the monks take an important role to instill the principles of Buddhism to students at the highest level. The needs of teachers and students to use the local media and technology in teaching morality and ethic were at the highest level. And learner-focused teaching method was concerned in the high level in line with the discussion group among teachers, parents and students who preferred conducting Dhamma seminar activities and training.

Keywords: Education, Development, Teaching models, Morality, Ethic learning

Introduction

The teaching currently focuses on developing students to become ethical and moral according to the guideline as defined in National EducationAct B. E. 2542 as part of the aim and principles of Article 6, which states that "education is what that needs to be adjusted to develop Thai citizen to be a complete human being for their physical and mental being, intellect, knowledge and moral, ethic and culture of living that can coexist happily with others." In addition, the Basic Education Core Curriculum B. E. 2551 has set the aim, which is the standard of learning for learners to achieve a desirable characteristic of having "morality, ethic and desirable value". The learners should also recognize their own value, should be discipline and practical to the principles of Buddhism or in respect to their religion as well as should hold to the principle of Sufficiency Economy.
According to the information stated in Section 6 of National Education Act, B. E. 2542 and the aim as discussed in the Basic Education Core Curriculum B. E. 2551 as mentioned earlier, it shows that in addition to focusing on the complete physical and mental being, intelligence and sensation, the learners should be more emphasized on morality and ethnic (Siriwan Sripahon. 2009: 124-125). Morality means the goodness, complementary conditions (Dictionary of Buddhism. 1985: 34), what people accept as something good, either very favorable or less useless. Differentiating what the morality of society is may be various because to recognize either something is good or bad, it depends on the culture, economy, religion and education of people in that society (Duangduian Panthumanawin. 2001: 116).

The ethic refers to moral conduct, moral the ecology (B. E. 2542 Thai Royal Institute Dictionary: 219) or good deeds, evil ignorance (Duangduen Panthumanawin. 2001: 115). According to the definition of morality as mentioned above, it found that there is still some relevant, similar meaning and related words which are morality and value. Regarding the word of “value” from the Dictionary of Sociology of the Royal Institute (2009: 411), it defines “value” as the ability of what is believed to satisfy the desire of human beings or properties of anything that makes it as an attractive benefit for individual or group. "Value" is defined as anything that individual holds as an aid for moral judgment and action indicator. As a matter of morality, it is all about goodness, legitimacy and justice (Soonthorn Na Rangsri. 1979: 29) And the meaning of morality is narrower, counting as part of ethic or morals. Ethics is a term used instead of morality as it is understood or recognized that morality is about religion. The use of the word “ ethic” has a broader meaning and more international. Then the word “ ethics” is the comprehensive meaning of virtue and morality together (Koson Meekun. 1994: 44) and the value is characterized by a belief or doctrine that an individual holds to live his or her life.

Concerning the morality and ethic development of the students who also are the youth of Thai society, before being asked with the question of “which morality and ethic should be developed for youth”, the question which the teachers should be asked is “what the students should be developed in terms of morality and ethnic”. Today's society should be concerned first is a problem of youth as there are a number of youth problems including going out partying at night, dressing improperly and spending too much money, aggressive behaviors, compulsive gambling, computer crime and learning difficulty. In addition, according to the Youth Risk Survey of the Ministry of Social Development together with the National Institute of Development Administration (NIDA), the problems of the youth students found are regarded to problem of carrying weapons to schools in order to protect themselves and to theft at schools, of being attacked by the family, of having depression causing suicidal thoughts, of being sexually abused, of having sex, of having children at a young age, of having aggressive behavior, of having relationship issues among family members, of having allurement which leads to ruin, of having abortion, of having teaching scandal, of being a thief, etc., which were all concerned as a mere reflection of the insufficient morality and ethic of the youth (Siriwan Sripahon. 2009: 127).

To solve such issues happening with the youths, therefore, the actions of solution must be taken urgently to cultivate morality and ethic to students by considering which morality and ethic should be input to the students. As seen from the case study of learning and teaching models in education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsa Nathan District, it found what the problem features of morality and ethic of the Matthayom Sucksa 1 students are and how the teachers solve learning and teaching problems to achieve a desirable purpose of the study, resulting in the interest of the researcher to conduct the study towards the development method of morality and ethic learning and teaching models in education expansion schools.

Objectives of the Study

1) To study the problem features of morality and ethic learning and teaching models in education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsa Nathan District Ubon Ratchathani Province.

2) To study the development method of morality and ethic learning and teaching models in education extended schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsa Nathan District Ubon Ratchathani Province.

Materials and Methods

1) The research instrument used in this study were 1) a questionnaire of problem features of morality and ethic learning and teaching models in education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsa Nathan District, 2) a questionnaire of the needs of morality and ethic learning and teaching models in education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsa Nathan District, 3) guideline questions for focus group discussion.
under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsahan District and 4) focus group discussion record.

2) Research methodology
The mixed research methodology of both qualitative and quantitative approach was used to conduct the study.

3) Population and Sample
The population and sample were 55 teachers responsible for learning area of religion and culture studies, 92 mathayom sueksa 1 students from 55 education expansion schools, parents from various education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsahan District.

This study was conducted with a sample of 30 teachers responsible for learning area of social studies, religion and culture course, 30 mathayom sueksa 1 students and their 30 parents. The sample was chosen by using simple random sampling technique through drawing. The target population was employed for grouping the focus group discussion, with the total number of 10 teachers responsible for learning area of religion and culture studies, 10 mathayom sueksa 1 students and their 10 parents.

Scope of Content
The research was conducted towards the content of the problem features of morality and ethic teaching and learning models in accordance with the principles of Buddhism, royal thought of King Bhumibol, including the Sufficiency Economy philosophy, the standardized morality and ethic of the Ministry of Education under the Basic Education Core Curriculum B. E. 2551 and the development method of morality and ethic learning and teaching models in education expansion schools.

4) The studied area was 3 education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsahan District.

5) Duration From January, 2015 to April, 2015

6) Data collection
   6.1) The data collection was developed based on the review of related literature.
   6.2) The field data collection was through a survey of problem features and developing model of morality and ethic teaching and data collection was from the focus discussion group.

7) Data analysis
   The data analysis of the problem features and development method of morality and ethic learning and teaching model

8) Statistical package
   Percentage was used in the analysis of answer concerning respondents’ information.

Results

1) The problem feature of morality and ethic teaching in the education expansion schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsahan District employed the field surveys of teachers, students and parents in compliance with the royal thought of King Bhumibol, including the Sufficiency Economy philosophy, modesty, rationality, and self – immunity was at the highest level, representing 80%. The problems of morality towards knowledge and morality itself were at the high level, representing 78%. Regarding the morality and ethic in accordance with the set standard of the Ministry of Education under Core Curriculum B. E. 2551, the eight morals in terms of diligence, economical, honesty and discipline found the problems at the highest level of 85% while the problems of cleanliness, harmony and generosity were at the high level, representing 77%. In addition, in accordance with the morality and ethic from eleven principles of Buddhism, the problems towards morality and ethic about the fear and shame of evil, remembrance, abstaining from fraud and from killing animals were at the highest level of 80%. The problems towards morality and ethic about how to be rational-oriented, giving, logical-oriented, generous and honest people were in a high level of 78%. The focus group discussion, it found that the teachers and parents suggested that students shared similar problems, for example, they were lack of self-discipline, lack of diligence, lack of patience, no mercy, quarrelsome, on drug and alcohol use, and theft. The students suggested their problems that they did not prefer doing their homework, had no self-discipline, were lavish spending money on mobile communications and excessively played online games. For the sake of teaching, some teachers did not understand the morality and ethic teaching content clearly enough and did not arrange the teaching curriculum and morality and ethic’s measurement instrumentation for the schools to use.

2) The development method of morality and ethic teaching model found that the teachers responsible for learning area of social studies desired to arrange the lesson plan for morality and ethic teaching at the highest level and desired to use resources in the community to provide training and transfer of knowledge regarding
morality and ethic to the students every Friday in a high level. Also, the teachers desired the students to be instilled with morality and ethic, corresponding to the Core Curriculum B. E. 2551 in terms of virtue - liked, knowledge – seeking, self-discipline, mercy-likedand behaviors. In addition, the continuing measurement and evaluation towards morality and ethic in educational institutes is in a high level, representing 77%. Concerning the needs of parents, the need for monks to teach morality and ethic regularly was at the highest level, representing 100%. The parents required the schools to provide the students volunteering activities for community development in any Buddhist holy days at the highest level of 90% as well. In addition, the needs of the students to have meditation before class and a written record of their good actions were at the highest level, representing 90% and the needs of having a field trip to the learning center of Buddhism and of having any Dhamma broadcasting media like radio or TV shows for documentary and of listening to Dhamma tales from the locals in a high level of 78%. All in all, such results were correspondent to the focus group discussion among teachers responsible for learning area of morality and ethic, students and parents that they all similarly needed the medication before class, training on morality and ethic from various media, including individual and video as well as needed the students’ hands to help their parents when favorable to. Not only that, the students were needed to pay attention to their study and be able to read out loud what they studied to their parents.

Conclusions and Discussion

1) Results of the study of the problem features of morality and ethic teaching in education of expanded schools reflected some issues from the parents, teachers responsible for learning area of social studies, religion and culture course and mathayom sueksa 1 students. The most commonly found problems were related to ethic according to the Core Curriculum B. E. 2551, representing 85% in line with the education development policies initiated by Ministry of Education to improve physical, mental, social and emotional intelligence for Thais. According to the Core Curriculum B. E. 2551, it has identified eight desirable characteristics, namely diligence, economical, honesty, discipline, politeness, cleanliness, harmony and generosity (Ministry of Education. 2008: 111) and complies with the problems of youth, of sexuality, of behaviors such as going out partying at night, dressing improperly and spending too much money as well as of aggressive behaviors (Siriwan Sripahon. 2009: 127). Parents have reflected some issues regarding the children’s and teenagers’ behavior towards drugs and alcohol use, gambling, online games and quarrel and fight (Bee, an alias of a parent of mathayom sueksa 1 student. 2004: interview). Such behavioral problems of children and teenagers are identical to the behaviors of mathayom sueksa 1 students in the education expanded schools under UbonRatchathani Primary Education Service Area Office 3, Phibunmangsahan District. There are moral and ethical issues of lavish spending, drug and alcohol use, and theft which urgently 2) The study of development method of morality and ethic teaching model need to find solutions. If focusing on the solutions towards teachers, the teachers should modify their teaching style, arrange learning and teaching plans, create variety of teaching materials, initiate training activities in accordance with the principles of Buddhism, provide Dhamma training seminar with guest speakers, let the students be a self-learner of virtue ethic from Buddhist Learning Center, consistent with the concept of Siriwan Sripahon (2009: 110), describing solutions to moral and ethical issues that the instruction get locally managed with a variety of activities and using multiple teaching techniques in accordance with the content of ethic and morality integrated with multiple types of virtues.

Recommendation for Further Research

Suggestions

Based on the findings and conclusion of the study of problem features of morality and ethic learning and teaching model and development method of morality and ethic learning and teaching model in education expansion schools, it is suggested that the integration of multiple sources of ethic teaching should be employed in order to instill some good ethic and mortality as well as Buddhist principles of moral thought and action, a concept of the sufficiency economy and a concept of the Basic Education Core Curriculum B. E. 2551 into the students.

Recommendation

Further research should be conducted to study morality and ethic learning and teaching model and development method by means of local wisdom in education extended schools.

References


Improving Self-Reliance by Using the Livelihood Form of the Local Wisdom at Yad-Fah Village, MahaChanachai, Yasothorn

Umaporn Aonkam, Prasobsuk Rittidetch, Praphatsorn Preeaem and Phanida Sittihakot
A Doctorial Student, Doctor of Philosophy in Education for Locality Development, Rajabhat Maha Sarakham University
bebe2520@gmail.com
A lecturer of Doctor of Philosophy in Education for Locality Development

Abstract

The research purposed 1) to investigate the problem of the agriculturists’ occupation in Yad-Fah village, MahaChanachai, Yasothorn and; 2) to investigate the requirement of the livelihood using the local wisdom to improve the self-reliance of the community. The research methodology was mixed methodology expressing on the quantitative and qualitative methods. The data included 1) the survey of the condition of the agriculturists’ occupation; 2) the survey of the requirement of the livelihood; and 3) group discussions. The scope of the study were 1) 649 agriculturists from the samples size of Krejcie and Morgan which getting the data from target groups were 20 households from Yad-Fah village; and 2) Yad-Fah village, MahaChanachai, Yasothorn was selected for collecting data. The data were analyzed through the average, the percentage, and the standard deviation. The results were presented in terms of the descriptive research.

The results shown that;
1. The problem of the agriculturists’ occupation of the village showthat (1) one of the most highest problems of the agriculturists was the loan; (2) the other problem was the production cost which involved about the production process, lacking involving fund, nonstandard products, and unpopular product. Therefore, the debt was begun.
2. After farming season, the agriculturists had needed the income through the local wisdom which called the rice garland. Moreover, the culture and tradition were the most requiring for the study.

Keywords: Livelihood, Local wisdom, Self-reliance

Introduction

Unquestionably, the government has realized on solving and developing the poverty of agriculturists under the distribution of prosperity to the region during the government offices and residents of the National Economic and social Development Board issue 1-7 (1961-1996). The government had required on working out the problem extensively, therefore, the government added more an effort to make the stability of the local economy by distributing productions and marketing. The preservation and managing of natural resources emphasized on human resources. Additionally, the government also madethe balance of qualitative and quantitative development with fairness to be improved capably and permanently.

The National Economic and social Development Board issue 8-11 (1997-2016) determines benefits and preservation of natural resources, and give chances for people to attend developing the country increasingly. Moreover, the plan also destines adding investments, handling and reactivating the nature to enhance the quality of life of people in order to increase and expand the choices of agriculture. The board emphasizes on the poverty by achieving a lasting self re-reliance and the power of the country on the local strength. Besides that, the self-sufficiency principally is focused on in the community, and also promotes people to have an occupation group with the management of the marketing and the skills of working. The mission of supporting people careers, purposes to raise and improve the people quality of lives through increasing revenue, reducing expenditures and enhancing communities in order to be self-reliance, be quality of life, and be suitable for the philosophy of self-sufficiency (The National Economic and social Development Board, 2005, p. 35-48).

According to the importance of this improvement, the local development is necessary for enhancing Thai society because it is the base of society, especially, communities or local areas. To develop communities continuously, it should be necessary to have the pattern and innovation of the local people because development bases on the people’s advantages importantly, have to be dependent on the new visions in developing communities: the sustainability development, the self-sufficiency, the quality of life, living in the good conditions, being strength, attending the public activities or the local wisdom (Kamdee, 2009, p. 1-2).

On the other hands, Thailand has been struggle with the economic problems since 1997, the ways of enhancing have not follow the National Economic and social Development Board. The people still have debts
from working, being unemployed, having the currency fluctuation, the lack of effective financial institutions and
government systems, as well as the economic structure that excessive reliance on the global economy. The
competitiveness of the country decreased. The production cost and import increases. As a result, revenue
decreased. There are no budgets in developing countries. People in rural communities are struggling to survive
with a debt credit loans. People have to migrate to urban workers to make agriculture the aim income. Making
agricultural production costs to rise gradually, but fall back on output does not meet expectations. For this
reason, the farmers want to borrow money, and the debt collectors are increasingly.

From the burden of debt problems, as it is one of the factors that resulted in farmers’ households. The
migration to labor hire in the season after the rice harvest yield of cassava do not pay attention to education
concerning their career or further knowledge from the Federal Agency to provide training to promote careers in
the household after the harvest. Where there is a research subject, a Community measure is offered to the
community or household and self-reliance by making the project enhance learning for the joy of the community
is the focus, the community members, consisting of a plurality of both human student developers. People were
sharing the learning process in a community-driven energy in the future through an exploration of the problem
of the debt burden of the self. The potential of the community and the pride in their profession and the ancestors
is there a chance to inherit their ancestors profession can be accepted or known (Walaisatien, 2010, p. 46).
From such an occupation problems, researchers require to study the subject, best professional development
using local wisdom in order to strengthen the self-reliance of Ban YadFah, MahaChana Chai district, Yasothon
province.

**Purposes of the Study**

1. To investigate the problems of working of the local people in Ban YadFah, MahaChana Chai
district, Yasothon province
2. To investigate the requirement of livelihood through the local wisdom to improve the self-reliance
people in Ban YadFah, MahaChana Chai district, Yasothon province

**Research Instruments and Methodology**

1. The instruments were (1) the questionnaire of the problems of working of the local people, (2) the
group discussions
2. The methodology used the mixed methodology by the quantitative and qualitative methods
3. The Scope of the Study
   3.1 The population and participants
       The population and participants were the agriculturists from 5 villages which included 2,089
       male agriculturists and 2,173 female agriculturists, totally 4,262.
   3.2 The sample groups were selected randomly, sample size by R.V.Krejcie& D.W. Morgan
(Srisad, 2002, p. 40). The sample groups were 322 male agriculturists and 649 female agriculturists.
   3.3 The target group was 20 households of the agriculturists in YadFah sub-district.
   3.4 The research content
       (1) The problems of working of the local people in Ban YadFah, MahaChana Chai district,
Yasothon province
       (2) The requirement of livelihood through the local wisdom to improve the self-reliance
people in Ban YadFah, MahaChana Chai district, Yasothon province
   3.5 The research area was Ban YadFah, MahaChana Chai district, Yasothon province.
   3.6 The research period was during January 2015 – April 2015.

**The Data Collection**

The data were collected (1) from research papers, (2) by the group discussion, (3) from a survey of
problems and assess the need for livelihood enterprises using local knowledge to enhance the self-reliance of
YadFah village, Mahachanachai district of Yasothon province.

**The Data Analysis**

The data were analyzed through (1) analyzing from documents and related research, (2) analyzing from
weather problems, and (3) analyzing of the demand on career best assembly using local wisdom in order to
strengthen the self-reliance of YadFah village, Mahachanachai district of Yasothon province which presentation
of the descriptive analysis of the study results.

**The Statistic Used to for Data Analysis**
The statistics were the average, percentage and standard deviation.

**The Results of the Study**

1. From data collection, surveys, the problem of occupation in the community. The number of people from 585 farmers in YadFah municipality, it was found that (1) farmers had lent the benefit of the Bank for agriculture and agricultural cooperatives, a million Community Fund has the most trouble level 84.10; (2) the factors of production to high production costs with the expense of mechanical subject. Labor, chemical fertilizer and pest eradication of drugs lack of funding, agricultural products 87.52% level most problems.

The study of community issues, occupational of YadFah people, the data from the survey coincide with the discussion group farmers in the Municipality of YadFah 20 households that are in debt from the career and livelihood, the people have to borrow from the private and public sector, investment for use as a cost in the purchase of seeds, chemical fertilizers wages, and rents land. The farmers were informed that the problem were “No investment is made debt from banks or capitalists. The main occupation is farming or some years for cassava. It was not enough income for sale securities” (Srinagar Valley, 2015, interview) and also was “not enough money to hire workers to work both as a person, find it only fair to give their children to school, no money left for saving” (Bunkongchon. 2015, interview). From problems regarding the occupation of the people in the community, farmers are having problems with debt both from the government and the capitalist system in order to bring the cost of occupation and livelihood.

2. The study needs to assemble the livelihood of local communities to strengthen the self-reliance of YadFah village, Mahachanachai district of Yasothon in collection of survey data coincident with the collection of data from focus groups discussion. There were 20 farmers join a voluntary people found that the demand characteristics in common were to earn the extra income after the season. The local teachers who were professional attending school, sharing knowledge transfer to community; garlands which were 90 percent demanded highest level (Silapon & Homwong, 2015: interview) in order to use as a learning area and to make the extra income to people in the community besides farming (Charksu Korn Wong. 2015: interview). Therefore, the investigation of the data collection, the survey requirements and group discussions, farmers are demanding similar in content to make rice garlands.

**Discussion**

The occupation problems in YadFah village, Mahachanachai district of Yasothon in the economy were (1) a farmer's household debt by borrowing from the sector, the Bank for Agriculture and Agricultural Cooperatives, Money Funds, and the household loan; (2) inputs. (Technology) high production costs. As a result of chemical agriculture, is for sales, funds were needed to buy fertilizers, weedkiller, hiring the agricultural machinery plowing and harvest high-wage workers. However, YadFah was the urban community, causing labor shortages in agriculture and; (3) the funding. This was consistent with findings Valaisathien et al (2010, p. 46) stated that the issue of the liability of farmers was a factor that resulted in farmers. The labor migrated out the area after the harvest season, cassava, not paying attention to providing education about their career (Nat Supa, 2001, p.57-58) argued that communities should have to produce for a living before. So I think selling And do activities outside agriculture, such as bundles growing perennial herb bundles to learn the local professional self-weaving, basketry and dance. From the discussion groups, livelihood used the local knowledge to strengthen and build community self-reliance of YadFah village, Mahachanachai district of Yasothon.

The farmers needed to earn the extra income after the season, a local teachers attended the teaching and sharing knowledge transfer to community to make wreaths popped consistent with the Office of the National Economic and Social Development (2011: 48-51) that provide the support for the identity of communities, the learning process and instill identity, the conservation and restoration of local communities by promoting lifelong learning. Moreover, the office has created continuously opportunities to people of all ages to access the resources and knowledge which including cultures, wisdom and knowledge which encouraged the community to contribute ideas and guidelines for the development of local communities on the principle of self-reliance.

**Recommendations and Suggestions**

1. The results should be depended on the conditions, problems, and people needs.
2. The future research should be focused on the livelihood in order to promote the culture and traditions of communities.
References


The Development Model of School Management and Local History

Thee Sittihakoat, Prasopsuk Rittidetch, Prapatsorn Preeaim and Phanida Sithakote

Doctorial Student, Doctor of Philosophy in Education for Locality Development,
Rajabhat Maha Sarakham University
Lecturer of Doctor of Philosophy in Education for Locality Development
(E-mail: Theestar.99@gmail.com; Fax: 0-4377-7320, 0-4377-7624)

Abstract

The purposes of the research were 1) to investigate the conditions of the community and the school management on the local history; 2) to study the need of the community and the school on the local history through the participatory action research and the quantitative. The research instruments were the survey of the conditions of the community and the school management on the local history, the survey of the need of the community and the school on the local history, the group discussion, and the record. The scopes of the study were 1) 92 people from the lecturers of the subject of Social Studies, Religion and Culture, the leaders of the community, the villagers, the local wisdom teachers, the director of NongMuen Than Wittaya School, and Mattayomsuksa 4; 2) the research area wereat the NongMuen Than village Moo 5, and 13 and at the NongMuen Than WittayaSchool, NogMeun Than sub-district, Art-Samart district, Roi-et. The data obtained were analyzed and interpreted statistically in terms of average, mean, and standard deviation and presented in terms of descriptive analysis.

The results show as follow:

1. From the conditions of the community and the school management on the local History, the results show that 1) the school lacks of the speakers who were expert on the local history; 2) the school lacks of experts who could relay the history to new generations; 3) the school lacks of teachers who experienced on teaching this subject; 4) most teachers thought that this subject was boring; 5) the school lacks of the suitable curriculum for this subject so the teachers and learners; 6) the learners not realized the importance of the subject; 7) learners familiar with the old teaching techniques; and 8) learners were attracted by the advanced technology such as mobile phone, websites etc.

2. From the needs of the community and the school found that in progress of shareholders realized that they required to raise awareness of having the local history in the community. For lecturers, the director and lecturers would like to promote the ancient places in their community for being learning materials and the lecturers would encouraged this subject to be center of the local history in their school. Besides that, the teachers preferred to promote their knowledge on history.

The results from the group discussion found that there were problems related to the Data Collection which were lacking of chances to share knowledge of the local wisdom teachers and the school did not promote the history sources. To the need of the school and the community, shareholders decided to participate and allow students to learn about local history.

Keyword: Development model, School of local history, Management

Introduction

The research presented in this article, the researcher has proposed developing a management school local history in Phase 1 which purposes to study the problems and needs of the community and schools about the local history education. According to the National Education Supplement 1999, 2002 and 2010 appear in Section 22 states that education must be based on the student-centered by learning about the local history which is the learning in the Social studies subjects, Religion and Culture. It aims to provide students with awareness and conservation of resources valuable in their own localities. (Ministry of Education, 2010, p. 2).

Thai society is the key to the development of the local community. Each locality has something important about the history of local areas including autoimmune problems, local traditions, legend, history, professional master key and community history, settlement which is sequel continuing from the past to the present. Sri Sakr (2009, p. 35) has suggested that learning local history makes the people in the local community to know themselves. Historians and scholars determine the nature and extent of the historic district. As well as Thida (2529) classified history into two parts, the first part is the cultural history to rely on archaeological and historical evidence from public. The second part focused on the study of the history and the sentiment of the
people in the local community because the study of the local history is an important tool in the search for potential local knowledge or wisdom. To learn and understand the root causes of local social experience and takes pride in the struggle of their ancestors and preserve joint reconstruction of local history. This means the resources and wisdom become "Community treasure" that they have the right to own and inherit each other (Sri Sakr, 1998, p.170).

For teaching on local history, a problem-oriented text not focused on learning life lessons arise from the knowledge and pasting, bring a set of books to learn. The students neglect to behave in accordance with social ethics and morality as the basis. Moreover, the lack of appreciation of the local history of the community due to lack of good teachers and a good school, students learn the history toughly (Wasi, 2009). Nowadays, the lives of people in the community are now beginning to change from rural societies to modern societies in which people in a community migration to the industry province because of the problem of poverty and discomfort of the countryside. Some people in the community had forgotten their roots, culture, local customs, such as dependence, supporting workers to modify the currency to play a role as a community case study of Ban NongMuen Than Wittaya, a large community with total population of 518 people with a learning school. In learning local history, teachers have been trying to teach students to understand the way the local community of Ban NongMuen Than because there are still tracing of the local history, the History of Pho KhunMueng Pak and Vera Wong, an important precursor who gather people for established houses in the village. The old appliances are still available in the community, but also the lack of resources, with zero learning local history occurred within school.

From the conditions of the local community of NongMuenThan, it reflects the lifestyle of the community and the local community history. This is a historic local people is vital to the creation of the ancestral home. Pho KhunMueng Pak and Vera Wong are considered heroes in the community building as the rulers of NongMuen local authority who attracted people in the community live together. To provide succession for future generations, this should study the local to be recognized in the community under the current dynamics of globalization (Mr. TINNAKORN Freshwater permanent. 2558: interview)

Therefore, researchers are interested in studying the development model of the school education, and the local history to build partnerships in the community. Students should be proud and love their local community.

**The Purposes of the Study**

1) To investigate the conditions of the community and the school management on the local history
2) To study the needs of the community and the school on the local history

**The Research Instruments and Methodology**

1. The research instruments were the survey of the conditions of the community and the school management on the local history, the survey of the needs of the community and the school on the local history, the group discussion, and the record. The quantitative and qualitative methods were chosen through the mixed research.
2. The methodology was the participatory action research and the quantitative.
3. The scopes of the study were
   3.1 There were 92 people from the lecturers of the subject of Social Studies, Religion and Culture, the leader of the community, the villagers, the local wisdom teachers, the director from NongMuen Than Wittaya School, and Mattayomsuksa 4
   3.2 The content of the research were the conditions of the community and the school management on the local history, and the need of the community and the school on the local history
   3.3 The research area was at the NongMuen Than village Moo 5, and 13 and at the NongMuen Than wittaya School, NogMeun Than sub-district, Art-Samart district, Roi-ent
   3.4 The time frame of the study is from January 2015 to April 2015

**The Data Collection**

The data was collected from 1) documents and related research; 2) the survey of the conditions of the community and the school management on the local history; 3) the survey of the need of the community and the school on the local history; 4) the group discussion ; and 5) the record.
The Data Analysis

The data were analyzed from the conditions, the needs and the group discussion of the local history

Statistic

The data obtained were analyzed and interpreted statistically in terms of average, mean, and standard deviation.

The Results of the Study

1. From the conditions of the community and the school management on the Local History, the results show that the school 1) lacks of the speakers who were expert on the local history at the 70 percentages; 2) lacks of experts who could relay the history to new generations at the 80 percentages; 3) lacks of teachers who experiences on teaching this subject at the 75 percentages; 4) most teachers had thought that this subject was boring at the 80 percentages; 5) lacks of the suitable curriculum for this subject so the teachers and learners; 6) the learners had not realized on the importance of the subject at the 85 percentages; 7) learners familiar with the old teaching techniques at the 80 percentages; and 8) learners were attracted by the advanced technology such as mobile phone, websites etc. at the 85 percentages.

The results of the group discussion on the conditions of the community and the school on managing local history from 15 people found that the teachers lacked the knowledge of teaching this subject. Moreover, there were no enough staffs on teaching, they lacked of planning and motivation on teaching history because they were not the local people so they could not express their knowledge to learners (Srimuang & Art-harn, 2015, interview). Furthermore, the leader were not pay attention of the local history thus there was not promotion on publishing and developing attractive places (Sorathawon, 2015, interview). For learners, they believed that this subject was complicated, they had to work hard but the subject was not used to evaluate in higher levels. Additionally, most learners paid more attention on new technology, for example, mobile phone, computer, and online games. Moreover, parents of the learners preferred offering their children chances to learn in town so learners had not been awareness on the local history (Champaphan & Changyan, 2015, interview). From the data collection, the results showed that the problems were ; lacking of chances to share knowledge of the local wisdom teachers and the school did not promote the history sources. To the need of the school and the community, shareholders decided to participate and allow students to learn about local history and they offer the center of learning the local history in the school in order to give learners chances to share the knowledge.

2. From the needs of the community and the school found that in the progress of Shareholders realized that they required to raise awareness of having the local history in the community at the 85 percentages. For lecturers, the director and lecturers would like to promote the ancient places in their community to be learning materials and the lecturers encouraged this subject to be the center of the local history in their school at the 80 percentages. Besides that, the teachers preferred to raise their knowledge on history at the 75 percentages.

The results from the group discussion of 15 people found that learners should be encouraged to share their knowledge in order to comprehend with their local (Sukprasert, 2015, interview). In the curriculum, the classes should offer and prepare the experts on the history in classes, for example, the history of establishing of the village, the belief, the tradition, and also the tools for working (Nanthasena, 2015, interview). Furthermore, the school should offer learners outside class activities such as supporting learners to go on field trips for studying the local history in order to stimulate learners in learning history. The shareholders, moreover, should pay attention on stimulating learners by establishing the center of the local history in the school (Piewngam, 2015, interview). The results from the group discussion found that there were problems related to the data collection which were; lacking of chances to share knowledge of the local wisdom teachers and the school did not promote the history sources. To the need of the school and the community, shareholders decided to participate and allow students to learn about local history and they offer the center of learning the local history in the school in order to give learners chances to share the knowledge.

Discussion

The condition of the community and school issues that pertain to local history education as a whole is a problem of the community does not have a clear role, as it does not convey the content, history and local knowledge from scholars or those who know the history of the request. Besides that, the new generations do not realize on the importance of local history, the school does not have a way to manage local history studies clearly, lack of a plan to teach local history to make teachers and students feel agreement with the importance of the study. Ratchalerm (2014, p. 241) states that teaches does not exist in the local teaching history so teachers
and students are not meet the importance and the least experienced teachers. Moreover, the teacher lacks teaching experience and the community has the least role in learning management.

The results from group discussion found that learners should have chances to learn their local history with the corporations of the shareholders who can give learners have shared their knowledge on the local history. John (2010, p. 396-412) studied the ways of teaching of the local history lecturers through the effect of the travel of the ancient society and using the assignments on the subject which can support this subject suits with the learners.

**Suggestions and Recommendation**

The results of the study of the problems and needs of the community and school-related education, the local history of Ban NongMuen Than can be applied to a document published to educate the community. The interested parties can bring such knowledge to be a fundamental concept in the proposed historic district schools of the NongMuen Than School and extend to other schools.

The problem should be based on the conditions and needs of the community and the schools in the education of the local history to be the guidelines in development studies of leaning local history for other schools.

**References**


The Development Model of the Model Farmers of the Water Meal to Strong Community

Manit Luemkoommarn, Prasopsuk Rittidetch, Prapatsorn Preeaim and Thipapon Sujaree

A Doctorial Student, Doctor of Philosophy in Education for Locality Development, Rajabhat Maha Sarakham University
Manit_English@hotmail.com
A lecturer of Doctor of Philosophy in Education for Locality Development

Abstract

The purposes of the research were 1) to investigate the sources of Chiang Ngam village, Buaban sub-district, YangTalad district, Kalasin Province; 2) to study the conditions and the needs of farmers on feeding the water meal using the mixed methodologies through the quantitative and the qualitative research. The research instruments were the survey of the conditions and the needs of the community and the school management on the local history, the survey of the needs of the farmers on feeding the water meal included 5 leaders, 10 master farmers and 5 general farmers. The research area was at Chiang Ngam village, Buaban sub-district, YangTalad district, Kalasin Province. The data obtained were analyzed and interpreted statistically in terms of average, mean, and standard deviation and presented in terms of descriptive analysis.

The result found that;
1. The Chiang Ngam village, Buaban sub-district, YangTalad district, Kalasin Province was established in 1837 or about 176 years ago. There was a group of people migrated from Ubon Rachathani Province to an upland surrounded by lowland for agriculture. This area was under supported by Lam Pao Dam in water supply supporting for agricultural propose, this helped agriculturists to utilize water supply from the dam for their profession and some of these agriculturists feed water meal for extra income.
2. The problem condition and requirement of the agriculturist’s role model in feeding water meal found that 100% of the agriculturists feed the water meal as an extra job because they wanted to earn more extra income for their family. 90% of them wanted to increase efficiency in water meal production at the highest potential in order to sell in markets in Northeastern region level. Besides, 100% of them also wanted to improve the marketing system (100%) and 100% of the agriculturist wanted to make groups to develop the progress of production (100%).

The problems found in the study were; 90% of the agriculturist had to face the problem of water supply shortage in dry season because Lam Pao Dam would not drain its water in that period. 60% of agriculturist emulated the water meal production from others and this generated conflicts among agriculturists who did the same business in the local market. 70% of them still lack of feeding water meal by scientific method and 90% of them had problem in making the highest production in order to response the consumer’s requirement.

Keywords: Development model, Master farmers, Feeding, Water meal

Introduction

According to the national economic and social development plan, vol. 11 (2012-2016) strategy III, a strong agricultural sector causes food and energy security, the management of natural resources as agricultural production bases. Therefore, the agricultural sector is the basis of food production and energy with increasing the efficiency and potential of agricultural production which supports the research and development of plants, animals and aquatic life, and also agricultural technology appropriately and environmentally. They play an important role for the social and economic growth of the country especially the food production which is the source of the income of household and agricultural production and supports the value of trade and export of the country. The agricultural sector is well-developed because of the appropriate geography and climate. There is a result of the study on the production and application of modified diets with strength and diversity and the result shows that this covers the majority of food market manufacturer of the world (Board of Directors of the national economic and social development, 2011, p. 52).

According to the National Economic and Social Development Plan Policy No. 11 on the food security, with developing the concept of the sufficiency economy philosophy, that His Majesty the King of Thailand initiated, has deeply roots for Thai people. His majesty featured on "human development" establishing on the basis of self-reliance, knowing the modesty, consideration of rational immunization and reminding
The researchers collected data from the surveys of farmers in the village of Chiang Ngam. In this area, farmer is the main occupation. Moreover, there are other extra jobs; the planting of melons grown organic vegetables, cricket weaving, reed weaving, and industry migration. Some farmers have ponds in a field to exploit. In feeding the water meal, some agriculturists succeed but some of them lack of the knowledge of farming process. There are problems with integration, manufacturing to create bargaining power in the marketplace. Egg production for distribution via a standard price, because sometimes there are problems with distribution via egg sales prices vary. The eggs are sold via a controversy and conflict with some farmers.

However, feeding the water meal is a demand of farmers in Chiang Ngam to increase the more number of farmers because there are some farmers considered wise people with the knowledge to feed the water meal by practicality who can be model farmers of the village. This career is to generate the income of the people in the community and to avoid migration to the cities which causes social problems, for example, divorce and the lack of workforce in farms. The community should have learned from the wise people who exemplify the model of feeding water meal.

Therefore, researchers focus on the development model of feeding water meal to strengthen because Chiang Ngam is a social that use the human to be the cost in terms of supplementary occupations which increase the income continuously.

**The Purposes of the Study**

1. To investigate the sources of Chiang Ngam village, Buaban sub-district, Yang Talad district, Kalasin province
2. To study the conditions and the needs of the farmers on feeding the water meal

**The Research Instruments and Methodology**

1. The survey of the conditions and the needs of the community and the school management on the local history
2. The survey of the needs of the farmers on feeding the water meal includes 5 leaders, 10 master farmers and 5 general farmers

**The Research Methodology**

The methodology was the mixed methodologies through the qualitative and the quantitative research.

**The Research Area**

1. The participants were the farmers on feeding the water meal includes 5 leaders, 10 master farmers and 5 general farmers
2. The research area was the history of Chiang Ngam village, Buaban sub-district, Yang Talad district, Kalasin province which focusing on the conditions and the needs of feeding the water meal
3. The scope of the study was at Chiang Ngam village, Buaban sub-district, Yang Talad district, Kalasin Province.
4. The research period had started from March 2015 to May 2015.
5. The data collection;
   5.1 The documents
   5.2 The Group discussion
   5.3 The survey of the conditions and the needs

**The Data Analysis**

The data were analyzed from the documents, related researches, the history document, the conditions evident, the needs and the group discussion of the local history.

**Statistic**

The data obtained were analyzed and interpreted statistically in terms of average, mean, and standard deviation.
The Results of the Study

1. The history of Chiang Ngam, Buaban sub-district, Yang Talad district, Kalasin province, Suphan Phuboonterm told that the village was established 176 years ago by migrants from Ubon Ratchathani province. At that time, there were not much people, but they built Chiang Ngam temple for people to make merit. Ban Chiang Ngam temple had become the center of people with monks who were ethical and unethical. After that, the population of Chiang Nagmawashigher so there were various careers on agriculture. Each household had enough income to live. In 1973, Chiang Ngam was changed because of the support from the Government’s since the administrative of Kukrit Pramote. He developed the utilities and transportation employment in the village of Chiang Ngam. The relationship was changed because of the money influence. The agriculture in Kalasin Province had been developed to build a dam Lam Pao and push Chiang Ngam was one part of the projects so there were various occupations on agriculture. In addition, farmers took advantage from the dam they could fish in the rice fields and feed the water meal in the rice fields. These secured lives because the investment of feeding water meal was slow. The water meal is the natural plant, it grows on the water. The agriculturists can consume and sell it.

Currently, Chiang Ngam has been developed by a centralized State power distribution from the municipality in Chiang Ngam Moo 6 with 104 households and leaded by Mr. Pitsanu Phuboonterm. Moreover, Chiang Ngam Moo 22 with 150 households, leaded by Mr. Somporn Suwanrueang, the geography of the place is located at Don surrounded by plains and is connected with neighboring villages; Kok Gong, Lao, Tume, Bua Ban, and Tha Sang. Chiang Ngam is next to the Lam Pao Dam, so the agriculture is suitable for the local people here (Phu Boon Term, 2015, interview).

2. From the study of the problems and needs of the model farmers on feeding water meal, the result found that the farmers demanded to feed the water meal in order to increase their income (100%). For feeding process, they fed the water meal in pond (90%) and some of them fed the water meal and sell it in the local market (60%). Moreover, the agriculturists required to increase the efficiency of the production of water meal to extend the trade to the region (100%). They wanted to improve the marketing system (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%). They wanted to make groups to develop the progress of production (100%).

After having discussion with 5 houses’ agriculturists, there were problems which were similar to the surveys and the needs; lacking of the water for planting. Since sometimes the dam could not prepare the water for agriculturists so the planting process had the problems on using the natural water which caused to meet with the disease. Another problem was the cost of the water meal was not stable, there was a conflict. Therefore, the agriculturists solved this conflict by using the scientific techniques to define the cost (Phu Bun Term, 2015, interview).

Discussion

Nowadays, Chiang Ngam has been locating for 176 years with 2 villages; Chiang Ngam Moo 6 with 104 households and leaded by Mr. Pitsanu Phuboonterm. Moreover, Chiang Ngam Moo 22 with 150 households, leaded by Mr. Somporn Suwanrueang, the geography of the place is located at Don surrounded by plains and is connected with neighboring villages; Kok Gong, Lao, Tume, Bua Ban, and Tha Sang. The water meal or “Khai Pham” is the smallest flowing plant without roots in the world found in the natural rivers. There are 2 ways of reproduction: 1) the sexual reproduction and the asexual reproduction in the soil at the Acid-Base 2. The essential nutrient is 15-15-1, the chamber at 400 ml, the illumination at 8,000-15,000 Lux (Nuramrum, 2008, p.39-42). The agriculturists seek to increase the efficiency on feeding in order to gain more income and strengthen the community.

Suggestions and Recommendations

The research will be the development model of feeding the water meal in the community. For the further research, researchers should do research on the process of feeding the water meal capability.
References


The Study Development of Elementary Students' Reading of the Thai Content

Pattra Sanhom1,*, Prasopsook Ritthidet2, Prapassorn Preea1 and Panida Sitthihakod2

1Ph.D. Candidate, Education Management for Local Development Faculty of Education, Rajabhat Maha Sarakham University
2Lecturer, Education Management for Local Development Faculty of Education, Rajabhat Maha Sarakram University
Thailand
(*author for correspondence, E-mail: Pattarapa.2505@gmail.com)

Abstract

This research aimed to 1) study problems regarding teaching elementary students' reading of the Thai content of elementary students, and 2) study guidelines for development of Thai reading instruction for elementary students. This research was conducted by using mixed methodology for collecting both quantitative and qualitative data; and the instruments used in this research were (1) a questionnaire for studying problems in teaching elementary reading of the Thai content strand, (2) a questionnaire of needs assessment for development of teaching and learning of elementary students' reading in the Thai content strand, and (3) focus-group discussion. Scope of the Study: (1) the sample group for this study consisted of 42 participants, who were 14 teachers, 14 students and 14 parents of the Angsila 4 Educational Quality Development Network Phibunmangsahan District Ubon Ratchathani province, obtained through simple random sampling; (2) the research area was the Angsila 4 Educational Quality Development Network Phibunmangsahan District Ubon Ratchathani province; and The statistics used in analyzing data for this study were mean, percentage, and standard deviation; and research results were descriptively presented.

Findings of the study are as follows:

1) Problems in elementary students' reading instruction of the Thai content found at the highest level were (1) lacking teachers for every class, (2) students' low learning achievement, and (3) contents beyond students' immediate local surroundings; while (4) lacking instructional media was found at high level. These problems were consistent with findings of the focus-group discussion: lacking teachers for ever class, having poor conditions of environment & school buildings, and small limited budgets.

2) Regarding needs assessment for development of elementary students' reading instruction of the Thai content of the Angsila 4 Educational Quality Development Network Phibunmangsahan District Ubon Ratchathani province, the study revealed what the teachers, students, and parents viewed as necessary: (1) contents of immediate local surroundings appropriate to the students' age and level, e.g. tales, songs, picture description in writing, which were needed at the highest level; (2) cooperative teaching techniques and process teaching, needed at the high level; (3) using instructional media, including both published materials and technological media, which were also needed at the high level; and (4) informing students of their learning results. The results were consistent with findings of the focus group discussion, which revealed that the teachers, students and parents preferred learning contents of familiar local contexts for reading in forms of folk tales, occupations, local foods, instructional media including both published materials and technological media, and continuous assessment of students' learning.

Keywords: Study development, Student, Elementary students, Prathomsueksa six

Introduction

The Thai people study of reading behavior, it is usually found out the popular sentence saying that “Thai people only read 8 lines a year.” This is, however, vague that it is a fact of an ironic trying to encourage Thai people to realize about the important of reading as well as to rush government to support reading. In August 5, 2009, the cabinet has raised the reading encouragement as the national agenda by appointing April 2 of every year to be “National Love Reading Day” and designating year 2009-2018 as the “National Reading Century.” Later in 2013, UNESCO, International Publisher Federation, International Book Distributor Federation, and other related organization have selected Bangkok as “World Book City,” making Bangkok a good city where good books for people are existed. The Office of International Statistics has several times observed reading behavior of people, emphasizing on part-time reading in all types of books as well as reading
through electronic media such as internet and CD. It is found out that, in 2013, children at young age have the highest rate of reading while the rests are youth, working age, and aging people, comparing to the survey in 2011. People maintained higher rate of reading which children aged below 6 reading rate increased from 53.5% to 58.9% while people aged above 6 reading rate rose from 68.6% to 81.8 %. It is considerably that because of the supporting policy and campaign from different sectors making the higher rate of reading The survey result on reading of Thai people indicated that reading is milestone of development on education and living quality. An example of the case study at the observed area represented that reading of Prathom sucksa 6 has an effect on learning achievement for only 60.05% which is below the standard fixing at 75%. The failure is based on teachers, laziness of students who are not passionate in reading, students want to play games, students using telephone in class, and non-fluency of pronunciation. Moreover, the guardians commented that the families must be importantly drive and motivate their children to read. (Dailynews Newspaper, April 11, 2014, p. 27)

Objectives of the Research

1. To study problems regarding teaching elementary students reading of the Thai content of the Angsila 4 Educational Quality Development Network phibunmangsahan District Ubon Ratchathani province.
2. To study guidelines for development of Thai reading instruction for elementary students of the Angsila 4 Educational Quality Development Network phibunmangsahan District Ubon Ratchathani province

Materials and Methods

Research Instruments:
(1) a questionnaire for studying conditions and problems in Thai teaching and learning of the elementary level,
(2) a questionnaire of needs assessment for development of teaching and learning of elementary students’ reading in the Thai content strand, and
(3) a focus-group discussion of 14 teachers, 14 students, and 14 parents.

Research Methodology:
This research was conducted by using mixed methodology of both qualitative and quantitative studies.
(4) Scope of the study
4.1 Population and Sample Group
The population of the study were teachers of the Thai content strand, and the sample group consisted of 14 teachers student and 14 parents from 14 schools under of the Angsila 4 Educational Quality Development Network phibunmangsahan District Ubon Ratchathani Office of Elementary Education Service Area 3.
4.2 Research Contents
(1) problems regarding teaching elementary reading of the Thai content strand in under the Angsila 4 Educational Quality Development Network phibunmangsahan District Ubon Ratchathani province
(2) guidelines for development of reading of the Thai content strand
4.3 Research Area
The schools of under the Angsila 4 Educational Quality Development Network phibunmangsahan Ubon Ratchathani province
(5) Collection of data
Data for this study were collected through (1) review of related literature, (2) focus-group discussion, (3) use of survey questionnaire regarding problems and questionnaire for assessing needs for development of elementary reading instruction of the Thai content students in Prathom Sucksa 6.
(6) Data analysis
Data analysis was done through the following: (1) analyzing review of related literature and research, (2) analyzing reading problems, (3) analyzing needs for development of elementary reading and writing instruction of the Thai content in Prathom Sucksa 6 students. Results were then presented in descriptive analysis.

(7) Statistics used in data analysis
Data were treated with basic statistics: percentage, mean and standard deviation.
Results

Findings reveal the following:

1. The data collected from teachers respondents of the survey questionnaire on problems regarding reading instruction in under the Angsila 4 Educational Quality Development Network Phibun Mungsahan District Ubon Ratchathani province reveal the following: (1) lack of teachers for every class (80%), the highest level; (2) teachers teaching subjects not related to their major fields, and working without morale & support (75%), the high level; and (3) students' low learning achievement (55.50%), that was below the required 65% criterion. This problem was determined at the highest level (80%); reading and writing contents beyond the students’ local contexts accounted for 80 %, also the highest level; too much learning content for Prathom Sucksa 6 students (80%); and in under the Angsila 4 Educational Quality Development Network phibunnangsaahan District Ubon Ratchathani province schools also have budget problems and lack instructional media (80%), also at the highest level.

Results of the focus-group discussion of 14 teachers, 14 parents and 14 students reveal the following: Teachers' problems include having low numbers of teachers, lacking support in training, teachers' requests to transfer to other schools, and lacking morale and support. Students' problems are the following: not wanting to do homework but preferring to listen to songs and watch television series, lacking self-confidence and courage to express themselves, and lacking reading and writing skills. The followings are typical teaching conditions described by the students during the interviews: "Our teacher uses television in her teaching and lets us watch and learn the contents from the teacher on TV but does not ask us questions or talk with us after watching. Rather, she lets us work on exercises after each lesson. We don't know if our answers are right or wrong"(Male Student A and Female Student B, pseudonyms. 2015: Interview). Some problems are described by the parents that "There are only a few teachers. Wealthy families prefer to send their children to large and famous schools of the province in town. Most of them are not sure if in under the Angsila 4 Educational Quality Development Network phibunnangsaahan District Ubon Ratchathani province schools can teach or prepare their children with all the knowledge or contents required in the curriculum. So, they cannot trust these schools."

From the aforementioned problems regarding reading instruction in under the Angsila 4 Educational Quality Development Network phibunnangsaahan Ubon Ratchathani province schools, it can be concluded that the same or similar problems viewed by the teachers, students, and parents are: having a few teachers and small number of students, not using a variety of instructional media in teaching reading and writing, lacking regular assessment of students' learning achievement, and not giving students feedback to reinforce their learning and to improve themselves.

2) The results of needs assessment for development of elementary reading of the Thai content strand are as follows: the teachers prefer teaching with activities using the content materials related to the students' immediate local surroundings such as folk tales(80%), which is the highest level, and other contents they consider appropriate to the ages of Prathom Sucksa six students such as songs and picture description (80%), which is also found at the highest level. Regarding teaching and learning activities, they prefer to prepare learner-centered instructional plans, e.g. collaborative and process learning at the high level (75%). For instructional media, they want to use printed or published materials, e.g. books of folk tales, cartoons, and document materials on reading and writing as well as a variety of technologial instructional media such as mixed media and instructional packages at the high level (75%). Findings on their needs for development of reading and writing from the collected data and information gained during the focus-group discussion of the teachers, students and parents reveal that the teachers prefer contents that involve local wisdom; particularly folk tales, traditional local foods, herbs, and occupations.(Tang Kanuekrat and Sakon Baibong. 2015: Interview). As for the students' needs regarding contents, they "want reading and writing picture description, writing words and sentences, reading along with pictures, reading story tales, singing during the lesson and writing correctly the lyrics of what they sing( Afe and Boy, pseudonym. 2015: Interviews). Regarding instructional media and activities, both the teachers and students want field trips or sight-seeing of learning sites outside the school, to be used as supplementary learning resources ( Teacher A, pseudonym. 2015: Interview). As shown in the results of the needs assessment from the survey questionnaire and the focus-group discussion, these subjects have the following needs in common: using learning activities or contents appropriate to the students' age group or level: story tales, songs, sentence reading, and reading picture description. Regarding teaching techniques, they prefer cooperative and process teaching techniques with a variety of instructional media such as printed or published materials and technological instructional media.
Conclusions and Discussion

Discussion on Research Findings

The problem conditions of elementary reading instruction of the Thai content from under the Angsila 4 Educational Quality Development Network phibunmangsahan Ubon Ratchathani province, can be summed up as follows: Teachers’ problems include not having enough teachers for every class, heavy teaching and work loads, lacking morale and support, and frequent requests for transfer to other schools, which are consistent with study results of Report on Educational Management Plans of Regional Office of Ubonratchathani Elementary Education Area 3 (2014). School Management Plan, Center of Education Network 4 Angsila Group Ubonratchathani, identifying problems of small schools as having small numbers of teachers and low numbers of students. Regarding academic performance, students of small schools have low learning achievement (Report on Evaluation Results of Thai Learning. 2015: 10). Findings of the focus-group discussion on needs for development of reading and writing reveal that the teachers, parents and students prefer content materials for reading and writing based on tales, songs, reading and writing of picture description, that should lead to increase in elementary students’ reading practice on what is relevant to their preference. This is consistent with the study results of Wannee Somprayoon (1996: 121-122), emphasizing that reading and writing are essential communicative skills for students to study other content strands of further levels.

Recommendation for Further Research

The same research path should also be conducted but focusing on reading development with cooperating group teaching by using local wisdom at Thai language of elementary students.

References

A new instrument was developed to assess student perceptions of psychosocial environment in science laboratory classrooms, and reports comprehensive validation information for small samples of 166 lower secondary educational students at Grade 8 level from Wapipatum School with the 4-science laboratory class environments. Science students’ perceptions of their actual and preferred laboratory classes were assessed and compared. Associations between students’ perceptions and their attitudes toward science were assessed. Using the 35-item and 5-Scale of Thai version of the Science Laboratory Environment Inventory (SLEI) instrument and students’ attitudes were assessed with a short of the Test of Science-Related Attitude (TOSRA) for administrating and revealing research methodology. Statistically significant between students’ perceptions of their actual and preferred science laboratory classroom learning environments were found. Associations between student’s perceptions and their attitudes toward their science all five scales, significantly. Using Cronbach’s alpha reliability coefficients for the scales were adequate while confirmatory factor analyzes provided support for the theoretical framework behind the questionnaire were omitted. The multiple correlations $R^2$ is significant for the SLEI and considered associations with the Attitude scale, and value indicates that 40% of the variance in students’ attitude was also determined. Suggestions that this study was known the effects of laboratory instruction on student learning and attitudes to conclude that “Laboratory work is an accepted part of science teachers were arranged to give its important place in the education of laboratory settings and show the impact of science laboratory classes on student outcomes”.

**Keyword:** Science Laboratory, Science classroom, Learning, Student perception

**Introduction**

Basically, the classroom learning environment research has spanned more than four decades with significant contributions to the field of education. Reviews of research (Fraser, 1986; Fraser, 1998; Fraser & Walberg, 1991; Haertel, Walberg & Haertel, 1981) reported that most of the studies on classroom learning environments used the perceptual measures approach to investigate the nature of classroom learning environments. This approach involved the use of classroom environment instruments to measure teachers’ and students’ perceptions of their classroom environments for investigating the nature of the classroom learning environment. These studies had developed many well-validated and robust classroom environment instruments for use in many countries in different classroom contexts (Fraser, 1998).

In terms of laboratory teaching is one of the hallmarks of education in the sciences (Hegarty, 1987), but writers are questioning whether the great expense of maintaining and staffing laboratories is really justified (Hofstein & Lunetta, 1982; Walberg, 1991), and whether many of the aims of laboratory teaching could be pursued more effectively and at less cost in non-laboratory settings. However, we know little about the effects of laboratory instruction on student learning and attitudes. In reviewing 16 recent studies, Gallagher (1987) concluded that “Laboratory work is an accepted part of science instruction. Given its important place in the education of youth, it is surprising that we know so little about its functioning and effects” was assessed (p. 351). New research will illuminate students’ views of laboratory settings and show the impact of laboratory classes on student outcomes.

The Science Laboratory Environment Inventory (SLEI) was developed to examine students’ perspectives about their science laboratory courses (Fraser et al., 1993). The SLEI is unique in that it comes in two parallel forms, one which addresses the current class, and one which addresses how they would prefer the class to be (Fraser et al., 1993). The SLEI examines five subscales: integration, rule clarity, student
cohesiveness, open-endedness, and material environment (Fraser et al., 1993). The SLEI consists of 7 items for each subscale, yielding 35 total items which are answered through a 5-Point Likert scale.

Focusing on the early 2001, the Ministry of Education began developing new national curricula in an endeavor to model the system of education on child, or student-centered learning methods. The years from 2001 to 2009 showed some of the greatest improvements in education, experiments had also been tried with restructuring the administrative regions for education or partly decentralizing the responsibility of education to real change and many attempts to establish a clear form inappropriate or mismatched syllabus in the schools that it should be followed as the Thai policy government. The purpose of this study is beyond the scope of this article to summarize the decades of research on this topic; however, a perusal of the school and classroom climate literature indicates that the stability and efficacy of elementary school children’s social interactions influence their academic and social development. This study is to focus on given the paucity of strong empirical research conducted with Thai secondary school students at the Wapipatum School at Grade 8 in Mahasarakham Province for demonstrating the reliability and validity of the Science Laboratory Environment Inventory (SLEI), before it could be recommended to school administration as a viable measure of school climate within the Test Of Science-Related Attitude (TOSRA), the instruments need to be thoroughly analyzed psychometrically.

Science Classroom Learning Environment

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers' use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currents trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, cross-national studies, transition between primary and secondary schooling, teacher education and teacher assessment) (Fraser, 1998).

Using students’ perceptions to this study educational environments can be approached to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits of quantitative method when studying educational environments (Fraser & Tobin 1991).

Science Education Learning Environment Instruments

In the past three decades, There are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos & Trickett 1987). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1994; MacAuley, 1990; von Saldern, 1992) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (Fisher 1994).

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos (1974) scheme for classifying human environments.
Selected the Research Instruments

The Science Laboratory Environment Inventory (SLEI)

The Science Laboratory Environment Inventory (SLEI) was developed to examine students’ perspectives about their science laboratory courses (Fraser et al., 1993). The SLEI is unique in that it comes in two parallel forms, one which addresses the current class, and one which addresses how they would prefer the class to be (Fraser et al., 1993). The SLEI examines five subscales: integration, rule clarity, student cohesiveness, open-endedness, and material environment (Fraser et al., 1993). The SLEI consists of 7 items for each subscale, yielding 35 total items which are answered through a 5-Point Likert scale.

The Science Laboratory Environment Inventory assesses students’ or teachers’ perceptions of five dimensions of actual or preferred classroom environment, namely, Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment. The instrument was field-tested in Canada, Australia, the United States, England, Israel, and Nigeria, both in secondary and in post-secondary institutions. Various analyses attested to each scale’s internal consistency, reliability, discriminant validity, factorial validity, predictive validity, and ability to differentiate between the perceptions of students in different classes. The instrument is equally valid for use in its actual and preferred versions, for senior secondary school and university laboratory classes, for the individual or the class mean as the unit of analysis, and for each of the six countries.

The Test Of Science-Related Attitude (TOSRA)

This study investigated associations between Actual and Preferred students’ perceptions of their science laboratory environment classes in Wapipatum School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among science laboratory environment classes in Wapipatum School’s students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred students’ perceptions of their science laboratory environment classes. Furthermore, the TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

Research Purposes

1. To assess student’s perceptions of their science laboratory environment classes at Grade 8 in Wapipatum School, Mahasarakham Province.
2. To compare between student’s perception of their actual and preferred science laboratory environment classes at Grade 8 in Wapipatum School, Mahasarakham Province.
3. To associate student’s attitudes of their perceptions to their actual science laboratory environment classes at Grade 8 in Wapipatum School, Mahasarakham Province.

Literature Review

Classroom environment instruments have served as sources of predictor and criterion variables in international studies in elementary and secondary schools. Student perceptions of actual classroom environment are consistently related to student cognitive and affective outcomes (Haertel, Walberg, 1981). For example, Fraser and Fisher’s (1982) study involving 116 Australian science classes established sizeable associations between several inquiry skills and science-related attitudes and classroom environment dimensions measured by the Classroom Environment Scale and the Individualized Classroom Environment Questionnaire (Fraser & Fisher, 1983a). Studies reviewed by Fraser (1986) and involving the actual form of scales as criterion variables have revealed that classroom psychosocial climate varies among different types of schools and between coeducational and single-sex schools. Both researchers and teachers have usefully employed classroom climate dimensions as criteria of effectiveness in curriculum evaluation because they differentiate revealingly between alternative curricula when student outcome measures show little sensitivity (Fraser & Fisher, 1986).

Aladejana (2007) reported of her study to determine how students assess the various components of their science laboratory environment. It also identified how the laboratory environment affects students’ learning outcomes. The modified ex-post facto design was used. A sample of 328 randomly selected students was taken from a population of all Senior Secondary School science students in a state in Nigeria, using Science Laboratory Environment Inventory (SLEI) designed and validated by Fraser et., al. (1993) was administered on the selected students. Findings revealed that students could assess the five components of the laboratory environment. Student cohesiveness has the highest assessment while material environment has the least. The results also showed that the five components of the science laboratory environment. Santiboon (2012) reported the research described science student programs’ perceptions of their physics laboratory classroom learning environments in Udon Thani Rajabhat University, Thailand. Associations between these perceptions and
students’ attitudes toward physics laboratory were also determined. The physics laboratory learning environment perceptions were obtained in 5 scales for using the 35-item Physics Laboratory Environment Inventory (PLEI), which was a modified from the original Science Laboratory Environment Inventory (SLEI) (Fraser, McRobbie, and Giddings, 1993). This questionnaire has the 2-Actual and a Preferred Forms. Students’ attitudes were assessed with the Test Of Physics-Related Attitude (TOPRA) modified from the Test of Science-Related Attitude (TOSRA) (Fraser, 1981). Statistically significant differences were found (p<0.001). The results also showed that the five components of the science laboratory environment.

Research procedure

Using the SLEI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating science laboratory classroom learning environments in science classroom learning environment for lower secondary educational students at Grade 8 in Wapipatum School, Mahasarakham Province.

Each scale of the SLEI were composed with the 7-item, minimum scoring is 7 and maximum score is 35. The first scale, Student Cohesiveness is composed the item of 1,6,11,16,21,26,31; the second scale, Open-Endedness is composed the item of 2,7,12,17,22,27,32; the third scale, Integration is composed the item of 3,8,13,18,23,28,33; the fourth scale, Rule Clarity is composed the item of 4,9,14,19,24,29,34; and the fifth scale Material Environment is composed the item of 5,10,15,20,25,30,35.

Data Analyses

Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred SLEI forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the SLEI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the SLEI with students’ attitudes to associate were analyzed.

Sample

This study is improved and developed students’ science laboratory classroom environment with actual and preferred student’s perceptions with a sample size 166 lower secondary educational students in 4 science classes at Grade level 8 in classes in Wapipatum School, Mahasarakahm Province, in the second semester in academic year 2014.

Results

Validity and Reliability of Research Instruments

This section reports typical validation data for selected classroom environment scales. Table 1, 2, and 3 provide a summary of a limited amount of statistical information for the SLEI and TOSRA instruments considered previously. Attention is restricted to the student actual form and to the use of the individual student as the unit of analysis. Table 1 provides information about each scale's internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms (significance level and eta² statistic from ANOVAs).

A. Validation of the SLEI

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1. The results given in Table 1 shows that on average item means for each of the five SLEI scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 7 and 35, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the SLEI. For the remaining five scales, namely; Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness scales.
Table 1.
Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the SLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Actual</td>
<td>28.84</td>
<td>4.12</td>
<td>0.22</td>
<td>0.46</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>preferred</td>
<td>31.34</td>
<td>4.48</td>
<td>0.21</td>
<td>0.46</td>
</tr>
<tr>
<td>Opened_</td>
<td>Actual</td>
<td>23.91</td>
<td>3.42</td>
<td>0.35</td>
<td>0.59</td>
</tr>
<tr>
<td>Endedness</td>
<td>preferred</td>
<td>28.91</td>
<td>4.14</td>
<td>0.23</td>
<td>0.48</td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>28.12</td>
<td>4.02</td>
<td>0.34</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>31.16</td>
<td>4.46</td>
<td>0.22</td>
<td>0.46</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>25.00</td>
<td>3.57</td>
<td>0.19</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>preferred</td>
<td>30.43</td>
<td>4.43</td>
<td>0.13</td>
<td>0.37</td>
</tr>
<tr>
<td>Material</td>
<td>Actual</td>
<td>25.47</td>
<td>3.64</td>
<td>0.32</td>
<td>0.56</td>
</tr>
<tr>
<td>Environment</td>
<td>preferred</td>
<td>30.28</td>
<td>4.33</td>
<td>0.20</td>
<td>0.44</td>
</tr>
</tbody>
</table>

The internal consistency reliability of the version SLEI used in this study was determined by calculating Cronbach alpha coefficient for the 35 items of the SLEI using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the SLEI, which ranged from 0.51 to 0.78 when using the students’ actual climate scores and from 0.63 to 0.82 when using the students’ preferred climate scores.

Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the SLEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA Results (eta²)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Actual</td>
<td>0.73</td>
<td>0.64</td>
<td>17.98</td>
<td>0.32</td>
<td>0.00***</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Preferred</td>
<td>0.82</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened_</td>
<td>Actual</td>
<td>0.69</td>
<td>0.65</td>
<td>6.76</td>
<td>0.21</td>
<td>0.00**</td>
</tr>
<tr>
<td>Endedness</td>
<td>Preferred</td>
<td>0.75</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>0.78</td>
<td>0.63</td>
<td>4.08*</td>
<td>0.18</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>0.51</td>
<td>0.70</td>
<td>16.63***</td>
<td>0.26</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.68</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Actual</td>
<td>0.59</td>
<td>0.68</td>
<td>4.97**</td>
<td>0.19</td>
<td>0.00**</td>
</tr>
<tr>
<td>Environment</td>
<td>Preferred</td>
<td>0.63</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)  
**Correlation is significant at the 0.01 level (2-tailed)  
***Correlation is significant at the 0.001 level (2-tailed)

This characteristic was explored using a series of one-way analyses of variance on the scales of the SLEI, which suggests that each scale of the SLEI was able to differentiate significantly (p<0.001) between students’ perceptions in science laboratory environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 4.08 to 17.98 for different scales, respectively.

Table 1 and Table 2 provide information about each scale’s internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms.

B. Factor Loading Analysis of the SLEI

The Actual and Preferred Forms of the SLEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

The SLEI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the
structure reported previously for the SLEI. Table 3 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).

Table 3.
Factor Loading for Items in the Actual Form of the SLEI

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>11</td>
<td>0.87</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>31</td>
<td>0.72</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>6</td>
<td>0.72</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>0.67</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>0.65</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>26</td>
<td>0.59</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>0.34</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>0.83</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>2</td>
<td>0.78</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>32</td>
<td>0.72</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>0.72</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.70</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>0.43</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>27</td>
<td>0.43</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>33</td>
<td>0.95</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>0.74</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>28</td>
<td>0.66</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>0.53</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>0.27</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>14</td>
<td>0.66</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>19</td>
<td>0.63</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>0.63</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>34</td>
<td>0.59</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>24</td>
<td>0.56</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>0.54</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>29</td>
<td>0.46</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>0.83</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>0.72</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.72</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>0.67</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td>0.61</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>35</td>
<td>0.60</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>0.59</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Act.</td>
<td>49.08</td>
<td>35.73</td>
<td>46.76</td>
<td>38.11</td>
<td>35.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pref.</td>
<td>51.14</td>
<td>42.17</td>
<td>44.69</td>
<td>48.65</td>
<td>32.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 166 students.
C. The Circumplex Nature of the SLEI:
To investigate the circumplex nature of the SLEI, correlations between the scales were calculated. The result is presented in Table 4. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 4. Scale Intercorrelations for the SLEI Using the Actual and Preferred Form

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>SC</th>
<th>OE</th>
<th>In</th>
<th>RC</th>
<th>ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.39*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opened-Endedness</td>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.69**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Actual</td>
<td>0.46**</td>
<td>0.50**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.65**</td>
<td>0.44*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>Actual</td>
<td>0.51**</td>
<td>0.56**</td>
<td>0.62**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.90**</td>
<td>0.62**</td>
<td>0.58**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Actual</td>
<td>0.31*</td>
<td>0.25</td>
<td>0.63**</td>
<td>0.59**</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Preferred</td>
<td>0.58**</td>
<td>0.58**</td>
<td>0.61**</td>
<td>0.51**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

D. Validation of the TOSRA
To measure science students’ attitudes towards science laboratory classroom learning environment in science learning group, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997; Kijkosol & Fisher, 2005, Santiboon & Fisher, 2005; Santiboon, 2010, 2011, 2012, 2013, 2014), which was based on the Test Of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the TOSRA had a value of 0.77 which was considered satisfactory for further use in this study.

The results of this study also indicate that using the SLEI helps science laboratory classroom learning environment teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the science laboratory classroom learning environment curriculum for the Wapipatum School students in science classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in science laboratory classroom learning environments.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the SLEI.
Associations between Students’ Perceptions of their Actual and Preferred Science Laboratory Classroom Learning Environments toward their Attitude (TOSRA)

In this study, it was also considered important to investigate associations between students’ perceptions of their science laboratory classroom learning environments with their attitude toward science laboratory classroom learning environments subject. The Cronbach alpha reliability of the selected TOSRA was 0.77, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in science laboratory classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOSRA that it’s reported in Table 5.

Table 5. Associations between SLEI Scale and Attitude Scale to seminar on science education Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple Correlation Attitude (r)</td>
<td>Standard Regress Weigh Attitude(β)</td>
<td></td>
</tr>
<tr>
<td>Student Cohesiveness</td>
<td>0.18*</td>
<td>0.20*</td>
<td></td>
</tr>
<tr>
<td>Opened-Endedness</td>
<td>0.24**</td>
<td>0.24**</td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>0.20*</td>
<td>0.21**</td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>0.27**</td>
<td>0.27**</td>
<td></td>
</tr>
<tr>
<td>Material Environment</td>
<td>0.23**</td>
<td>0.23**</td>
<td></td>
</tr>
<tr>
<td><strong>Multiple Correlation (R)</strong></td>
<td>0.6304**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>0.3974**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science laboratory classroom learning environments on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favourable attitude towards their science laboratory classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their science laboratory classroom learning environments on all scales of the Actual Form.

Conclusions and Discussions

Table 5 is compared to investigate associations between science students’ perceptions of their science laboratory classroom learning environments with their attitude toward science laboratory classes. Using the SLEI instrument in the higher education level, Wapipatum School, Thailand, will help teachers to evaluate their learning environments in science laboratory classroom learning environments in order to improve their education process. Furthermore, the information from the SLEI could be useful as the guide to enhance the effectiveness of science laboratory classes. The effectiveness in science laboratory classroom learning environments is very important because the improving work is high cost and time consuming. Therefore, evaluation of science laboratory classroom learning environments teaching is important for improving and developing students’ learning achievement successfully.

The actual and preferred perceptions of 166 student of their science laboratory classroom learning environments were measured with the SLEI. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more cohesiveness, friction, difficulty, satisfaction, and competitiveness in their science laboratory classroom learning environments. In general, students’ perceptions of their preferred science laboratory classroom learning environments were to be greater than what they actually perceive to be provided. The results of this study also indicate that using the SLEI helps science teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.
An investigation of the association between students’ perceptions of learning environments with their attitudes to their science laboratory classroom learning environments with regard to the SLEI, it was found that all of five scales were positively associated with students’ attitude to science laboratory classroom learning environments. The multiple correlation R is significant for the SLEI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The R² values indicate that 60%, with actual form of the valiance in students’ attitudes to their English Graduate Studies II class was attributable to their perceptions of their English Graduate Studies II classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their science laboratory classroom learning environments lessons.

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments My Class Inventory (SLEI). This instrument provides the information of students’ perceptions on actual and preferred learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science laboratory classroom learning environments.

Overall, this study replicated previous studies using the SLEI, with the findings being consistent with the situation in Wapipatum School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the science laboratory classroom learning environments, interestingly.

The SLEI could be used as either a predictor or an outcome variable depending upon the research questions being asked. It may also be a useful evaluation tool. For example, if one was testing a new type of laboratory course, the SLEI could be used to see not only what students would prefer in the course, but also to see how they felt about the course after it was implemented.

Acknowledgements

Firstly, I would like to thank the 99 science students in Wapeepatum School at the Grade level 8 who were parted of the study. Thank you to the Mr. Pisit Wannasee, Mrs. Laksamee Muangkla, and Mrs. Iladda Pamuta who allowed students to complete the questionnaire. I must thank you my supervisor; Dr. Nukul Kuttalang and my co-supervisor; they understood and never pushed me to build up of my research that it was going on work, completely. Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Associations Between Student’s Perceptions and their Science Attitudes Toward Science in Borabu Wittayakhan School at Grade 9th Level

Nopphadon Manolai1, Nukul Pondang2, Patcharin Teappim3 and Toansakul Santiboon1,∗

1,4Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
2Department of Science Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
3Science Learning Group Borabuwittayakhan School, Maha Sarakham, Thailand 44130
∗(author for correspondence, E-mail: toansakul35@yahoo.com.au)

Abstract

Because of the critical importance and uniqueness of laboratory settings in science education, an instrument specifically suited to assessing the environment of science laboratory classes at the lower education levels was developed (Fraser, Giddings & McRobbie 1995, Ssntiboon & Fisher 2005, Santiboon, 2012). The SLEI has five scales (each with seven items) and the five response alternatives are Almost Never, Seldom, Sometimes, Often and Very Often. The purposes of this study were to explore and assess the science laboratory classroom learning passive reveal with the Science Laboratory Environment Inventory (SLEI) meanwhile was assessed with a sample of 116 students in 3 science classes in Borabu Wittayakhan School at the Tenth-Grade level. Associations between actual students’ perceptions of the SLEI and the Test of Science-Related Attitude (TOSRA) toward science to relate, which it has indicated that statistically significant on validity and reliability of the research instruments were associated. In terms of the multiple correlations (R) are is significant for the actual form of the PLEI and shows that when the five scale are considered together there is significant (p <0.05) associations with the TOPRA, the R2 value indicates that 18% of the variance in students’ attitude to their science class was attributable to their science laboratory classroom learning environment. This findings are the strongest tradition in past classroom environment research has involved investigation of associations between students’ cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their science classroom, interestingly.

Keywords: Actual form, Education, Science Laboratory, Students perceptions, Learning

Introduction

Background of Science Educational System in Thailand

Education in Thailand is provided mainly by the Thai government through the Ministry of Education from pre-school to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years’ school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable (Ministry of Education, 2010). An assessment of the quality of secondary school education has indicated that only 40% of 3 secondary learners received adequate preparation for readiness in learning before attending university. Although Thailand has a very high percentage of youth learners attending child development centers, if such centers are not supported properly through strengthening capacity and management, the quality of secondary development and young children’s preparation for primary and secondary schooling can be seriously affected (UNESCO, 2011). Most students attend formal educational institutions administered by the Ministry of Education and about half of these children enroll in learning childcare/development centers of the formal education system, mainly administered by the Department of Local Administration. The Office of Basic Education Commission (OBEC) prepares the basic core curriculum and disseminates it to all Educational Service Area (ESA) Offices for distribution to parents, guardians and teachers, so as to ensure that all key stakeholders combine efforts to provide school children with quality education. The 10-Year Plan and Policy for the Basic Educational Secondary Development (2006-2015) provides a blueprint for achieving universal student education for all Thai children. The 10-Year Plan and Policy gives priority to three main strategies, namely; (1) to support youth development; (2) to support
parents and other stakeholders; and (3) to promote an environment that facilitates secondary educational learners.

Science laboratory has a crucial role in science education as it gives students a chance to embody their theoretical knowledge. In the literature, there have been many studies investigating the relationship between students’ perceptions of laboratory environments and students outcomes. Previous studies have consistently showed that there is a strong relationship between students’ laboratory environment perceptions and their outcomes. The possible effects of other student characteristics such as gender, grade level, subject, school type were also investigated with different studies all around the world (e.g. Wong & Fraser, 1994).

The Institute for the Promotion of Teaching Science and Technology (IPST)
There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as: curricula, teaching/learning process, media and materials then publicize them to all relevant organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner’s development. To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations (IPST, 2011).

International Classroom Learning Environment
Using students’ and teachers’ perceptions to study educational environments can be contrasted with the external observer's direct observation and systematic coding of classroom communication and events (Brophy & Good 1986). Murray (1938) introduced the term alpha press to describe the environment as assessed by a detached observer and the term beta press to describe the environment as perceived by milieu inhabitants. Another approach to studying educational environments involves application of the techniques of naturalistic inquiry, ethnography, case study or interpretive research. Defining the classroom or school environment in terms of the shared perceptions of the students and teachers has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data which the observer could miss or consider unimportant. Students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if teachers are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this chapter, discussion focuses on the merits of combining quantitative and qualitative methods when studying educational environments (Fraser & Tobin 1991).

Science Classroom Learning Environments
During the past 35 years, the study of classroom environments has received increased attention by researchers, teachers, school administrators and administrators of school systems. The concept of environment, as applied to educational settings, refers to the atmosphere, ambience, tone, or climate that pervades the particular setting. Research on classroom environments has focused historically on its psychosocial dimensions, those aspects of the environment concerned with human behaviour in origin or outcome (Boy and Pine, 1988). Reviews of classroom environment research by Fraser (1998b), Dorman (2002), Goh and Khine (2002) and Khine and Fisher (2003) have delineated at least 10 areas of classroom environment research including: associations between classroom environment and outcomes, evaluation of educational innovations, differences between students’ and teachers’ perceptions of classrooms, comparisons of actual and preferred environments, effect on classroom environment of antecedent variables (for example, gender, year level, school type, subject), transition from primary to secondary school, school psychology, teacher education, educational productivity research, and using environment instruments to facilitate changes in classroom life.

Instruments for Assessing Classroom Environment
Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCF); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos’s (1974) scheme for classifying human environments. Moos’s three basic types of dimension are Relationship Dimensions (which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other), Personal Development Dimensions (which assess basic
directions along which personal growth and self-enhancement tend to occur) and System Maintenance and System Change Dimensions (which involve the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Context of Borabu Wittayakhon School

Normally, almost all villages have an elementary school. Most sub-districts have a school for ages 6 through 14 and all districts have secondary schools for ages 12 through 17. Many have vocational colleges for students from age 15. The government is not able to cope with the entire number of students, thus the private sector, which is supervised by the government, provides a significant contribution. The level of education in the private sector is generally, but not always, higher than that of the government schools. Expensive, exclusive private and international schools provide for a high level of achievement and a large number of their students continue their education at universities abroad. Charitable organisations (missionary societies or diocesan), and other religions provide the backbone of non-government, low-fee, general education and some established universities, and their standard is relatively high. Cheaper, newer and individual private schools, are occasionally run more for profit and government subsidies than for results, and are often indistinguishable from government schools in terms of quality of buildings, resources, teaching competency, and overcrowded classrooms. Their only real benefit is the prestige afforded to the parents for schooling their children in the private sector. In rural schools, absenteeism among both students and teachers is high due to family and farming commitments. Some schools close down during rice planting and harvesting seasons.

At elementary levels, students follow eight core subjects each semester: Thai language, mathematics, science, social science, health and physical education, arts and music, technology, and foreign languages. At age 16 (Matthayom 4), students are allowed to choose one or two elective courses. The science program (Wit-Kanit) and the mathematics-English language program (Sil-Kamnuan) are among the most popular. Foreign language programs (Sil-Phasa), and the social science program (sometimes called the general program) are also offered. Both elementary and secondary level has special programs for students called English Program and Gifted Program. In English Program students can learn almost every subject in English except for Thai and Social Studies. The Gifted Program is the Mathematics-Science program.

Focused on Borabu Wittayakhon School is a rural or government school located in downtown as Nongsim Subdistrict and Borabu district, Mahasakham Province, Thailand. It admits from lower to upper secondary students (Grade level at of 7-12) and has the largest yearly enrolment in Borabu district in Mahasakham Province. Founded in 1971 as at 59 Jangsanit Roand, Villege number 3 Nongsim Subdistrict as a for supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. (Borabu Wittayakhon School has among the development, enhancement, and improvement entry rates for local Thai schools. The school has 5) buildings, 56 classrooms, 10 laboratory classes. This school comprises with 2,330 students, 100 senior professional teachers, a schooling administrator is Mr. Manoonchai Tapchareeoon and Miss Patcharin Teappim is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely Thai language; mathematics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

Important Problems in Science Secondary Educational Classroom Learning Environment in this study

Thailand has formulated a policy and framework for action on education for all in the 1992 National Education Scheme in compliance with the World Declaration on Education for All adopted by all UNESCO Member States during the World Conference on Education for All in March, 1990 at Jomtien, Chonburi, Thailand. The scheme aims at guiding all related agencies to implement their activities. The World Declaration will have reached one-decade old in 2000 since its adoption. An assessment on education for all will be conducted to follow up the progress of the management of education for all in UNESCO Member States. UN agencies, namely, UNESCO, UNICEF, UNDP, UNFPA, and the World Bank, have jointly published a Guideline for the Assessment as well as provided technical assistance to Member States.

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the transition to lower and upper secondary education levels was approximately 90% and it tends to be on a continual increase. The provision of pre-primary education was obviously extended as the number of school age children having obtained this level of education was relatively higher from 1990 to 68.64%. The approaches of the provision of this level of education are offered through the Community Child Care Centers, Child Care attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary education is 91.32% with equal opportunity in terms of gender. These are some of the successful models of education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to undertake the national activities in providing education for all.
This study will be made possible by the assistance of agencies relating to basic education for all, both central and regional offices under the Ministry of Education as well as other relevant agencies outside the Ministry of Education. Additionally, UNESCO has also rendered its technical and financial support to the Ministry while UNICEF has assisted in translating the report into English. The Thai Ministry of Education, as the focal point of the Assessment of EFA 2000, would like to express its sincere appreciation to all concerned and hope that this report would be of benefited to wider circles of readers.

Unfortunately that isn’t the kind of good news for Asia that Thailand can share. The PISA tests of all know that Thai students don’t belong in the same class as the world-class East Asian. Of course Thailand has a few of our own some stellar students who win medals at the math and science Olympiads but their scholastic achievements are at odds with the general performance of their peers in the Thai education system. Thai students’ performance in international standardized tests is generally below average. That’s not a surprise given such appalling scores they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor. However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is on school students, the international test that is the most relevant and highly regarded for measuring performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA 2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above 15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan, Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such as Chile, Turkey and Romania.

What has Thailand done to improve the quality of education in the past decade? Thailand has tried to do quite a lot of things in the past decade setting up the NIETS to organize O-NET was among them, but evidently the initiatives haven’t yielded good results. Thailand’s PISA scores over the past nine years have shown no discernable progress whatsoever. A lot of money has been put into the Thai education system: 20% of overall national budget or 4% of GDP. That rate of spending puts Thailand among the top spenders on education—more than what Singapore and Japan spend relative to size, although other top performers such as Hong Kong and South Korea, and neighboring countries such as Malaysia and Vietnam, also spend around 4-5% of their GDP on education. Yet, as this situation has seen, Thailand’s results leave much to be desired.

Focusing on this research study, science laboratory classroom environment dimensions have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of school. This study will be established associations between teacher personality and classroom environment, and will report differences in the science classroom environment perceptions of Borabu Wittayakhan school students, the individual cultural differences in student perceptions of teacher-student interaction and their classroom learning environments.

This study wills also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample science students in 11 classes and a school environment instrument to 4 teachers of these classes, only weak associations between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

Materials and Methods

Research Purposes

1. To explore the science classroom learning environment instruments for using these research instruments in learning classroom research in the secondary education in Thailand.
2. To describe and investigate of actual students’ perception in Science Classroom learning environment for using the SLEI in Borabu Wittayakhan School at level 8.
3. To analyze of reliability and validity of the SLEI and the TOCRA research instrument will use in Borabu Wittayakhan school at level 8.
4. To associate between students’ perception of their actual individual Science classroom learning environment and their Science attitudes.

Previous Research
Angela F. L. Wong & Barry J. Fraser (2008) using the Science Laboratory Environment Inventory (SLEI) is a recently developed classroom environment instrument for assessing students’ or teachers’ perceptions of their science laboratory classroom environment. This paper describes its development and reports on the validation and application of its modified form, the Chemistry Laboratory Environment Inventory (CLEI), with a Singapore secondary school sample. The sample consisted of 1,592 final-year secondary school (i.e. tenth grade) chemistry students from 56 intact classes from 28 randomly selected co-educational government secondary schools in Singapore. Various item and factor analyses supported the reliability and validity of the instrument for assessing students’ perceptions of their chemistry laboratory environment specifically in Singapore.

Aladejana (2007) this studied to determine how students assessed the various components of their science laboratory environment. It also identified how the laboratory environment affected students’ learning outcomes. The modified the factor design with a sample of 328 randomly selected students was taken from a population of all Senior Secondary School Science students in a state in Nigeria. The research instrument, Science Laboratory Environment Inventory (SLEI) designed and validated by Fraser et., al. (1993) was administered on the selected students. Data analysis was done using descriptive statistics and Product Moment Correlation. It had revealed that students could assess the five components (Student cohesiveness, Open-endedness, Integration, Rule clarity, and Material Environment) of the laboratory environment. Student cohesiveness has the highest assessment while material environment has the least. The results also showed that the five components of the science laboratory environment are positively correlated with students’ academic performance in science.

Che Nidzam Che Ahmad (2010) ‘This paper reports a survey which was conducted in order to determine teachers’ and students’ perception of science laboratory learning environment schools in Malaysia and to compare their perceptions regarding the physical and psychosocial aspects. Teachers’ and students’ perception on psychosocial aspects were measured by using Science Laboratory Environment Inventory (SLEI) while perception on physical aspects was measured using Physical Science Laboratory Environment Inventory (PSLEI). Analysis of findings found that teachers and students demonstrate positive attitudes in all SLEI scales, with an exception in open ended scale, hi terms of physical aspects, teachers provide a high level of fitness for lighting and technology while moderate for furniture and equipment, space, air quality and safety aspects scales. Meanwhile students rate the lightning and space as having high level of fitness while technology, air quality and safety aspects scales as moderate. Subsequent analysis also reveals that there exist significant differences between teachers’ and students’ perception of physical and psychosocial laboratory learning environment. © 2010 Published by Elsevier Ltd.

Research Procedures
Using the SLEI was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating science laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 9 in Borabu Wittayakahan school, Maha Sarakham Province

Each scale of the SLEI were composed with the 7-item, minimum scoring is 5 and maximum is 35. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16, 21, 26, and 31; the second scale, Student Cohesiveness behavior is composed the item of 1, 6, 11, 16, 21, 26, and 31; The second scale, Open-Endedness behavior is composed the item of 2, 8, 12, 17, 22, 27, and 32; The third scale, Integration behavior is composed the item of 3, 8, 13, 18, 23, 28, and 33; Fourth, Rule Clarity scale is composed the item of 4, 9, 13, 18, 23, 28, and 34; and Final scale, Material Instrument scale is composed the item of 5, 10, 15, 20, 25, 30, and 35.

Data Analyses
Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred SLEI forms and the Attitude scale as specified in Santiboon (2014). Factorial validity and adequacy of fit for the dimensionality of the SLEI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the SLEI with students’ attitudes to associate were analyzed.

Sample
This study is explored and described based on the developing students’ science laboratory classroom environment with actual and preferred student’s perceptions with a sample size 116 lower secondary educational students at Grade level 9 in 3 classes in Borabu Wittayakhan school, Maha Sarakham Province, in the first semester in academic year 2015.

Research Instruments
The Science Laboratory Classroom Inventory (SLEI)
Using the SLEI, associations with students’ cognitive and affective outcomes have been established for a sample of approximately 80 senior high school chemistry classes in Australia (Fraser & McRobbie 1995; McRobbie &
Fraser 1993), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 1997) and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser 1996). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (1995a) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the SLEI, associations between student outcomes and perceived patterns of physics laboratory classes were reported for samples of 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 1995), 3,994 high school science and mathematics students in Australia (Fisher, Fraser & Rickards 1997), 1,512 primary school mathematics student in Singapore (Goh, Young & Fraser 1995), 4,560 upper secondary students in 243 physics school classes at the twelfth-grade level (Santiboon, 2006), and 2,265 lower secondary students in 77 school classes throughout in Thailand (2011, 2012).

**The Test of Science-Related Attitude (TOCRRA)**

This study investigated associations between Actual students’ perceptions of their science laboratory environment classes in Borabu Wittayakhan School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) and Santiboon (2008, 2010, 2011, 2012, 2013, and 2014) was modified, adapted, and selected to the Test Of Science-Related Attitude (TOSRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in Borabu Wittayakhan school students. The eight items are suitable for group administration and all can be administered within the duration of actual students’ perceptions of their science laboratory environment classes. Furthermore, the TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Results**

**Validity and Reliability of Research Instruments**

**Validation of the SLEI**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
<th>Cronbach’s Alpha Reliability</th>
<th>Discriminant Validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>29.03</td>
<td>4.17</td>
<td>0.25</td>
<td>0.57</td>
<td>0.69</td>
<td>0.64</td>
<td>5.22***</td>
</tr>
<tr>
<td>Open-Endedness</td>
<td>29.01</td>
<td>4.06</td>
<td>0.20</td>
<td>0.54</td>
<td>0.65</td>
<td>0.65</td>
<td>2.30**</td>
</tr>
<tr>
<td>Integration</td>
<td>28.84</td>
<td>4.01</td>
<td>0.23</td>
<td>0.56</td>
<td>0.67</td>
<td>0.65</td>
<td>4.53***</td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>30.13</td>
<td>4.76</td>
<td>0.29</td>
<td>0.68</td>
<td>0.62</td>
<td>0.66</td>
<td>2.14***</td>
</tr>
<tr>
<td>Material Instrument</td>
<td>30.27</td>
<td>4.05</td>
<td>0.23</td>
<td>0.56</td>
<td>0.64</td>
<td>0.65</td>
<td>4.97***</td>
</tr>
</tbody>
</table>
Factor loading Analysis of the SLEI

The Actual and Preferred Forms of the SLEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 3. Factor Loading for Items in the Actual Form of the SLEI.

<table>
<thead>
<tr>
<th>Item</th>
<th>Student Cohesiveness</th>
<th>Open-Endedness</th>
<th>Integration</th>
<th>Rule Clarity</th>
<th>Material Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>0.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td>0.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td>0.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td>0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.69</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.67</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.56</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.52</td>
</tr>
</tbody>
</table>

% of Variance: 28.13 25.87 47.34 44.31 39.67

Eigenvalue: 2.51 2.02 2.60 2.57 2.63

*Loading smaller than .30 omitted. The sample consisted of 88 students
The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between students' perceptions on each scale of the SLEI and their attitudes towards physics laboratory classes when the effect of relationships between the scales is controlled.

Table 4. Associations between SLEI scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlate Attitude (r)</th>
<th>Std. Regress Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Cohesiveness</td>
<td>0.31***</td>
<td>0.68***</td>
<td></td>
</tr>
<tr>
<td>Open-Endedness</td>
<td>0.19*</td>
<td>0.29*</td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>0.38***</td>
<td>0.71*</td>
<td></td>
</tr>
<tr>
<td>Rule Clarity</td>
<td>0.17*</td>
<td>0.16*</td>
<td></td>
</tr>
<tr>
<td>Material Instrument</td>
<td>0.26</td>
<td>0.28*</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.4803**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.1773**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The multiple correlation R is significant for Actual Forms of the SLEI and shows that when the scales are considered together there is a significant ($p<0.01$) association with the TOSRA. The $R²$ value indicates that 39% of the variance in teacher’s attitude to their school administration environment was attributable to their perceptions of their physics teachers. The beta weights (β) show that in physics laboratory environments where the teachers perceived management a more favorable attitude towards their physics laboratory environments.

Conclusions and Discussions

The strongest tradition in science classroom environment of this study has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their performances. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics. This study involves tabulation of 116 past studies in science education shows that associations between outcome measures and classroom environment perceptions have been replicated for a variety of cognitive and affective outcome measures, a variety of classroom environment instruments and a variety of samples.

This research study has been conducted on educational environments; less has been done to help teachers to improve the environments of their own classrooms or schools. This result reports how feedback information based on student perceptions can be employed as a basis for reflection upon, discussion of, and systematic attempts to improve classroom and school environments. The proposed methods have been applied successfully in studies lower upper secondary levels. The attempt at improving classroom environments described below made use of the short 35-item version of the SLEI discussed previously. The procedure followed by the teacher of this class incorporated the following five steps.

These results summarised show that some change in actual environment occurred during the time of the intervention. When tests of statistical significance were performed, it was found that differences were significant ($p<0.05$) only for Student Cohesiveness the second Open-Endedness the third scale, Integration the fourth scale, Rule Clarity the fifth scale, Material Environment Teacher Support, Task Orientation and Order and Organisation. These findings are noteworthy because two of the dimensions on which appreciable changes were recorded were those on which the teacher had attempted to promote change. Although the second administration of the environment scales marked the end of this teacher's attempt at changing a classroom, it might have been thought of as simply the beginning of another cycle.

This study evidences confirmation of the research studies at the four past decades, for example; using the SLEI, associations with students' cognitive and affective outcomes have been established for a sample of approximately 40 senior high school chemistry classes in (Fraser & McRobbie, 1993, 2003; McRobbie & Fraser 2005), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 2007) and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser 2006). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (2005a) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the QTI, associations between student outcomes and perceived patterns of teacher-student interaction were reported for samples of 489 senior high school biology students in Australia (Fisher, Henderson & Fraser
Acknowledgments

Firstly, I would like to thank the 116 science students in Borabu Wittayakhan School at the Grade level 9 who were part of the study. Thank you to the Manoonchai Tapchareon and Miss. Ratirat Kommool, and Miss. Patcharin Teappim who allowed students to complete the questionnaire.

Secondary, I would like to my fellow Master of Science students, Jirapron Sanrabun to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Thirdly, I must thank you my supervisor; Dr. Toansakul Santiboon and my co-supervisor; they understood and never pushed me to build up of my research that it was going on work, completely.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


[22] Santiboon, T. (2010). Developing learning achievement with controlled activities by the forms of learning administration plans onto students’ center in geology course in Udon Thani Rajabhat University. Proceeding of the 3rd International Conference on Education Reform (ICER2010): Education Change in the Age of Global Warming at Hoang Anh Gia Lai in Danang. The National University of Lao People's Democratic Republic, the National University of Vietnam, The University of Da Nang, Central State University, USA, GSMI, and Mahasarakham University. Da Nang City, Vietnam. pp. 1-12. CERTIFICATE OF MERIT: PRESENTED WITH BEST TEACHINGPAPER AWARD.


Associations Between Teacher-Student Interpersonal Behavior and Student Attitudes to Physics Classroom Learning in Borabu Wittayakhan School

Weerayut Taodee¹, Toansakul Santiboon¹, ² and Phattanawong Dorkmai²

¹Department of Master of Science Education, Faculty of Education, Rajabhat Maha Sarakham University MahaSarakham, Thailand
²Science Learning Group Section, Borabu Wittayakhan School Maha Sarakham, Thailand

(Author for correspondence, E-mail: toansakul35@yahoo.com.au)

Abstract

This study assessed teacher-student interpersonal behavior in physic classrooms with a sample of 72 students in 2 classes at Grade 10 in Borabu Wittayakhan School and examines the relation of teacher-student interpersonal behavior to student attitude. It also describes how physics teachers can and have used the actual Questionnaire Teacher Interaction (QTI) to assess perceptions of their own teacher-student interpersonal behavior, and used for reflecting on their own teaching assessments. The QTI may thus provide a basis for systematic attempts to improve one’s own teaching was also used. The Test Of Physical-Related Attitude (TOPRA) associated between students’ perceptions of their teacher interpersonal behaviors to their attitudes toward physics classes. The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all eight QTI scales. The physics teachers could be identified as those whose students’ perceptions were more than one standard deviation above the mean on the scales of leadership, helping/friendly, and understanding and more than one standard deviation below the mean on the uncertainty, dissatisfied and admonishing scales. The multiple correlation $R$ is significant for the actual form of the QTI and shows that when the eight scales are considered together there is significant ($\rho < 0.05$) association with the TOPRA, the $R^2$ value indicates that 39% of the variance in students’ attitude to their physics class was attributable of their individual classroom learning environment. Based on research on learning environments, several practical implications for policy-makers and practitioners can be drawn and provided.

Keywords: Interpersonal behaviors, Borabu Wittayakhan school, Physics classroom, Learning, Teacher

Introduction

During the last three decades, considerable interest has been shown internationally in the conceptualization, measurement and investigation of perceptions of psychosocial characteristics of the learning environment in science classrooms Fraser, B.J.& Walberg, H.J. (Eds.). (1991)[1]. in these studies, the role of students’ perceptions of the physics classroom environment in influencing cognitive and affective outcomes has been extensively demonstrated (Wubbels, Brekelmans. 1997[2]; Wubbels, Brekelmans, den Brok, Tartwijk. 2006)[3]. The teacher-student relationship can be regarded as one of the most important factors in (science or physics) teaching, as it directly relates to classroom management (Doyle. 1986) [4]. Research has shown that students’ perceptions of teacher-student interpersonal behavior are strongly related to student achievement and attitudes in all subject areas (den Brok, Brekelmans, Wubbels. 2004[5]; Wubbels, Brekelmans, den Brok, Tartwijk. 2006)[3] and that healthy teacher-student interpersonal relationships are a prerequisite for engaging students in learning activities (Brekelmans, Sleegers, Fraser. 2000)[6].

Several studies conducted in Thailand have shown a similar importance of the teacher-student interpersonal relationship for the Thailand context (Santiboon, Fisher. 2004[7]; Santiboon. 2011[9]; Kijkosol, Fisher. 2006[10]; Wanpen. 2005)[11]. These studies mainly used teacher and student interviews or (expert) observation as their primary methods of investigation and collected data with relatively small samples. The present study investigated students’ perceptions of teacher interpersonal behavior by means of a (widely used) questionnaire and focused uniquely on the teacher-student relationship in the classroom. Moreover, the development of a ‘Thai typology’ of science, physics, chemistry, biology, and physics teacher interpersonal behaviors in secondary schools has been attempted previously only with a small sample. The present study investigated to what extent earlier found also apply to a small sample of upper secondary school physics teachers. The results of this study may help teachers and teacher trainers in Thailand or countries with providing insight into teacher behaviors that are common in Thai classes and that are relevant to Thai students’ attitudes toward physics.
Context of BorabuWittayakhan School

BorabuWittayakhan School is a government school located in NongsimSubdistrict and Borabu district, Masakham, Thailand. It admits from lower to upper secondary students Grade level at of 7-12 and has the largest yearly enrolment in Borabu in MahaSarakham. Founded at 59ChaengSanitRoad, NongsimSubdistrict, Borabu District, MahaSarakham Province for supported the household families who live in this local area, the school has long been regarded as one of the attracting students from their social community and daily life. BorabuWittayakhan School has among the development, enhancement, and improvement entry rates for local Thai schools. The school has 10 buildings, 61 classrooms, 5 laboratory classes. This school composes with 2,330 students, 100 senior professional teachers, a schooling administrator is ManolchaiTapjarean, PattanawongDorkmai is the teacher trainer. The school follows the National Core Curriculum of Basic Education, BE 2551 (2008 CE), providing three years of lower secondary education and three years of upper secondary education. Subjects are grouped into eight basic subject areas, namely; Thai language; physics; science; social studies, religion and culture; health and physical education; arts; vocations and technology; and foreign languages.

Important Problems in Science Secondary Educational Classroom Learning Environment in this study

What has Thailand done to improve the quality of education in the past decade? Thailand has tried to do quite a lot of things in the past decade setting up the NIETS to organize O-NET was among them, but evidently the initiatives haven’t yielded good results. Thailand’s PISA scores over the past nine years have shown no discernible progress whatsoever. A lot of money has been put into the Thai education system: 20% of overall national budget or 4% of GDP. That rate of spending puts Thailand among the top spenders on education—more than what Singapore and Japan spend relative to size, although other top performers such as Hong Kong and South Korea, and neighboring countries such as Malaysia and Vietnam, also spend around 4-5% of their GDP on education. Yet, as this situation has seen, Thailand’s results leave much to be desired (Regional education office No.8) [12].

This study wills also several have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment. To be administered a classroom environment instrument to a sample Physics Classroom students in 2 classes and a school environment instrument to a teacher of these classes, only weak associations between classroom environment and school environment will associated. Although school rhetoric often will suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

Research Purposes

1. To describe and investigate of teacher-students interpersonal behaviors of actual in physical classroom learning environments using the QTI in BorabuWittayakhan School at Grade level 10
2. To analyzes of reliability and validity of QTI and the TOPRA research instruments.
3. To associate between teachers interpersonal behaviors of actual in physical classroom learning environments and physical classroom learning environment in students attitude.

PreviousWork

International research efforts involving the conceptualization, assessment and investigation of perceptions of psychosocial aspects of the classroom environment have firmly established classroom environment as a thriving field of study (Fraser, 1991[1]; 1994)[13]. For example, recent classroom environment research has focused on science laboratory classroom environments (McRobbie & Fraser, Giddings, 1991[14]; McRobbie, Fraser, 1995[15]) constructivist classroom environments (Taylor, Fraser & White, 1994)[16] and computer assisted instruction classrooms (Trinidad, Aldridge, Fraser, Wood, 2000[17]; Trinidad, Aldridge, Fraser, 2004[18]). Recently, a team of researchers in The Netherlands extended this research by focusing specifically on the interpersonal relationships between teachers and their students as assessed by the Questionnaire on Teacher Interaction (QTI)(Fisher, Fraser, Rickards. 1996[19]; Kim, Fisher, Fraser. 2000[20]; Santiboon, Fisher. 2005[21]; den Brok, Fisher, Brekelmans, Wubbels, Rickards, 2006[22]. This article describes this instrument, reports its cross-validation with an Australiansample, and describes case studies of its use as a basis for teachers’ reflection on their teaching investigated teacher behaviour in classrooms from a systems perspective, adapting a theory on communication processes developed by (Watzlawick, Beavin and Jackson 1967)[23]. Within the systems perspective on communication, it is assumed that the behaviors of participants influence each other mutually. The behavior of the teacher is influenced by the behavior of the students and in turn influences student behavior. Circular communication processes develop which not only consist of behavior, but determine behavior as well.
Materials and Methods

Research Procedures
The study involved students at Grade 10 physics classes in Borabu Wittayakhan School. The sample comprised 72 students in 2 classes together with their 1 teacher. The 48-item version of the QTI was used to gauge students' perceptions of student-teacher interpersonal behavior. Student attitudes were assessed with a ten-item TOPRA, which was based on the Test of Science-Related Attitudes (Fraser, 1981; Santiboon 2014). The wording of the items in this attitude scale are associated such that they can be used equally well with a physics class as with a physics class. In the present study, the Cronbach alpha reliability of this scale was found to be 0.79.

Using the QTI was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOPRA on the 7-8th week for associating physical classroom learning environments for upper secondary education students at Grade 10 physics classes in Borabu Wittayakhan School.

Each item of the QTI was composed of the Likert Scale for 5-Point. The first scale, Leadership is composed the item of 1, 5, 9, 16, 17, and 21; the second scale, Helpful/Friendly is composed the item of 2, 6, 10, 14, 18, and 22; the third scale, Understanding is composed the item of 25, 29, 33, 37, 41 and 45; the fourth scale, Student Responsibility/Freedom is composed the item of 26, 30, 34, 38, 42, and 46; the fifth scale, Competitiveness is composed the item of 3, 7, 11, 15, 19, and 23; the six scale, Dissatisfied is composed the item of 4, 8, 12, 16, 20, and 24; the seven scale, Admonishing is composed the item of 27, 31, 35, 39, 43, and 47; the eight scale, Strict is composed the item of 28, 32, 36, 40, 44 and 48.

Data Analyses
Assuming that the scaling of the items approximated a 5-point ranking, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual forms and the Attitude scale as specified in Santiboon (2014). Factorial validity and adequacy of fit for the dimensionality of the QTI were assessed through principal component analyses. The multiple correlations were significant of students' perceptions of their school climate for the Actual Form of the QTI with students' attitudes to associate were analyzed.

Sample
This study is explored and described based on the developing student's' Physical classroom environment with actual student's perceptions with a sample size 72 upper secondary education students at Grade level 10 in 2 classes in Borabu Wittayakhan School in the first semester in academic year 2015.

Research Instrument

Questionnaire Teacher Interaction (QTI)
For the measurement of students’ perceptions of teacher–student relationships in terms of teacher behavior, different instruments are needed, for the message and for the pattern level.

Figure 1 Two-dimensional coordinate system of the model for interpersonal teacher behavior
The Leary model has been investigated extensively in clinical psychology and psychotherapeutic settings and has proven effective in describing human interaction (Lonner, 1980)[24]. In the two dimensions are Influence (Dominance—Submission) and Proximity (Opposition—Cooperation). These dimensions can be represented in an orthogonal coordinate system. The two dimensions, represented as two axes, underlie eight types of teacher behavior: leading, helpful/friendly, understanding, student responsibility and freedom, uncertain, dissatisfied, admonishing and strict (see Fig. 1).

The sectors are labeled DC, CD, etc. according to their position in the coordinate system (much like the directions in a compass). For example, the two sectors ‘leading’ and ‘helpful/friendly’ are both characterized by Dominance and Cooperation. In the DC-sector, the Dominance aspect prevails over the Cooperation aspect covering teacher enthusiasm, motivating, and the like. The adjacent CD-sector includes more cooperative and less dominant perceptions; the teacher shows helpful, friendly, and considerate behavior.

Fig. 2 provides an overview of typical teacher behaviors that relate to each of the eight sectors of the Model.

To investigate the associations between Actual students’ perceptions of their Physics environment classes in Borabu Wittayakhan School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) [25] and (Santiboon, Chumpolkulwong, Yabosdee, Klinkaewnarong. 2012)[26] was modified, adapted, and selected to the Test Of Physics-Related Attitude (TOPRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure two distinct science-related attitudes among Physical environment classes in Borabu Wittayakhan School students. The tenth items are suitable for group administration and all can be administered within the duration of actual students’ perceptions of their physics environment classes.

**Results**

**Validity and Reliability of Research Instruments**
Reliability and Validity of the QTI in Table 1 provides some statistics on the QTI for the present sample of physics classes. Cronbach alpha reliabilities are reported for two units of analysis, namely, the student and the class. As expected, reliabilities for classes were usually higher than those where the individual student was used as the unit of analysis. Table 1 shows that the reliability for different QTI scales ranged from 0.71 to 0.94 when the individual student was used as the unit of analysis.
Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual Form of the QTI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Score</th>
<th>Mean Variance</th>
<th>Standard Deviations</th>
<th>Cronbach's Alpha Reliability</th>
<th>Discriminant Validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>15.10</td>
<td>2.79</td>
<td>0.12</td>
<td>0.75</td>
<td>0.87</td>
<td>0.75</td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>16.72</td>
<td>2.68</td>
<td>0.13</td>
<td>0.94</td>
<td>0.85</td>
<td>0.76</td>
</tr>
<tr>
<td>Understanding</td>
<td>11.65</td>
<td>2.80</td>
<td>0.12</td>
<td>0.77</td>
<td>0.76</td>
<td>0.78</td>
</tr>
<tr>
<td>Responsibility/Freedom</td>
<td>13.24</td>
<td>1.71</td>
<td>0.26</td>
<td>0.71</td>
<td>0.77</td>
<td>0.76</td>
</tr>
<tr>
<td>Uncertain</td>
<td>17.14</td>
<td>1.10</td>
<td>0.10</td>
<td>0.74</td>
<td>0.86</td>
<td>0.76</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>18.33</td>
<td>1.39</td>
<td>0.09</td>
<td>0.84</td>
<td>0.74</td>
<td>0.77</td>
</tr>
<tr>
<td>Admonishing</td>
<td>10.82</td>
<td>1.20</td>
<td>0.23</td>
<td>0.82</td>
<td>0.68</td>
<td>0.78</td>
</tr>
<tr>
<td>Strict</td>
<td>15.31</td>
<td>2.10</td>
<td>0.32</td>
<td>0.73</td>
<td>0.74</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Another desirable characteristic of an instrument like the QTI is the capability to differentiate between the perceptions of students in different classrooms. That is, students within the same class should perceive their teachers’ interpersonal behaviour relatively similarly, while mean perceptions should vary from class to class. This characteristic was explored for each scale is the QTI, using a one-way ANOVA with class membership as the main effect. It was found that each QTI scale differentiated significantly (p < 0.001) between classes; the eta-squared statistic, representing the proportion of variance explained by class membership, ranged from 0.09 to 0.32. These results indicate that the QTI is able to distinguish between the perceptions of students in different physics classrooms.

Factor loading Analysis of the QTI

The Actual Forms of the QTI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.
Table 2. Factor Loading for Items in the Actual Form of the QTI

<table>
<thead>
<tr>
<th>Item</th>
<th>Lea</th>
<th>Hfr</th>
<th>Und</th>
<th>Stu</th>
<th>Unc</th>
<th>Dis</th>
<th>Adm</th>
<th>Ste</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.94</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
</tr>
<tr>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.67</td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of variance</th>
<th>65.74</th>
<th>48.98</th>
<th>36.72</th>
<th>38.64</th>
<th>72.63</th>
<th>59.42</th>
<th>57.32</th>
<th>54.81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eigen-value</td>
<td>3.72</td>
<td>2.75</td>
<td>2.36</td>
<td>2.35</td>
<td>4.63</td>
<td>3.42</td>
<td>3.28</td>
<td>3.21</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 88 students*

The Actual Form of the QTI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent,
the structure reported previously for the QTI. Table 2 lists the items which were found to have factor loading greater than 0.30.

**The Circumplex Nature of the QTI**

To investigate the circumplex nature of the QTI correlations between the scales were calculated. The sample in

Table 3 is presented the results show that the correlations between a scale and the next scale.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Lea</th>
<th>Hel</th>
<th>Und</th>
<th>Stu</th>
<th>Unc</th>
<th>Dis</th>
<th>Adm</th>
<th>Stc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>0.83***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding</td>
<td>0.74***</td>
<td>0.63***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student’s Responsibility/Freedom</td>
<td>0.65***</td>
<td>0.57***</td>
<td>0.57*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td>-0.41*</td>
<td>-0.59**</td>
<td>-0.52**</td>
<td>-0.56**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>-0.65***</td>
<td>-0.72***</td>
<td>-0.68***</td>
<td>-0.49**</td>
<td>0.53**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admonishing</td>
<td>-0.59**</td>
<td>-0.50**</td>
<td>-0.82***</td>
<td>-0.59**</td>
<td>0.53**</td>
<td>0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strict</td>
<td>-0.52**</td>
<td>-0.55**</td>
<td>-0.51**</td>
<td>-0.51**</td>
<td>0.65***</td>
<td>0.52**</td>
<td>0.65**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

**Association between Teacher Interpersonal Behaviour and Student Attitude**

The relation of the QTI to student attitude was examined in two ways. Firstly, simple correlations were calculated between each Actual QTI scale and the attitude scale. Secondly, a multiple regression analysis was conducted in order to assess the relative weighting of the QTI scales as joint predictors of attitude. Table 4 reports the relevant statistics.

All eight simple correlations between the QTI scales and students’ attitude to class were significant ($\rho < 0.01$) all of eight scale of the QTI. The multiple correlation analysis shows that there was some overlap between the QTI scales, with four scales showing significant regression coefficients ($p < 0.05$). In physics classes where the students perceived greater Leadership and Helping/Friendly, Understanding, and Responsibility/Freedom behaviors in their teachers, there was a more favorable attitude toward the class. The converse was true when the teacher was perceived as showing Strict or Dissatisfied behaviors. It is apparent that teachers’ behavior to their students has a considerable effect on their students’ attitudes towards physics. Generally, cooperative and somewhat dominant physics teacher behavior seems to contribute to a favorable student attitude whereas oppositional and submissive behavior has the opposite effect.

The regression coefficients reported in Table 4 confirm that students’ attitude to class was positively associated with the scales on the right side of the Wubbels model (Figure 1) and negatively associated with the scales on the left side of the model. This result is consistent with previous findings of (Wubbels and Levy, 1993)[27] and suggest that, if physics teachers wish to enhance student attitudes in their classes, they should ensure they exhibit the interpersonal behaviors described on the right side of the model and reduce those described on the left side.
Table 4. Associations between QTI scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Simple Correlate Attitude (r)</th>
<th>Std. Regress Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>0.26**</td>
<td>0.24**</td>
</tr>
<tr>
<td>Helpful/Friendly</td>
<td>0.24**</td>
<td>0.25**</td>
</tr>
<tr>
<td>Understanding</td>
<td>0.23**</td>
<td>0.26**</td>
</tr>
<tr>
<td>Responsibility/Freedom</td>
<td>0.24**</td>
<td>0.23**</td>
</tr>
<tr>
<td>Uncertain</td>
<td>-0.21**</td>
<td>-0.25**</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>-0.20**</td>
<td>-0.23**</td>
</tr>
<tr>
<td>Admonishing</td>
<td>-0.26**</td>
<td>-0.21**</td>
</tr>
<tr>
<td>Strict</td>
<td>-0.19**</td>
<td>-0.20**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td></td>
<td>0.6209**</td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
<td>0.3856**</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

This study has confirmed the reliability and validity of the QTI when used in physics classes. Generally, the QTI scales were found to be associated moderately strongly with student attitude scores. In particular, student attitude tended to be higher in classrooms where students perceived greater Leadership, Understanding, Responsibility/Freedom, and Helping/Friendly behaviors in their teachers, and lower in classrooms where students perceived Uncertain, Dissatisfied, Admonishing and Strict behaviors. Physics teachers are likely to promote favorable student attitudes in their classes if they monitor and adjust their interpersonal behavior accordingly. The QTI enable physics teachers to obtain their students’ perceptions of their interpersonal behavior, their own perceptions and the behavior that they consider to be ideal. This valuable information could then be used as a basis for self-reflection by teachers on their teaching performance. In particular, sector profiles could be used in staff development activities to enable teachers to identify areas for personal development in specific classroom environments. In addition, the sector diagrams could be used as a basis for discussion of critical teaching behaviors.

The QTI has considerable value as a research tool and offers a way for physics education researchers to measure teacher-student interpersonal behavior in classrooms. The QTI could, for example, be used to investigate the impact that different interpersonal behaviors have on student attitude; to assess changes that result from the introduction of new curricula or teaching methods; and to check whether a physics teacher's interpersonal behavior is seen differently by students of different genders, abilities or ethnic backgrounds. The assessment of interpersonal behaviors could be as important as teacher personality traits and teaching style in describing the effective physics teacher.

As reported in some of the earlier studies cited above, one advantage of the QTI can be used to obtain the perceptions of either students or teachers. When the QTI is administered to both teachers and their students, comparisons can be made between teachers' perceptions of their own interpersonal behavior and their students' perceptions. Anumber of physics teachers have, in cooperation with the authors, used the QTI as a basis for self-reflection. The process begins with the teacher completing the QTI which ask the teacher to rate themselves and their ideal teacher. The teacher's students are then asked to complete the student version of the QTI.
Once the three versions of the QTI have been completed, the totals for each scale for each version are found and the mean student perception calculated. It is helpful to display the results as sector profiles similar to those shown in Figure 1 (b). This graphical presentation is easier to interpret than a table of results, and allows ready comparison to the model on which the QTI is based. The teachers are provided with a report that begins with a brief description of the model for teacher interpersonal behavior on which the QTI is based. The QTI can be considered as a way to check the interpersonal situation in the classroom both from a student and a teacher point of view, and as a diagnosing instrument to investigate the classroom climate. The results of this study may initiate and support activities in physics (teacher) education in Thailand. At this point, there are hardly (research) instruments available in the Thai context to map the (science) learning environment in a reliable and valid way.

Acknowledgments

Firstly, I would like to thank the 72 students in Borabu Wittayakhan School at the Grade level 10 who were part of the study. Thank you to the Manolchai Tapjarean, Ratirhat Khammoon and Pattanawong Dorkmai who allowed students to complete the questionnaire.

Finally, my greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


Using a classroom environment instrument for adapting the College and University Classroom Environment Inventory (CUCEI) questionnaire to examine factors that influence biology student perceptions of their learning environment was administered. Data were collected from 109 upper secondary educational school biology students in 3 classes at Grade 12 in Thakhonyang Pittayakom School. To investigate the effects of actual and preferred students’ perceptions of their biology classroom learning environments was also selected, and using the Test Of Biology-Related Attitude (TOBRA) was associated. The CUCEI are more inclined to measure personal or idiosyncratic features of student perceptions of their learning environment whereas contains preferred form more variance than at the actual class form. Also, it was found that different variables affect different scale scores. A variable that consistently affected students’ perceptions, regardless of the element of interest in the learning environment was student’s learning achievements. The factors were analyzed to appear to be affecting student perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients for the scales were provided to support for the theoretical framework behind the questionnaire were omitted. Associations between students’ perceptions and their attitudes toward their actual biology classroom learning environments were determined. The multiple correlations $R^2$ is significant for the CUCEI and considered associations with the TOBRA, and value indicates that 76% of the variance in students’ attitude was also developed. Based on findings, speaking preferred classroom learning perceived their learning environment more positively than did actual form of biology learning environment classes are achieved.

**Keywords:** Biology classroom, Learning, Student perception, Developing classroom

**Introduction**

Classroom environment instruments have been used as sources of predictor and criterion variables in a variety of research studies conducted in primary and secondary schools. Use of student perceptions of actual classroom environment as predictor variables in several different countries has established consistent relationships between the nature of the classroom environment and various student cognitive and affective outcomes (Haertel et al., 1981). Studies involving use of the actual form of classroom environment scales as criterion variables have revealed that classroom psychosocial climate varies between different types of schools, between classes of different sizes, and between classes following different subject matter; also both researchers and teachers have found it useful to employ classroom climate dimensions as process criteria of effectiveness in curriculum evaluation because they have differentiated revealingly between alternative curricula when student outcome measures have not (Fraser, 1985). Other studies have incorporated both the actual and preferred forms of classroom environment instruments in comparisons of students' and teachers' perceptions of actual and preferred classroom environment (Fraser, 1982b) and in person-environment fit studies of whether students achieve better in their preferred classroom environment (Fraser & Fisher, 1983c). As well, teachers have used assessments of their students' perceptions of their actual and preferred classroom environment as a basis for identification and discussion of actual-preferred discrepancies, followed by a systematic attempt to improve classrooms (Fisher & Fraser, 1986). Despite the existence of this strong tradition of classroom environment research at the primary and secondary school levels, surprisingly little analogous work has been conducted at the tertiary level. Although some notable work has focused on the institutional or school-level environment of universities and colleges (Pace & Stern, 1958; Halpin & Croft, 1963; Stern, 1970), classroom-level studies are conspicuously absent. One likely explanation for this simply is the unavailability of suitable, reliable, and practical instruments for use in tertiary classrooms.

A variety of instruments for assessing distinct aspects of the classroom climate, including teacher immediacy, teacher-student relationships, and the classroom environment was assessed. Teachers should employ evaluation processes to assess the classroom climate. Such assessments offer diagnostic utility in identifying specific facets of the learning environment that need improvement (Ryan, Wilson, & Pugh, 2011).
The College and University Classroom Environment Inventory (CUCEI) questionnaire was developed specifically for seminars or other small classes (<30 students). The CUCEI assesses the degree to which seminars specify task orientation but also foster independent, student-motivated projects. Sample items include “Activities in this class are clearly and carefully planned” and “Teaching approaches allow students to proceed at their own pace” (Fraser, Tregast, & Dennis, 1986).

The initial development of the College and University Classroom Environment Inventory was guided by the following four criteria: Firstly, consistency with Secondary-School Instruments. Guidance in identifying dimensions was obtained by examining all dimensions contained in existing instruments for the secondary-school level. Secondary, coverage of Moos's General Categories. Dimensions chosen provided coverage of the three general categories of dimensions identified by Moos (1974) for conceptualizing all human environments was developed. These three general categories are Relationship Dimensions (the nature and intensity of personal relationships), Personal Development Dimensions (basic directions along which personal growth and self-enhancement tend to occur), and System Maintenance and System Change Dimensions (extent to which the environment is orderly, clear in expectation, maintains control, and is responsive to change). Since Moos claims that, at minimum, Relationship Dimensions, Personal Development Dimensions, and System Maintenance and System Change Dimensions must be assessed to provide an adequate and reasonably complete picture of any environment, dimensions for the CUCEI were chosen to include at least one scale in each of Moos's three general categories. Thirdly, salience to tertiary teachers and students are assessed. By interviewing a number of tertiary teachers and students and asking them to comment on draft versions of sets of items, an attempt was made to ensure that the CUCEI's dimensions and individual items were considered salient by teachers and students. In order to achieve economy in answering and processing, the CUCEI was assigned to have a relatively small number of reliable scales, each containing a fairly small number of items. It was found that the above criteria could be satisfied with an instrument containing the following seven scales: Personalization, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, and Individualization. By writing new items and rewriting existing ones, scales selected from secondary school inventories were redefined and modified to make them well-suited to small higher education classes. The set of items passed through several successive revisions based on reactions solicited from colleagues with expertise in questionnaire construction and teaching at the higher education level. Careful attention was paid to making each item suitable for measuring either actual or preferred classroom environment.

The resulting preliminary version of the CUCEI contained 12 items per scale. Both the actual and preferred forms were field tested with a sample of 127 students in 10 classes following several different courses at one multi-purpose tertiary institution in Perth, Western Australia (Fraser et al., 1984). Both undergraduate and postgraduate classes were involved. Data were subjected to item analysis in order to identify items whose removal would enhance each scale's internal consistency (the extent to which items in the same scale measure the same dimensions) and discriminant validity (the extent to which a scale measures a unique dimension not covered by the other scales in the instrument).

In particular, scale internal consistency was improved by removing items with low item-remainder correlations (correlations between a certain item and the rest of the scale excluding that item), while discriminant validity was enhanced by removing any item whose correlation with its a priori assigned scale was lower than its correlation with any of the other six scales in the CUCEI. These procedures led to a version of the CUCEI which contained seven items per scale. The final version of the CUCEI contains 49 items altogether, with an equal number of items belonging to each of the seven scales. Each item is responded to on a four-point scale with the alternatives of Strongly Agree, Agree, Disagree, and Strongly Disagree. The scoring direction is reversed for approximately half of the items. Table I clarifies the meaning of each CUCEI scale (which has a common-sense meaning) by providing its classification according to Moos's scheme, a scale description, and a sample item. The items listed are from the actual form of the CUCEI, but the wording of the preferred form is almost identical except for the use of words such as would”. For example, the item "The instructor goes out of his/her way to help students in the actual form is reworded in the preferred form to read “The instructor would go out of his/her way to help students”.

A complete copy of the CUCEI is arranged in cyclic order so that the first, second, third, fourth, fifth, sixth, and seventh item, respectively, in each block measures Personalization, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, and Individualization. Items whose item numbers are underlined are scored 1, 2, 4, and 5, respectively, for the responses Strongly Agree, Agree, Disagree, and Strongly Disagree. All other items are scored in the reverse manner. Omitted or invalidly answered items are scored 0.30.

The strongest tradition in past classroom environment research has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms (Haertel et al., 1981). Numerous research programs have shown that student
perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics. The practical implication from this research is that student outcomes might be improved by creating classroom environments found empirically to be conducive to learning. In the present study, associations between students’ perceptions of their biology upper secondary education classroom environment and student attitudes were explored for the previously described sample of 3 classes at Grade 10 for two separate outcome measures. Because one of the CUCEI’s scales is Satisfaction, use of this dimension as a dependent variable provided some useful information about what other aspects of classroom environment tend to be linked with student satisfaction within the class.

The purposes of this study describes the development, validation, and use of a research instrument, the College and University Classroom Environment Inventory (CUCEI), designed to assess the environment of upper secondary education classrooms. The instrument evaluates students’ perceptions of the following seven psychosocial dimensions of actual or preferred classroom environment: personalization, involvement, student cohesiveness, satisfaction, task orientation, innovation, and individualization. Administration of the CUCEI to 109 students in 3 classes to the internal consistency reliability and discriminant validity of the actual and preferred forms with either the individual or the class mean as the unit of analysis, and supported the ability of the actual form to differentiate between the perceptions of students in different classrooms. A research application of the CUCEI involving associations between student outcomes and classroom environment tentatively suggested that the nature of the classroom environment affects outcomes. Another research application suggested that both students preferred a more favorable classroom environment than the one actually present, and that teachers viewed classroom environments more positively than did their students in the same classrooms. Desirable future applications of the CUCEI for research purposes and in improving teaching in upper secondary education are considered, adaptation.

Research Purposes

19. To assess student’s perceptions of their biology laboratory classroom learning environment monitoring constructivists for upper secondary educational students at Grade 12 in Thakhonyang Pittayakom School, Mahasarakham Province.

20. To compare between students’ perceptions of their actual and preferred biology laboratory classroom learning environment monitoring constructivists for upper secondary educational students at Grade 12 in Thakhonyang Pittayakom School, Mahasarakham Province.

21. To associate between students’ biology laboratory attitudes and their actual perceptions toward their biology laboratory classroom learning environment monitoring constructivists for upper secondary educational students at Grade 12 in Thakhonyang Pittayakom School, Mahasarakham Province.

Literature Reviews

Treagust and Fraser (1986) reported the paper to describe the development, validation, and use of a research instrument, the College and University Classroom Environment Inventory (CUCEI), designed to assess the environment of small higher education classrooms. The instrument evaluates students’ or instructors’ perceptions of the following seven psychosocial dimensions of actual or preferred classroom environment: personalization, involvement, student cohesiveness, satisfaction, task orientation, innovation, and individualization. Administration of the CUCEI to 372 students in 34 classes and to 20 instructors attested to the internal consistency reliability and discriminant validity of the actual and preferred forms with either the individual or the class mean as the unit of analysis, and supported the ability of the actual form to differentiate between the perceptions of students in different classrooms. A research application of the CUCEI involving associations between student outcomes and classroom environment tentatively suggested that the nature of the classroom environment affects outcomes. Another research application suggested that both students and instructors preferred a more favorable classroom environment than the one actually present, and that instructors viewed classroom environments more positively than did their students in the same classrooms. Desirable future applications of the CUCEI for research purposes and in improving teaching in higher education are considered.

Fraser, Treagust, and Dennis, (1986) reported in this inquiry consisted of the application of two classroom learning environment questionnaires developed in a Western context to a culturally diverse context, namely, the Pacific Islands. The College and University Classroom Environment Inventory (CUCEI) and Questionnaire on Teacher Interaction (QTI) instruments were administered to intact classes of first- and second-year science students ( n = 257) at a regional university in the Pacific Islands, containing a total of 12 ethnicities. The data reveal that the QTI instrument holds good reliability for all scales, whereas the CUCEI holds reliability for only two scales. This may be due to the simple nature of the questions on the QTI whereas the questions on the CUCEI require more interpretation, the latter exacerbated by the fact that English is a second or third language for most participants. Surprisingly, there were few differences in perceptions of teacher student interaction based on ethnicity, but substantial differences based on gender. As reported in previous classroom
environment research at the secondary school level, in this study, females perceived their environment more favourably than males.

Booth (1997) studied to undertaken to evaluate a change from formal lectures to raised student -teacher interaction in one learning environment. This report considers a teacher who was dissatisfied with the lack of responses from students to questions asked in class and sought a strategy to overcome the perceived problem. It was believed that the introduction of something innovative into the classroom would challenge and interest the students further. The proposal was to improve the learning environment through raised teacher-student interaction by involving the students, at both an individual and a group level, in the learning process. The students’ reaction to that change was sought using the College and University Classroom Environment Inventory (Fraser, 1992). The CUCEI Instrument contains seven scales: Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation and Individualisation. The learning environment used in this project was a class of thirty final year dental students. The learning module was “Fractures of the Jaws”. The students entered their actual perceptions before and after the module. The teacher entered his preferred perceptions. There were improvements in the students’ ratings of all scales over the test period. The teacher rated the student cohesiveness higher than the students.

Nair and Fisher (2001) This study reports the first use and validation of a modified and personalized form of the College and University Classroom Environment Inventory (CUCEI) and its use to compare both students' and instructors' actual and preferred perceptions of their classroom learning environments at the senior secondary and tertiary levels of education. The reliabilities of the scales of the modified CUCEI ranged from 0.73 to 0.94. Students at the tertiary level had a less favourable perception of the learning environment compared with senior secondary students and preferred a more positive attitude in terms of the satisfaction with courses they were taking and the level of difficulty. No differences in student attitude to the speed of delivery of science courses were found. Instructors in this study generally perceived their environment more favourably than their students; however, senior secondary instructors viewed the learning environment more favourably than the instructors at the tertiary level.

Koyak (2009) This study analyzed the effects of cooperative learning techniques versus lecture techniques on the following aspects of a higher education classroom: (a) the perception of a student's learning environment and (b) a student’s critical thinking skills. Preservice teachers at a small Midwest college completed the College and University Classroom Environment Inventory (CUCEI) and the Watson-Glaser Critical Thinking Appraisal, Form-S (WGCTA-FS). Results revealed significantly higher means in the cooperative learning group in four of the eight constructs within the CUCEI. Results within the WGCTA-FS disclosed no significant differences between the means of the two groups. The outcomes of this study suggest that cooperative learning techniques have merit and profit in the undergraduate classroom. Suggestions for further research were also included.

Li (2014) validated the College and University Classroom Environment Inventory (CUCEI) in the context of Chinese tertiary education, which has not been investigated before. The research sample included 4617 first-year undergraduate students (116 classes) in two Chinese universities. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted. Data analysis shows that the CUCEI has robust validity and reliability after six items being deleted. The final solution of the CUCEI performs well for the Chinese sample at tertiary schools, which suggests that the CUCEI is a promising instrument for assessing learning environment at Chinese university, and can be further applied for empirical studies of Chinese higher education.

Research Methodology

Background of Differences between Student Perceptions of their Actual and Preferred Environments

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow.

Adapting Classroom Learning Environment Instrument for this Research

The College and University Classroom environment inventory (CUCEI) Questionnaire

Although some notable prior work has focused on the institutional-level or school-level environment in colleges and universities (Halpin& Croft 1963; Stern 1970), surprisingly little work has been done in higher education classrooms which is parallel to the traditions of classroom environment research at the secondary and
primary school levels. Consequently, the CUCEI was developed for use in small classes (say up to 30 students) sometimes referred to as ‘seminar’ (Fraser & Treagust 1986; Fraser, Treagust & Dennis 1986).

The final form of the CUCEI contains seven seven-item scales. Each item has four responses (Strongly Agree, Agree, Disagree, and Strongly Disagree) and the polarity is reversed for approximately half of the items. Typical items are: ‘Activities in this class are clearly and carefully planned’ (Task orientation) and ‘Teaching approaches allow student to proceed at their own pace’ (Individualization). This study was to improve the learning environment through raised students’ learning achievements by involving the students, at both an individual and a group level, in the learning process. The students’ reaction to that change was sought using the College and University Classroom Environment Inventory (Fraser, 1992). The CUCEI Instrument contains seven scales: Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation and Individualisation. The learning environment used in this project was a class of thirty final year dental students. The learning module was “Fractures of the Jaws”. The students entered their actual perceptions before and after the module. The teacher entered his preferred perceptions. There were improvements in the students’ ratings of all scales over the test period. The teacher rated the student cohesiveness higher than the students.

**The Test of Biology-Related Attitudes (TOBRA)**

To investigate of associations between students’ perceptions of their science classroom environment constructivist and their attitudes toward science learning classes for lower secondary educational students at Grade 10 in Thakhonyang Pittayakom School. This study adapted version the Test of Biology-Related Attitudes (TOBRA) that modified from the original Test of Science-Related Attitudes (TOSRA) (Fraser, 1981; Santiboon, 2011, 2013) was designed to measure eight distinct classroom-related attitudes among upper secondary educational students. The eight items are suitable for group administration and all can be administered within the duration of learning in biology laboratory environment science. Furthermore, TOBRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Assessing Students’ Perceptions with the CUCEI and TOBRA**

Using the CUCEI was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOBRA on the 15th week for associating science classroom learning environments in science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 12 in Thakhonyang Pittayakom School, Mahasarakham Province.

Each scale of the CUCEI were composed with the 7-item, minimum scoring is 7 and maximum is 49. The first scale, Personalization is composed the item of 1, 8, 15, 22, 29, 36 and 43; the second scale, Involvement is composed the item of2, 9, 16, 23, 30, 37 and 44; the third scale, Student Environment cohesiveness is composed the item of 3, 10, 17, 24, 31, 38 and 45; the fourth scale, satisfaction is composed the item of 4, 11, 18, 25, 32, 39 and 46; the fifth scale, Task orientation is composed the item of 5,12, 19, 26, 33, 40 and 47; the six scale, Innovation is composed the item of 6, 13, 20, 27, 34, 41 and 48; the seven scale, Individualization is composed the item of 7, 14, 21, 28, 35, 42 and 49.

**Data Analysis**

Quantitative data were obtained using the two questionnaires (CUCEI and TOBRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable. These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. A t-test for correlated samples was used for each individual CUCEI scale to investigate whether students have significant different perceptions of their actual and preferred classroom learning. Assuming that the scaling of the items approximated a 5-point Likert scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred CUCEI forms and the TOBRA. Factorial validity and adequacy of fit for the dimensionality of the CUCEI were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their biology laboratory learning environment classes for the Actual Form of the CUCEI with students’ attitudes to associate were analyzed.

**Sample**

This study is improved and developed biology laboratory classroom learning environment for upper secondary educational students at Grade 12 in Thakhonyang Pittayakom School classes of their biology laboratory learning classroom environments to actual and preferred student’s perceptions with sample size of 109 students in 3 classes at Grade 12 in Thakhonyang Pittayakom School, Mahasarakham Province.
Results

Validity and Reliability of Research Instrument

D. Validity and Reliability of CUCEI

Description of quantiative data of analyzing responses for eleventh-grade biology students of Thakhonyang Pittayakhom School assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual and Preferred Forms of the CUCEI

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean Score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>25.78</td>
<td>3.88</td>
<td>0.09</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>27.09</td>
<td>4.43</td>
<td>0.13</td>
<td>0.36</td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>25.84</td>
<td>3.92</td>
<td>0.10</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.56</td>
<td>4.15</td>
<td>0.12</td>
<td>0.34</td>
</tr>
<tr>
<td>Student Cohesiveness</td>
<td>Actual</td>
<td>25.53</td>
<td>3.59</td>
<td>0.07</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.56</td>
<td>4.15</td>
<td>0.12</td>
<td>0.34</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>25.56</td>
<td>4.15</td>
<td>0.12</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>27.56</td>
<td>4.67</td>
<td>0.15</td>
<td>0.37</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>25.75</td>
<td>3.81</td>
<td>0.08</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.75</td>
<td>4.25</td>
<td>0.12</td>
<td>0.34</td>
</tr>
<tr>
<td>Innovation</td>
<td>Actual</td>
<td>25.78</td>
<td>3.88</td>
<td>0.08</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.38</td>
<td>4.09</td>
<td>0.11</td>
<td>0.33</td>
</tr>
<tr>
<td>Individualization</td>
<td>Actual</td>
<td>25.91</td>
<td>3.97</td>
<td>0.10</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>26.75</td>
<td>4.25</td>
<td>0.12</td>
<td>0.34</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the seven CUCEI scales, that they contain seven items, so that the minimum and maximum score possible on each of these scales is 7 and 49 items, respectively. Because of this difference in the number of items in the seven scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the CUCEI. For the remaining seven scales, namely; Personalization, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, and Individualization scales.

The internal consistency reliability of the version CUCEI used in this study was determined by calculating Cronbach alpha coefficient for the 49 items of the CUCEI using both actual and preferred environmental climates’ perceptions scores. Table II reports the internal consistency of the CUCEI, which ranged from 0.71 to 0.89 when using the students’ actual climate scores and from 0.68 to 0.83 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the CUCEI. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.10 to 5.92 for different scales, respectively.

The results summarised graphically in Table 1 and Table 2 show that some change in actual environment occurred during the time of the intervention. When tests of statistical significance were performed, it was found that differences were significant (p < 0.05) only for Teacher Support on organisation. These findings are noteworthy because two of the dimensions on which appreciable changes were recorded were those on which the teacher had attempted to promote change. (Note also that there appears to be a side effect in that the intervention could have resulted in the classroom becoming more task oriented than the students would have preferred.) Although the second administration of the environment scales marked the end of this teacher’s attempt at changing a classroom, it might have been thought of as simply the beginning of another cycle.
Table 2.
Scale Internal Consistency (Cronbach alpha reliability), Discriminant Validity (Mean Correlation of a Scale with Other Scales) and Ability to Differentiate between Actual and Preferred Forms (ANOVA) for the CUCEI.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>t-test</th>
<th>ANOVA (eta2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>0.74</td>
<td>0.69</td>
<td>3.87***</td>
<td>0.49**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>Actual</td>
<td>0.73</td>
<td>0.73</td>
<td>4.36***</td>
<td>0.42**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.81</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>Actual</td>
<td>0.75</td>
<td>0.71</td>
<td>4.26***</td>
<td>0.45*</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Preferred</td>
<td>0.82</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Actual</td>
<td>0.71</td>
<td>0.68</td>
<td>5.92***</td>
<td>0.62**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.85</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>Actual</td>
<td>0.84</td>
<td>0.70</td>
<td>3.10**</td>
<td>0.43**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.84</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>Actual</td>
<td>0.82</td>
<td>0.69</td>
<td>3.47***</td>
<td>0.41**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.86</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individualization</td>
<td>Actual</td>
<td>0.84</td>
<td>0.68</td>
<td>3.42***</td>
<td>0.48**</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.89</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

B. The Circumplex Nature of the CUCEI

To investigate the circumplex nature of the CUCEI correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale.

Table 3.
Scale Intercorrelations for the CUCEI Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>PE</th>
<th>IN</th>
<th>CO</th>
<th>SA</th>
<th>OR</th>
<th>IN</th>
<th>IND</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>Actual</td>
<td>0.84**</td>
<td>0.76**</td>
<td>0.25*</td>
<td>0.75**</td>
<td>0.77**</td>
<td>0.91***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.88**</td>
<td>0.85**</td>
<td>0.27*</td>
<td>0.85**</td>
<td>0.85**</td>
<td>0.95***</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Actual</td>
<td>0.85**</td>
<td>0.26*</td>
<td>0.89**</td>
<td>0.78**</td>
<td>0.74**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.87**</td>
<td>0.29*</td>
<td>0.93**</td>
<td>0.83**</td>
<td>0.80**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>Actual</td>
<td>0.28*</td>
<td>0.74**</td>
<td>0.73**</td>
<td>0.75**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.31*</td>
<td>0.86*</td>
<td>0.81**</td>
<td>0.89**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>Actual</td>
<td>0.28*</td>
<td>0.33*</td>
<td>0.27*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.33*</td>
<td>0.77**</td>
<td>0.33*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>Actual</td>
<td></td>
<td>0.72**</td>
<td>0.74**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.80***</td>
<td>0.87**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IND</td>
<td>Actual</td>
<td></td>
<td></td>
<td>0.84**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td></td>
<td></td>
<td>0.86**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

The internal consistency reliability of the version CUCEI used in this study was determined by calculating Cronbach alpha coefficient for the 49 items of the CUCEI using both actual and preferred environmental climates’ perceptions scores. Table III reports the internal consistency of the CUCEI, which ranged from 0.71 to 0.89 when using the students’ actual climate scores and from 0.75 to 0.91 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the CUCEI, which suggests that each scale of the CUCEI was able to differentiate significantly (p<0.05) between students’ perceptions in my school and my dream school environmental climates in the same school. The t-test statistic which is the ratio of “between” to “total” sums of squares and represents
the proportion of variance in scale scores accounted for class by membership, ranged from 3.10 to 5.92 for different scales, respectively.

C. Factor Loading Analysis of the CUCEI

The Actual and Preferred Forms of the CUCEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual students’ score (see in Table 4).

Table 4.
Factor Loading for Items in the Actual Form of the CUCEI

<table>
<thead>
<tr>
<th>Item</th>
<th>PE</th>
<th>IN</th>
<th>CO</th>
<th>SA</th>
<th>OR</th>
<th>IN</th>
<th>IND</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8</td>
<td>0.75</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>1</td>
<td>0.68</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>29</td>
<td>0.67</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>22</td>
<td>0.62</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>36</td>
<td>0.56</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>0.58</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>2</td>
<td>0.69</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>0.59</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td>0.54</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>44</td>
<td>0.55</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>0.57</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>0.49</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>37</td>
<td>0.45</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>0.92</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>0.95</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>3</td>
<td>0.83</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>45</td>
<td>0.83</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>38</td>
<td>0.64</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>31</td>
<td>0.67</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>0.60</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>46</td>
<td>0.87</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>32</td>
<td>0.84</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>39</td>
<td>0.76</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>0.77</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>18</td>
<td>0.73</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>4</td>
<td>0.73</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>0.65</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>33</td>
<td>0.65</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>0.58</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>47</td>
<td>0.58</td>
<td>0.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>40</td>
<td>0.57</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5</td>
<td>0.55</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>0.48</td>
<td>0.45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>26</td>
<td>0.44</td>
<td>0.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>6</td>
<td>0.77</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>48</td>
<td>0.67</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>34</td>
<td>0.63</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>41</td>
<td>0.67</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>27</td>
<td>0.62</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>13</td>
<td>0.59</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>20</td>
<td>0.50</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>42</td>
<td>0.85</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>35</td>
<td>0.80</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>49</td>
<td>0.79</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>28</td>
<td>0.75</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>14</td>
<td>0.69</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>7</td>
<td>0.68</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>0.59</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance Act. 43.75 41.76 42.61 39.16 52.68 55.45 51.72
Eigen value Pref. 49.14 44.92 49.54 57.55 52.32 54.77 51.55

*Loading smaller than 0.30 omitted. The sample consisted of 109 students
D. Validation of the Test Of Biology-Related Attitude (TOBRA)

To measure Master of Science teacher students’ attitudes towards Seminar on Science Education Classroom Learning Environment course, the present study adapted the eight-item of the TOBRA (Santiboon & Fisher, 2005; Santiboon, 2011, 2013, 2014). Using internal consistency reliability the Attitude Scale had a value of 0.80 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of their Actual and Preferred Science Education Constructivist Class

On comparing differences between the students’ perceptions of their actual and preferred Science Classroom Managements Class environment in Table IV and Figure 1, it was found that students’ preferred perceptions an environment with upper levels of Personalization, Participation, Independence, Investigation, and Differentiation scales than student’s actual perceptions.

![Figure 1](image)

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the CUCEI.

The results of this study also indicate that using the CUCEI helps science educational management instructors to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the science educational management curriculum for the eleventh-grade biology students from Thakhonyang Pittayakom School management environment. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the eleventh-grade biology students from Thakhonyang Pittayakom School classes.

Associations between Students’ Perceptions of Actual Science Classroom Learning Educational Constructivist Environments with the TOBRA

The strongest tradition in past classroom environment research has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms. Numerous research programs have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics.

In this study, it was also considered important to investigate associations between students’ perceptions of their physics classroom learning environments with their attitudes toward physics. The selection of an evaluation and assessment instrument suitable for confirming the third research purposes was required. The internal consistency of the selected TOPRA was 0.79, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in physics classes.

Two main methods of data analysis were used to investigate this environment attitude relationship. These involved: simple correlational analyses of relationships between students’ perceptions of actual physics laboratory classroom environments with their attitude toward physics; and multiple regression analyses of relationships between the set of actual environment scales as a whole and the TOPRA. The summary of the result of this analysis is reported in Table 4.

In this study, it was also considered important to investigate associations between science classroom learning environment constructivists for eleventh-grade biology students from Thakhonyang Pittayakom School
environment classes of their science constructivist classroom learning environment with their attitude toward science. The Cronbach alpha reliability of the selected the TOBRA was 0.80, when using individual student as the unit of analysis. This suggests that the TOBRA is reliable for measuring students’ attitudes in science classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOBRA that it’s reported in Table 5.

Table 5. Associations between CUCEI Scale and Attitude Scale to Science Educational Constructivist Class in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From</th>
<th></th>
<th>Standard Regression Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple Correlation Attitude (r)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>0.24*</td>
<td>0.28*</td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>0.33*</td>
<td>0.29*</td>
<td></td>
</tr>
<tr>
<td>Student Cohesiveness</td>
<td>0.35*</td>
<td>0.33*</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0.29*</td>
<td>0.32*</td>
<td></td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.48**</td>
<td>0.52**</td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>0.33*</td>
<td>0.32*</td>
<td></td>
</tr>
<tr>
<td>Individualization</td>
<td>0.28*</td>
<td>0.26*</td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.8721</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.7607</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science educational constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Science Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their biology classes. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students' attitudinal outcomes and their classroom environment on all scales of the Actual Form.

CONCLUSION

The actual and preferred perceptions of 109 students of their Biology classroom environment in Thakhonyang Pittayakom School were measured with the CUCEI. The comparisons of the Actual Form with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their biology management class. In general, students’ perceptions of their preferred classroom in biology management class to be greater than what they actually perceive to be provided. The results of this study also indicate that using the CUCEI helps Thakhonyang Pittayakom School teachers or lecturers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their biology management classes, with regard to the CUCEI, it was found that all of seven scales were positively associated with students’ attitude to science management class. The multiple correlation $R$ is significant for the CUCEI and shows that when the scales are considered together there are significant associations with the Attitude Scale. The $R^2$ values indicate that 76%, with actual form of the variance in students’ attitudes to their science management class was attributable to their perceptions of their science management classroom environment. The beta weights ($β$) show that in class where the students perceived greater than all scales in their science management learning classroom.

DISCUSSIONS AND IMPLICATIONS

Learning environment is an important aspect in education process. It is not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment
assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments of CUCEI Questionnaire. This instrument provides the information of students’ perceptions on actual and preferred science educational management learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science educational management course.

Overall, this study replicated previous studies using the CUCEI, with the findings being consistent with the situation in Thakhonyang Pittayakom School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the Master of Science teacher students of Science Education Program, Faculty of Education, interestingly.

ACKNOWLEDGMENT

Firstly, I would like to thank the 109 students in biology classroom in Thakhonyang Pittayakom School who allowed students to complete the questionnaire. My greatest thanks go to Assist. Prof. Dr. Toansakul Santiboon, as my supervisor, who understood my professional and personal commitments throughout the study and never pushed but always encouraged. Without his support, I would never have achieved the completion of my manuscript of full paper. Finally, I would like to thank Dr. Panwilai Chomchid, as the co-advisor too. This work was supported in part by a grant from Rajabhat Maha Sarakham University, Thailand.

References


The Critical Theory Perspectives for Monitoring Constructivist on Science Classroom Learning Environments at Ninth-Grade Level Students in Wat Sathong Municipal School

Atipong Sangrat, Toansakul Santiboon* and Panwilai Chomchid

Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, 44000, Thailand

(*author for correspondence, E-mail: toansakul35@yahoo.com.au)

Abstract

The incorporating constructivist and critical theory perspectives on the framing of the classroom learning environment, developing the Constructivist Learning Environment Survey (CLES) to monitor constructivist teaching approaches and to address key restraints to the development of constructivist classroom climates in five scale and composes with 30 items. To investigate students’ perceptions with a sample size of 98 students on science learning monitoring constructivist classes in lower secondary educational students at Grade 9 in Wat Sathong Municipal School, Roi-Et, Thailand. Students’ perceptions of their actual and preferred science classroom were assessed and compared. Associations between students’ perceptions and their attitudes toward science constructivist classes were determined. Student’ attitudes were assessed with a short Thai version of the Test Of Science-Related Attitude. Statistically significant between students’ perceptions of their actual and preferred science classroom learning environments of their science classroom monitoring classes also were found. The factor analyses were analyzed to appear to be affecting student perceptions of their responses to their research instruments. Cronbach’s alpha reliability coefficients for the scales were adequate, while confirmatory factor analyses provided support for the theoretical framework behind the questionnaire. The multiple correlations $R^2$ is significant for the CLES and considered association with the TOSRA, and value indicates that 59% of the variance in students’ attitudes was also determined. In future research, the CLES could be used in exploring the relationship between teachers’ sense of self-efficacy and their commitment to the emotionally-demanding task of engaging their students in renegotiating the social reality of the science classroom.

Keywords: Actual forms, Learning, Science classroom, Wat Sathong Municipal School

Introduction

Historical Background

A revised version of the Constructivist Learning Environment Survey (CLES) has been developed for researchers who are interested in the constructivist reform of high school science and mathematics. Constructivist theory and critical theory have been combined to create a powerful interpretive framework for examining science and mathematics teaching. The cognitive focus of the earlier instrument has been broadened by including a concern for the socio-cultural forces that shape the rationality of traditional science and mathematics classrooms. The revised CLES is concerned with the extent of emphasis within a classroom environment on: (a) making science and mathematics seem relevant to the world outside of school; (b) engaging students in reflective negotiations with each other; (c) teachers inviting students to share control of the design, constructivist, and evaluation of their learning; (d) students being empowered to express concern about the quality of teaching and learning activities; and (e) students experiencing the uncertain nature of scientific and mathematical knowledge. The revised CLES was trialed in an innovative empirically-oriented mathematics classroom. The results of the study, which combined statistical analyses and interpretive inquiry, confirmed the practical viability of the CLES and generated important insights into use of learning environment questionnaires in classrooms undergoing constructivist transformation (Taylor, Fraser, and White, 1994).

The original version of the CLES was based on a theory of constructivism that underpins recent research in science and mathematics education that is concerned with developing teaching approaches that facilitate students’ conceptual development (Driver, 1988, 1990; Treagust, Duit, & Fraser, in press). This conceptual change research highlights: (1) the key role of students’ prior knowledge in their development of new conceptual understandings, especially the problematic role of students’ alternative conceptions; and (2) the reflective process of interpersonal negotiation of meaning within the consensual domain of the classroom community.

Science Education Classroom Learning Environment

Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and
environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currently trends and future desirable directions in research on educational environments are identified (e.g., combining quantitative and qualitative methods, educational institute-level environments, educational institute psychology, links between educational environments, teacher education and teacher assessment) (Fraser, 2014).

**Approaches to Study on Educational Environments**

Using students’ perceptions to this study educational environments can be approached to studying science educational environments involves application of the techniques of naturalistic inquiry, ethnography, interpretive research, to define the classroom environment in terms of the shared perceptions of the students has the dual advantage of characterising the setting through the eyes of the participants themselves and capturing data, students are at a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if instructors are inconsistent in their day-to-day behaviour, they usually project a consistent image of the long-standing attributes of classroom environment. Later in this research, discussion focuses on the merits of using students’ perceptions to this study educational environments can be approached to studying science classroom environment fit studies (Fraser & Tobin 1991).

**Historical Science Education Learning Environment**

In the past four decades, there are educational researchers began seminal independent programs of research which form the starting points for the work reviewed in this study. Walberg developed the widely-used Learning Environment Inventory (LEI) as part of the research and evaluation activities of Harvard Project Physics (Walberg & Anderson 1968). Moos began developing the first of his social climate scales, including those for use in psychiatric hospitals and correctional institutions, which ultimately resulted in the development of the Classroom Environment Scale (CES) (Moos 1979; Moos & Trickett 1987). The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment developed into major research programs and spawned a lot of other research is reflected in books (Fraser 1986; Fraser & Walberg 1991; Moos 1979; Walberg 1979), literature reviews (Fraser 1998; von) and monographs sponsored by the American Educational Research Association's Special Interest Group (SIG) on the Study of Learning Environments (e.g., Fisher 1994).

**Instruments for Assessing Classroom Environment**

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to Moos’s (1974) scheme for classifying human environments.

**Selected Classroom Learning Environment Instruments in this study**

**The Constructive Learning Environment Survey (CLES)**

The CLES (Taylor, Fraser, & White, 1994, 2008) was developed to assist researchers and teachers to assess the degree to which a particular classroom’s environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice. The CLES has 30 items with five response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation). According to the constructivist view, meaningful learning is a cognitive process in which individuals make sense of the world in relation to the knowledge which they already have constructed, and this sense-making process involves active negotiation and consensus building. The CLES developed to assist researchers and teachers to assess the degree to which a particular classroom’s environment is consistent with a constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practice. The CLES has 30 items with five response alternatives ranging from Almost Never to Almost Always. Typical items are “I help the teacher to decide what activities I do” (Shared Control) and “Other students ask me to explain my ideas” (Student Negotiation).

**The Test of Science-Related Attitudes (TOSRA)**

To investigate of associations between students’ perceptions of their science classroom environment constructivist and their attitudes toward science classroom learning classes for lower secondary educational students at Grade 10 in Wat Sathong Municipal School, Roi- Et Province. This study modified the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981; Santiboon, 2011, 2013) of Thai version was designed to measure eight distinct classroom-related attitudes among lower secondary educational students at Grade 10 in...
Wat Sathong Municipal School classes, Roi-Et Rajaphat Province. The eight items are suitable for group administration and all can be administered within the duration of a learning and science classroom constructivist. Furthermore, TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

**Actual and Preferred Forms of Scales**
A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of 'actual' or experienced classroom environment, but also another form to measure perceptions of 'preferred' or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow.'

**Research Purposes**
22. To assess student’s perceptions of their science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.
23. To compare between students’ perceptions of their actual and preferred science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.
24. To associate between students’ science attitudes and their actual perceptions toward their science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School, Roi-Et Province.

**Previous Research on the CLES**
This article focuses on the validation and use of English and Chinese versions of the Constructivist Learning Environment Survey (CLES) in a cross-national study of high school science classrooms in Australia, China, and Taiwan. The CLES was administered to 1081 students from 50 classes in Australia and 1879 students from 50 classes in Taiwan. Data analysis supported each scale’s internal consistency reliability, factor structure and ability to differentiate between classrooms, and revealed interesting differences between average scale scores in Taiwan and Australia. The questionnaire data were used to guide the collection of qualitative data in each country to explain patterns and differences in mean scale scores in Australia and Taiwan. Interviews with students also provided precautionary information regarding students’ understanding of some items and the use of a Western survey to measure monitoring constructivist learning environments in an Eastern country. (Aldridge, Fraser and Taylor, 2010). In Australia, Fraser and colleagues initially elaborated the Individualised Classroom Environment Questionnaire (ICEQ) (Fraser, 1990), but this was followed by other widely used instruments such as the Science Laboratory Environment Inventory (SLEI), Monitoring constructivist Learning Environment Survey (CLES) and the WIHIC (Fraser, 1998). In Asia, the study of learning environments has been undertaken in Brunei (Scott & Fisher, 2004), Indonesia (Margiant, Aldridge & Fraser, 2004); Taiwan (Aldridge, Fraser & Huang, 1999), Singapore (Khoo & Fraser, 2008), Japan (Hirata & Sako, 1998), Korea (Lee, Fraser & Fisher, 2003) and Thailand (Santiboon, 2005, 2011, 2013, 2014). It should be noted that this study is one of the few learning environment studies conducted in Iran to date.

**Methodology**

**Steps on Assessing Students’ Perceptions with the CLES and TOSRA**
Using the CLES was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOSRA on the 15th week for associating science classroom learning environment in science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School, Roi-Et Province. Each scale of the CLES were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1, 2, 3, 4, and 5; the second scale; Uncertainty is composed the item of 7, 8, 9, 10, 11, and 12; the third scale; Critical Voice is composed the item of 13, 14, 15, 16, 17, and 18; the fourth scale, Shared Control is composed the item of 19, 20, 21, 22, 23; and 24; the fifth scale, Student Negotiation is composed the item of 25, 26, 27, 28, 29, and 30.

**Data Analysis**
Quantitative data were obtained using the two questionnaires (CLES and TOSRA). Appropriate statistical procedures were selected to determine whether the Thai versions of the questionnaires are valid and reliable.
These were those tests traditionally used with learning environment questionnaires: factor analysis, internal consistency reliability, and ability to differentiate between students in different classrooms. Simple and multiple correlation analyses were used with the actual and preferred versions. A $t$-test for correlated samples was used for each individual CLES scale to investigate whether students have significant different perceptions of their actual and preferred science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School.

**Sample**
This study is improved and developed science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School of their science learning classroom environments with actual and preferred student’s perceptions with sample size of 98 science classroom learning environment monitoring constructivists for lower secondary educational students in four science classes at Grade 10 in Wat Sathong Municipal School classes, Roi-Et Province, Thailand.

**Results**

**Validity and Reliability of Research Instrument**

**D. Validation of the CLES**

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean Score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>Actual</td>
<td>22.53</td>
<td>3.75</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.56</td>
<td>4.26</td>
<td>0.33</td>
<td>0.57</td>
</tr>
<tr>
<td>Science</td>
<td>Actual</td>
<td>15.28</td>
<td>2.54</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.09</td>
<td>4.18</td>
<td>0.44</td>
<td>0.66</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Preferred</td>
<td>25.25</td>
<td>4.20</td>
<td>0.39</td>
<td>0.62</td>
</tr>
<tr>
<td>Critical View</td>
<td>Actual</td>
<td>24.71</td>
<td>3.88</td>
<td>0.34</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.25</td>
<td>4.20</td>
<td>0.39</td>
<td>0.62</td>
</tr>
<tr>
<td>Shared Control</td>
<td>Actual</td>
<td>24.31</td>
<td>4.05</td>
<td>0.24</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.71</td>
<td>4.28</td>
<td>0.40</td>
<td>0.63</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>Actual</td>
<td>23.75</td>
<td>3.95</td>
<td>0.18</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>25.18</td>
<td>4.19</td>
<td>0.41</td>
<td>0.64</td>
</tr>
</tbody>
</table>

The results given in Table 1 shows that on average item means for each of the five CLES scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 6 and 30, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the CLES. For the remaining five scales, namely; Personal Relevance, Science Uncertainty, Critical View, Shared Control, Student Negotiation scales.
The internal consistency reliability of the version CLES used in this study was determined by calculating Cronbach alpha coefficient for the 30 items of the CLES using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the CLES, which ranged from 0.80 to 0.85 when using the students’ actual climate scores and from 0.87 to 0.93 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the CLES, which suggests that each scale of the CLES was able to differentiate significantly ($p < 0.05$) between students’ perceptions in my school and my dream school environmental climates in the same school classes. The $t$-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 3.79 to 7.71 for different scales, respectively.

**B. The Circumplex Nature of the CLES:**
To investigate the circumplex nature of the CLES correlations between the scales were calculated. The sample in Table is presented the results show that the correlations between a scale and the next scale.

### Table 3. Scale Intercorelations for the CLES Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pr</th>
<th>Uc</th>
<th>Cv</th>
<th>Sc</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>0.56**</td>
<td>0.81***</td>
<td>0.63**</td>
<td>0.77***</td>
<td>0.55*</td>
</tr>
<tr>
<td>Preferred</td>
<td>0.81***</td>
<td>0.87***</td>
<td>0.87***</td>
<td>0.92***</td>
<td>0.77***</td>
</tr>
</tbody>
</table>

---

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
C. Factor loading Analysis of the CLES

The Actual and Preferred Forms of the CLES were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student's score.

Table 3.
Factor Loading for Items in the Actual and Preferred Forms of the CLES

<table>
<thead>
<tr>
<th>Item</th>
<th>Pr</th>
<th>Uc</th>
<th>Cv</th>
<th>Sc</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>0.76</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.72</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.72</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>0.68</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>0.68</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>0.67</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>0.90</td>
<td>0.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>0.90</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>0.89</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>0.89</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>0.75</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>0.86</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>0.86</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>17</td>
<td>0.83</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>13</td>
<td>0.77</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>0.74</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>0.49</td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>0.82</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>22</td>
<td>0.73</td>
<td>0.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>0.72</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>24</td>
<td>0.71</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>20</td>
<td>0.69</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>19</td>
<td>0.55</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>27</td>
<td>0.82</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>29</td>
<td>0.79</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>25</td>
<td>0.74</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>28</td>
<td>0.72</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>26</td>
<td>0.65</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>0.60</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of variance</td>
<td>Act.</td>
<td>50.29</td>
<td>75.48</td>
<td>59.81</td>
<td>50.86</td>
</tr>
<tr>
<td>Eigen value</td>
<td>Pref.</td>
<td>62.08</td>
<td>77.16</td>
<td>69.23</td>
<td>75.70</td>
</tr>
</tbody>
</table>

*Loading smaller than 0.30 omitted. The sample consisted of 98 students*
preferred perceptions an environment with upper levels of Personal Relevance, Science Uncertainty, Critical View, Shared Control, and Student Negotiation scales than students’ actual perceptions.

Figure 1. Significant differences between science students’ perceptions of their actual and preferred scores on the CLES.

The results of this study also indicate that using the CLES helps science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School environment classes for science teachers to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that teachers needed to take differences into consideration when planning and designing the science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School environment classes. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in the science educational monitoring constructivist class.

Associations between Students’ Perceptions of Actual Science Classroom Learning Monitoring Constructivist Environments with the TOSRA

In this study, it was also considered important to investigate associations between science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School environment classes of their science monitoring constructivist classroom learning environments with their attitude toward science. The Cronbach alpha reliability of the selected the TOSRA was 0.84, when using individual student as the unit of analysis. This suggests that the TOSRA is reliable for measuring students’ attitudes in science classes. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the TOSRA that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their science educational monitoring constructivist classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater Personal Relevance, Science Uncertainty, Critical View, Shared Control, Student Negotiation environments there was a more favourable attitude towards their science educational monitoring constructivist class. In the other hand, the sample correlation values (r) are reported which does not show statistically significant correlations between students’ attitudinal outcomes and their science education monitoring constructivist classroom environment on all scales of the Actual Form.
Table 5. 
Associations between CLES Scale and Attitude Scale to Science Classroom Learning Monitoring Constructivist Classes in Term of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Simple Correlation</th>
<th>Standard Regression Weight Attitude (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Relevance</td>
<td>2.10*</td>
<td>2.11*</td>
</tr>
<tr>
<td>Science Uncertainty</td>
<td>2.94*</td>
<td>3.89**</td>
</tr>
<tr>
<td>Critical View</td>
<td>3.08*</td>
<td>3.10*</td>
</tr>
<tr>
<td>Shared Control</td>
<td>3.03*</td>
<td>3.03*</td>
</tr>
<tr>
<td>Student Negotiation</td>
<td>3.90**</td>
<td>3.82**</td>
</tr>
</tbody>
</table>

Multiple Correlation (R) 0.7662**  

R² 0.5871**

*Correlation is significant at the 0.05 level (2-tailed)  
** Correlation is significant at the 0.01 level (2-tailed)  
*** Correlation is significant at the 0.001 level (2-tailed)

Conclusions

The actual and preferred perceptions of 98 science classroom learning environment monitoring constructivists for lower secondary educational students in 4 classes at Grade 10 in Wat Sathong Municipal School of their science classroom environment monitoring constructivist classes were measured with the CLES. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their science classroom learning monitoring constructivist classes. In generally, students’ perceptions of their preferred science educational monitoring constructivist classroom learning environment were to greater than what they actually perceive to be provided. The results of this study also indicate that using the CLES helps science classroom learning environment monitoring constructivists for lower secondary educational students at Grade 10 in Wat Sathong Municipal School of science teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students.

An investigation of the association between students’ perceptions of learning environments with their attitudes to their science classroom learning monitoring constructivist classes, with regard to the CLES, it was found that all of five scales were positively associated with students’ attitude to science classroom learning monitoring constructivist classes. The multiple correlation R is significant for the CLES and shows that when the scales are considered together there are significant associations with the TOSRA. The R² values indicate that 59%, with actual form of the valiance in students’ attitudes to their science educational monitoring constructivist class was attributable to their perceptions of their science educational monitoring constructivist classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their science educational monitoring constructivist lessons.

Discussions and Implications

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Science teacher could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate Constructive Learning Environment Survey (CLES). This instrument provides the information of students’ perceptions on actual and preferred science educational monitoring constructivist learning environment. The information from this instrument could be used for improvement and effectiveness teaching in science classroom learning monitoring constructivist course.

As described in the results section, Lower Secondary Educational students at Wat Sathong Municipal School classes show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the CLES questionnaire. Focusing on science classroom learning environment monitoring constructivists for lower secondary educational students in 4 classes at Grade 10 in Wat Sathong Municipal
School classes show relatively favorable perceptions of their science classroom learning environment monitoring constructivist lessons, with the higher score occurring for the whole prefer scales of the CLES. It seems that science classroom learning environment monitoring constructivist lesson activities related to science classroom learning environment monitoring constructivist course are operated rather as supplementary to theory classes rather than being independently important in their own right.

Overall, this study replicated previous studies using the CLES, with the findings being consistent with the situation in science classroom learning environment monitoring constructivist in classroom learning environment Wat Sathong Municipal School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the Wat Sathong Municipal School, responsibility and interestingly.

References


Measuring and Improving Chemistry Classroom Learning Environments for Upper Secondary Students at Twelfth-Grade Level

Atipong Phukaokaew¹, Tanawat Somtua², Udomlak Wanitchang³ and Toansakul Santiboon¹*

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
²Department of Chemistry Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand
³Science Learning Group Section, Wapipathum School, Wapipathum District, Maha Sarakham, Thailand

*(¹author for correspondence. E-mail: toansakul35@yahoo.com.au; Fax: +66 43 713 206)

Abstract

Adaptation of an international research instrument; the Individualized Classroom Environment Questionnaire (ICEQ) measure chemistry classroom learning environments for students’ outcomes. To administer for using data with a sample size of 49 upper secondary students at the Twelfth-Grade level in Wapipathum School for associating actual students’ perceptions of their ICEQ to their attitude with the Test Of Chemistry-Related Attitude (TOCRA) toward chemistry studies were analyzed. Comparisons of the mean difference, factor analysis, scale-inter-correlations, multilevel variance components models, and standardized regression coefficient to derive interaction class correlations to determine the degree to which ICEQ scores may validly be revealed to measure aspects of chemistry classroom learning environments as against individual student attitudes. It has found that the chemistry class variable accounted for large and noteworthy proportions of overall variance in all five ICEQ scales. The whole analyses showed that significant proportions of variance were attributable to the chemistry class’s variable. In terms of the ICEQ ought to be considered to be a relatively good measure of chemistry classroom environment. The multiple correlation R is significant for the actual form of the ICEQ and indicated that the five scales are considered together there is significant (ρ < 0.05) association with the TOCRA, the $R^2$ value expecting measurement that 18% of the variance in students’ attitude to their chemistry class was attributable to their perceptions of their individual classroom learning environment in chemistry classes, opportunity.

Keywords: Actual form, Associations, Student, Chemistry classroom, Learning

Introduction

Background of Science Educational System in Thailand

Education in Thailand is provided mainly by the Thai government through the Ministry of Education from pre-school to senior high school. A free basic education of twelve years is guaranteed by the constitution, and a minimum of nine years’ school attendance is mandatory. Formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education, the latter being further divided into three years of lower- and upper-secondary levels, respectively. Kindergarten levels of pre-primary education, also part of the basic education level, span 2–3 years depending on the locale, and are provided variable (Ministry of Education, 2010)¹. The school structure is divided into four key stages: the first three years in elementary school, the first primary level or Prathom 1–3, are for age groups 7–9 (Grade 1-3); the second primary level or Prathom 4 through 6 are for age groups 10–12 (Grade 4-6); the third lower secondary level or Matthayom 1–3, is for age groups 13–15 (Grade 7-9). The upper secondary level of schooling consists of Matthayom 4–6 for age groups 16–18 (Grade 10-12), and is divided into academic and vocational streams. There are academic upper secondary schools, vocational upper secondary schools and comprehensive schools offering academic and vocational tracks. Students who choose the academic stream usually intend to enter a university. Vocational schools offer programs that prepare students for employment or further studies.

An assessment of the quality of secondary school education has indicated that only 40% of 3 secondary learners received adequate preparation for readiness in learning before attending university. Although Thailand has a very high percentage of youth learners attending child development centers, if such centers are not supported properly through strengthening capacity and management, the quality of secondary development and young children’s preparation for primary and secondary schooling can be seriously affected (Athan,2011)². Most students attend formal educational institutions administered by the Ministry of Education and about half of these...
children enroll in learning childcare/development centers of the formal education system, mainly administered by the Department of Local Administration. The Office of Basic Education Commission (OBEC) prepares the basic core curriculum and disseminates it to all Educational Service Area (ESA) Offices for distribution to parents, guardians and teachers, so as to ensure that all key stakeholders combine efforts to provide school children with quality education. The 10-Year Plan and Policy for the Basic Educational Secondary Development (2006-2015) provides a blueprint for achieving universal student education for all Thai children. The 10-Year Plan and Policy gives priority to three main strategies, namely; (1) to support youth development; (2) to support parents and other stakeholders; and (3) to promote an environment that facilitates secondary educational learners.

The Institute for the Promotion of Teaching Science and Technology (IPST)
There is an institute of the Ministry of Education in Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) was established in 1972 supported by UNDP. Now an agency under the direction of the Ministry of Education; to research, develop and advocate science, mathematics and technology, such as; curricula, teaching/learning process, media and materials then publicize them to all relevant organizations, to develop teachers and education personnel in science, mathematics and technology to help they gain cutting-edge knowledge and capacity in using technology and planning lessons effectively focusing on learner’s development, To research, develop and promote the standard evaluation to enhance the quality of teaching and learning science, mathematics and technology, and to promote the culture of science and technology in Thai society especially among new generations (IPST, 2011)[3].

Thai student IQs: An Important for Student’s Learning Managements and Outcomes
On 27 May 2015, the Ministry of Public Health released Thai student IQ survey results. They indicate that the IQ of Grade 1, students have dropped from 94 in 2011 to 93. The international standard is 100. It is highly possible that Thailand’s education system is harming student IQs. While the IQ of pre-school students is acceptable, IQ drops as primary schooling commences, suggesting a need for changes at schools. The IQ of students in rural areas is considerably lower, at just 89. This difference persists at university. While studies have found the IQ of Bangkok university students averages 115, the IQ of provincial university students is 5-8 points lower (Maxwell and Kammuansilpa, 2015)[4]. Alarmingly, the low IQ levels in the recent survey confirm continuing high levels of intellectual disability: IQ levels lower than 70, also termed "mildly impaired or delayed". The average global percentage of such students is 2%. However, a previous 2011 survey found that 6.5% of Thai students scored in this range. The recent results suggest intellectual disability in some rural areas could now be up to 10%.

Science Classroom Learning Environments
During the past 35 years, the study of classroom environments has received increased attention by researchers, teachers, school administrators and administrators of school systems. The concept of environment, as applied to educational settings, refers to the atmosphere, ambience, tone, or climate that pervades the particular setting. Research on classroom environments has focused historically on its psychosocial dimensions, those aspects of the environment concerned with human behaviour in origin or outcome (Boy and Pine, 1988)[5]. Reviews of classroom environment research by Fraser (1998b)[6], Dorman (2002)[7], Goh and Khine (2002)[8] and Khine and Fisher (2003)[9] have delineated at least 10 areas of classroom environment research including: associations between classroom environment and outcomes, evaluation of educational innovations, differences between students’ and teachers’ perceptions of classrooms, comparisons of actual and preferred environments, effect on classroom environment of antecedent variables (for example, gender, year level, school type, subject), transition from primary to secondary school, school psychology, teacher education, educational productivity research, and using environment instruments to facilitate changes in classroom life.

Actual Form of Scale
A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the actual form such as ‘There is a clear set of rules for students to follow’ would be changed in the preferred form to ‘There would be a clear set of rules for students to follow’.

Instruments for Assessing Classroom Environment
Many science educators and researchers have been improved and developed the following historically important and contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualised Classroom Environment Questionnaire (ICEQ); My Class Inventory (MCI); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is
Focused on Wapipathum School is a rural or government school located in downtown as Nongsang Subdistrict, Wapipathum District, Mahasarakham Province, Thailand. It admits from lower to upper secondary students and has an enrollment of 3,228 students. The school has 7 buildings, 72 classrooms. The school is administered by Mr. Phisit Wannasri, the principal, and is staffed by 138 teachers, including 12 senior professional teachers and a principal. The school follows the National Core Curriculum of Basic Education, BE 2551(2008 CE), which provides three years of lower secondary education and three years of upper secondary education. Students are grouped into eight basic subject areas, namely science, mathematics, social studies, health and physical education, art, and vocational studies.

Important Problems in Science Secondary Educational Classroom Learning Environment in this study
Thailand has formulated a policy and framework for action on education for all in the 1992 National Education Scheme in compliance with the World Declaration on Education for All adopted by all UNESCO Member States during the World Conference on Education for All in March, 1990 at Jomtien, Chonburi, Thailand. The scheme aims at guiding all related agencies to implement their activities. The World Declaration will have reached one-decade old in 2000 since its adoption. An assessment on education for all will be conducted to follow up the progress of the management of education for all in UNESCO Member States. Important problems in science secondary education are grouped into eight subject areas, namely, science, mathematics, social studies, health and physical education, art, and vocational studies.

In the past decade, Thailand’s attempts to implement activities in education for all have steadily progressed, particularly the extension of compulsory basic education from six to nine years. In 1998, the rate of the
transition to lower and upper secondary education levels was approximately 90% and it tends to be on a
continual increase. The provision of pre-primary education was obviously extended as the number of school age
children having obtained this level of education was relatively higher from 1990 to 68.64%. The approaches of
the provision of this level of education are offered through the Community Child Care Centers, Child Care
attached to temples and mosques, and other non-governmental agencies. The transitional rate to primary
education is 91.32% with equal opportunity in terms of gender. These are some of the successful models of
education for all representing the efforts of mobilizing relevant agencies to jointly render their resources to
undertake the national activities in providing education for all.

In addition to such concerted efforts, Section 43 of the 1997 Constitution stipulates that all Thai citizens shall
enjoy their right to education which will be provided by the government to all citizens at least twelve years of
basic education with quality and free of charge. The 1999 National Education Act also legislates that
compulsory education shall be extended from six to nine years and shall be completely undertaken within the
year 2002. These policies reflect the models of education administration and management supporting the
 provision of education for all in compliance with the goals. About 10% of the out-of-school youth, particularly
the disadvantaged, require special needs to enable them to maintain in the formal education system. Both public
and private agencies, have undertaken several projects to enable this group to access to formal education system.
Consequently, some duplications and inequitable distribution of services were seen. Therefore, the assessment
of EFA 2000 will help identify problems and solutions to ensure that the current education reform will yield
maximum impacts in improving efficiency of education for all.

Unfortunately that isn't the kind of good news for Asia that Thailand can share. The PISA tests of all know that
Thai students don't belong in the same class as the world-class East Asian. Of course Thailand has a few of our
own some stellar students who win medals at the math and science Olympiads but their scholastic achievements
are at odds with the general performance of their peers in the Thai education system. Thai students’ performance
in international standardized tests is generally below average. That's not a surprise given such appalling scores
they get in national standardized tests like O-NET, although the word standardized may be a bit misleading in
the O-NET case. Thai students’ scores in most international tests can be described as mediocre or poor.
However, as appalling as the O-NET scores? To answer that we’ll need to get into some details. As the focus is
on school students, the international test that is the most relevant and highly regarded for measuring
performance of school students is the PISA test. These scores put Thailand at No. 50 (out of 65) in the PISA
2014 score ranking by country/economy. In other words, Thailand stands right at the top of the poorest
performers in the bottom 25%. Thailand’s scores are on par with those of Mexico, Romania and Uruguay, above
15 countries in the developing world such as Columbia, Brazil, Indonesia, Tunisia, Argentina, Kazakhstan,
Albania, Peru, and Azerbaijan, and below other countries in comparable stages of economic development such
as Chile, Turkey and Romania.

In an article published in the Bangkok Post on July 7, 2014. TC’s Thomas Corcoran outlines his views on the
challenges in the teaching and learning of science in Thai secondary schools. Corcoran directs the College’s
participation in the Consortium for Policy Research in Education (CPRE), the oldest federally funded education
policy center in the United States, of which TC President Susan Fuhrman is the founding director. “The biggest
problem that students face is time,” says Corcoran, a curriculum expert who has played a major role in TC’s
work in Jordan. “The problem is, basically, at Thailand's lower-secondary level. Only 120 minutes a week are
allocated to science. That's about half of what most of the rest of the world provides for that age group. A
typical schedule would include 240 to 250 minutes a week for science.” Corcoran led a project evaluation of the
Inquiry Based Science and Technology Education Program (IN-STEP), a public-private science education
initiative designed to improve teaching and learning in science in Thai lower secondary schools (Corcoran, 2014)[11].

Focusing on this research study, Chemistry classroom environment dimensions have been used as criterion
variables in research aimed at identifying how the classroom environment varies with such factors as teacher
personality, class size, grade level, subject matter, the nature of the school-level environment and the type of
school. This study will be established associations between teacher personality and classroom environment, and
will report differences in the Chemistry classroom environment perceptions of Wapiatham School students, the
individual cultural differences in student perceptions of teacher-student interaction and their classroom learning
environments.

This study will also several have attempted to bring the fields of classroom environment and school
environment together by investigating links between classroom and school environment. To be administered a
classroom environment instrument to a sample Chemistry students in one class and a school environment
instrument to a teacher of these classes, only weak associations between classroom environment and school
environment will associated. Although school rhetoric often will suggest that the school ethos would be
transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a
whole. Importunately, this study is going to seek for answering many problems on education in secondary school classes.

**Research Purposes**

1. To explore the science classroom learning environment instruments for using these research instruments in learning classroom research in the secondary education in Thailand.
2. To describe and investigate of actual students’ perception in Chemistry Classroom learning environment for using the ICEQ in school at level 12.
3. To analyze of reliability and validity of the ICEQ and the TOCRA research instrument will use in Wapiopathum School at level 12.
4. To associate between students’ perception of their actual individual chemistry classroom learning environment and their chemistry attitudes.

**Literature Reviews**

Fraser (1982)\(^{12}\) to extensive research conducted in developed countries has established classroom learning environment as a thriving field of study. The present investigation makes a contribution to classroom environment research in that it involved the translation into Indonesian of scales previously available only in English, and the subsequent validation and use of these translated scales among Indonesian students. The new Indonesian instrument consists of nine seven-item scales based upon the Individualized Classroom Environment Questionnaire and the Classroom Environment Scale. Analyses of data collected from a sample of 373 Indonesian students from nine schools supported the new instrument's internal consistency, discriminant validity, ability to differentiate between classrooms, and predictive validity (i.e. ability to predict student outcomes). Potential applications of the new instruments in Indonesian classrooms are suggested.

Bell, C. R. (2000)\(^{13}\) studied as the purpose of the research was to form a defensible basis for considering possible changes in classroom practice within a small rural state school, and it involved four, mixed-ability classes comprising Year 9 and 10 students. These classes were taught an energy-related module by the researcher. In the preliminary phase, which involved two classes, resources were developed to produce a more student-centred module. These resources, and the constructivist approach which informed their development, are described. In the subsequent comparative phase, the reformed module was taught using two contrasting strategies - one teacher-directed and the other, student-managed. During this phase individual achievement and group investigative skills were assessed. Student perceptions of classroom environment were probed using an existing instrument, the ICEQ. The range of classroom activity and level of student engagement was continuously monitored by independent observers using a specifically developed instrument, termed the SALTA. No overall learning advantage was demonstrated to either teaching strategy. A small strategy advantage favouring Year 10 students in the student-managed strategy was offset by a similar disadvantage to the Year 9 cohort. A cohort penalty was found to apply to Year 9 students under either strategy, with a paradox in its application. The role of the teacher was found to change significantly under each strategy, with a consistent hierarchy of student engagement with activity emerging. Boys were found to have significantly higher levels of engagement than girls under either teaching strategy. However, this was associated with only modest advantages in achievement. The relationship between engagement and achievement was stronger and more positive under the student-managed strategy.

Fraser (2005)\(^{14}\) used the Dull classroom environments, poor students’ attitudes and inhibited conceptual development led to the creation of an innovative mathematics program, the Class Banking System (CBS), which enables teachers to use constructivist ideas and approaches. To assess the effectiveness of the CBS, the Individualised Classroom Environment Questionnaire (ICEQ), Constructivist Learning Environment Survey (CLES), Test of Mathematics-Related Attitudes (TOMRA), and concept map tests were administered to two groups of fifth-grade students as pretests and posttests over an academic year. To enrich the data collected from those questionnaires, three case studies (one for the experimental group and two for the control group) were undertaken based on observations and interviews of selected students.

Smith (2010)\(^{15}\) summarized the six commonly used instruments: Learning Environment Inventory (LEI), Classroom Environment Scale (CES), Individualized Classroom Environment (ICEQ), My Class Inventory (MCI), College and University Classroom Environment Inventory (CUCEI), and Science Laboratory Environment Inventory (SLEI). According to Fraser, each of these instruments was reliable and valid, to differing degrees. Each instrument also classified the environment, more or less, on the following dimensions: relationship, personal development, and system maintenance and change.

Wheldall (2014)\(^{16}\) used the data from 1,467 high school students in New South Wales schools on the Individualized Classroom Environment Questionnaire (ICEQ) were analyzed using multilevel variance components models to derive intra-class correlations to determine the degree to which ICEQ scores may validly be said to measure aspects of classroom climate as against individual student attitude.
Materials And Methods

Research Procedures
Using the ICEQ was follows as for assessing students’ perception of their actual form on the 6-7th week, and the TOCRA on the 7-8th week for associating chemistry classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 12 in Wapipathum School, Mahasarakham Province.

Each scale of the ICEQ were composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Personalization is composed the item of 1, 6, 11, 16 and 21; the second scale, Participation is composed the item of 2, 7, 12, 17 and 22; the third scale, Independence is composed the item of 3, 8, 13, 18 and 23; the fourth scale, Investigation is composed the item of 4, 9, 14, 19 and 24; the fifth scale, Differentiation is composed the item of 5, 10, 15, 20 and 25.

Data Analyses
The scales of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the Actual ICEQ form and the TOCRA as specified in Santiboon (2014) [17]. Factorial validity and adequacy of fit for the dimensionality of the ICEQ were assessed through principal component analyses. The multiple correlations were significant of students’ perceptions of their school climate for the Actual Form of the ICEQ with students' attitudes to associate were analyzed.

Sample
This study is explored and described based on the developing students’ chemistry laboratory classroom environment with actual and preferred student’s perceptions with a sample size 49 upper secondary educational students at Grade level 12 in a class in Wapipathum School, MahaSarakham Province, in the first semester in academic year 2015.

Research Instrument
The Individual classroom Environments Questionnaire (ICEQ)
Fraser (1990) [18] The ICEQ assesses those dimensions which distinguish individualized classrooms from conventional ones. The initial development of the ICEQ was guided by: the literature on individualised, open and inquiry-based education; extensive interviewing of teachers and secondary school students; and reactions to draft versions sought from selected experts, teachers and junior high school students. The final published version of the ICEQ contains 50 items altogether, with an equal number of items belonging to each of the five scales. Each item is responded to on a five-point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items. Typical items are “The teacher considers students’ feelings” (Personalisation) and “Different students use different books, equipment and materials” (Differentiation). The copyright arrangement gives permission to purchasers to make an unlimited number of copies of the questionnaires and response sheets.

The Test of Chemistry-Related Attitude (TOCRA)
This study investigated associations between Actual students’ perceptions of their chemistry laboratory environment classes in Wapipathum School. A Test Of Science-Related Attitude (TOSRA) previously by Fraser (1981) [19] and Santiboon (2014) [20] was modified, adapted, and selected to the Test Of Chemistry-Related Attitude (TOCRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure ten distinct science-related attitudes among chemistry environment class in Wapipathum School students. The ten items are suitable for group administration and all can be administered within the duration of Actual Students’ Perceptions of their chemistry environment class. Furthermore, the TOCRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.
Validity and Reliability of Research Instruments

Validation of the ICEQ

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1.

Table 1. Scale Mean Scores, Means, Variance, and Standard Deviations for Actual Form of the ICEQ

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean score</th>
<th>Mean standard deviation</th>
<th>Cronbach’s alpha reliability</th>
<th>Discriminant validity</th>
<th>F-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>20.86</td>
<td>4.17</td>
<td>2.94</td>
<td>0.68</td>
<td>0.78</td>
</tr>
<tr>
<td>Participation</td>
<td>20.38</td>
<td>4.07</td>
<td>3.02</td>
<td>0.68</td>
<td>0.78</td>
</tr>
<tr>
<td>Independence</td>
<td>21.12</td>
<td>4.22</td>
<td>3.20</td>
<td>0.87</td>
<td>0.73</td>
</tr>
<tr>
<td>Investigation</td>
<td>21.61</td>
<td>4.32</td>
<td>3.08</td>
<td>0.84</td>
<td>0.74</td>
</tr>
<tr>
<td>Differentiation</td>
<td>20.88</td>
<td>4.18</td>
<td>2.55</td>
<td>0.73</td>
<td>0.77</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Factor loading Analysis of the ICEQ

The Actual and Preferred Forms of the ICEQ were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.

Table 2. Factor Loading for Items in the Actual Form of the ICEQ

<table>
<thead>
<tr>
<th>Item</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.98</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.98</td>
<td></td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.99</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.99</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>0.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>0.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.89</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.80</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.64</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.53</td>
</tr>
<tr>
<td>% of Variance</td>
<td>59.01</td>
<td>64.10</td>
<td>66.13</td>
<td>62.53</td>
<td>51.10</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>2.95</td>
<td>3.21</td>
<td>3.31</td>
<td>3.13</td>
<td>2.56</td>
</tr>
</tbody>
</table>

*Loading smaller than .30 omitted. The sample consisted of 49 students.
The SLEI was subjected to separate principal components factor analysis (with varimax rotation) involving the individual student’s score. The factor structure that emerged replicated to a large extent, the structure reported previously for the SLEI. Table 2 lists the items which were found to have factor loading greater than 0.30 (which is minimum value conventionally accepted as meaningful in factor analysis).
The Circumplex Nature of the ICEQ

To investigate the circumplex nature of the ICEQ correlations between the scales were calculated. The sample in Table 3 is presented the results show that the correlations between a scale and the next scale.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Personalization</th>
<th>Participation</th>
<th>Independence</th>
<th>Investigation</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.93***</td>
<td>0.16</td>
<td>0.12</td>
<td>0.30*</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.19*</td>
<td>0.16</td>
<td>0.16</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.85***</td>
<td>0.81***</td>
<td></td>
<td></td>
<td>0.85***</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.85***</td>
<td>0.81***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

To investigate the circumplex nature of the SLEI, correlations between the scales were calculated. The result is presented in Table 2. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Associations between ICEQ scale and attitude scale to information communication technology class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual Form</th>
<th>Simple Correlate Attitude (r)</th>
<th>Std. Regress Attitude (β)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>0.23***</td>
<td>4.07***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>0.22***</td>
<td>4.09***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.22***</td>
<td>4.45***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>0.39***</td>
<td>4.65***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.4193**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)
***Correlation is significant at the 0.001 level (2-tailed)

Conclusion and Discussions

This research study has been conducted on educational environments; less has been done to help teachers to improve the environments of their own classrooms or schools. This result reports how feedback information based on student perceptions can be employed as a basis for reflection upon, discussion of, and systematic attempts to improve classroom and school environments. The proposed methods have been applied successfully in studies lower to upper secondary levels. The attempt at improving classroom environments described below made use of the short 25-item version of the ICEQ discussed previously. The class involved in the study consisted of 22 grade 9 males and females of mixed ability studying science at a government school in Thailand. The procedure followed by the teacher of this class incorporated the following five steps, such as; Assessment, Feedback, Reflection and discussion, Intervention, and Reassessment.

These results summarised show that some change in actual environment occurred during the time of the intervention. When tests of statistical significance were performed, it was found that differences were significant (p<0.05) only for Personalization, Participation, Independence, Investigation, and Differentiation. These findings are noteworthy because two of the dimensions on which appreciable changes were recorded were those on which the teacher had attempted to promote change. Although the second administration of the environment scales marked the end of this teacher's attempt at changing a classroom, it might have been thought of as simply the beginning of another cycle.

This study evidences confirmation of the research studies at the four past decades, for example; using the SLEI, associations with students' cognitive and affective outcomes have been established for a sample of approximately 80 senior high school chemistry classes in Fraser & McRobbie 2003[21], 489 senior high school
Acknowledgments

Firstly, I would like to thank the 49 chemistry students in Wapipathum School at the Grade level 12 who were part of the study. Thank you to Mr.PhisitWannasri, Mrs.LaksameeMuangkla and Ms.UdomlakWantichang who allowed students to complete the questionnaire.

Secondly, I would like to my fellow Master of Science students, NootchanardWaidee to advise some problem point for fixing up commendation from my supervisor and co-supervisor.

Thirdly, I must thank you my supervisor; Dr.TanawatSomtua and my co-supervisor; he understood and never pushed me to build up of my research that it was going on work, completely.

Finally, my greatest thanks go to Assist. Prof. Dr.ToansakulSantiboon, as my extra supervisor, he has understood my professional and personal commitments throughout this study always encouraged. Without his supporting guidelines, I would never have achieved the completion of this research.

References


A Variety of the ICEQ Instrument for Assessing Distinct Aspects of the Chemistry Classroom Climates in Tenth-Grade in Khattiyawongsa School

Isara Boonyatipitak¹, Thanawat Somtua², Panwilai Chomchid¹, Kronthong Ponyeiam³ and Toansakul Santiboon¹,*

¹Department of Master of Science Education Program, Faculty of Education, Rajabhat Maha Sarakham University, 44000, Thailand
²Department of Science Program, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham, Thailand 44000
³Science Learning Group in Khattiyawongsa School, Roi-Et Province, Thailand, 45000

(*) author for correspondence, E-mail: toansakul35@yahoo.com.au

Abstract

Basically, the Individualized Classroom Environment Questionnaire (ICEQ) assesses the degree to which a course offers a personalized, student-centered teaching approach, and measures students’ participation in creating their own education, including open, independent inquiry-based investigation and differentiated instruction. This study is to assess of students’ perceptions of chemistry classroom environment and their learning styles provided a framework within which to study factors related to perceptions of students in learning. Using the ICEQ and the Test of Chemistry-Related Attitudes (TOCRA), modified from the TOSRA were administered to a stratified random sample of 90 Upper Secondary Educational students at Grade 10-12 in Khattiyawongsa School. Data analyses supported the factor structure, internal consistency reliability and discriminant validity of the ICEQ questionnaire and the TOCRA, as well as ICEQ scales’ ability to differentiate between classrooms. Data analyses also supported the internal consistency reliability and its ability to differentiate between classrooms. Also, the circumplex nature of the ICEQ was supported by analyzing its pattern of scale intercorrelations. Overall, the learning environment instruments (ICEQ) and attitude instrument (TOCRA) were found to be valid and reliable. Simple correlation and multiple regression analyses revealed positive associations between the learning environment and students’ attitudes. All five ICEQ scales were statistically significantly correlated with attitudes to chemistry. Associations between students’ perceptions of their attitudes toward their chemistry classes were chosen as the dependent variable of the model to the correlation coefficient significant for the ICEQ and considered associations with the TOCRA at 32% of the variance in students’ attitude were also provided. Results of several studies on the relationship between chemistry students’ perceptions of their classroom environments and their cognitive and affective achievements indicate strong variety association between the perceptions and the achievements.

Keywords: Individualized Classroom Environment Questionnaire (ICEQ), Chemistry classroom, Learning, Khattiyawongsa School

Introduction

Background on Classroom Learning Environment

The Individualized Classroom Environment Questionnaire (ICEQ) is designed to measure student or teacher perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information about: (1) the validity of the ICEQ; (2) differences between scores on different forms of the ICEQ; (3) relationships between student learning outcomes and perceptions of classroom individualization; and (4) relationships between student learning outcomes and actual/preferred congruence. Although research and evaluation in science education have relied heavily on the assessment of academic achievement and other valued learning outcomes, an overview is given of several lines of past research involving environment assessments in science classrooms (including associations between outcomes and environment, use of environment dimensions as criterion variables, and person-environment fit studies of whether students achieve better in their preferred environment), consideration is given to teachers’ use of classroom and educational institute environment instruments in practical attempts to improve their own classrooms and educational institute, currently trends and future desirable directions in research on educational environments are identified (Fraser, 1998). Differences between Student Perceptions of Actual and Preferred Environment An investigation of differences between students and teacher in their perceptions of the same actual classroom environment and of differences
between the actual environment and that preferred by students or teachers was reported by Fisher and Fraser (1983a) using the ICEQ with a sample of 116 classes for comparisons of student actual with student preferred scores and a subsample of 56 of the teachers of these classes for contrasting teacher’ and students’ scores. Students preferred a more positive classroom environment than was actually present for all five ICEQ dimensions. Also, teachers perceived a more positive classroom environment than did their students in the same classrooms on five of the ICEQ’s dimensions. These results replicate patterns emerging in other studies in school classrooms in the USA (Moos 1979), The Netherlands (Wubbel, Brekelmans & Hooymayers 1991), Thailand (Santiboon & Fisher, 2004), (Santiboon 2007), (Santiboon 2010), (Santiboon 2011), (Santiboon 2013), (Santiboon 2014) and Australia (Fraser 1982b; Fraser & McRobbie 1995), and in other settings such as hospital wards and work milieus (e.g., Moos 1974).

Focused on contemporary instruments: Learning Environment Inventory (LEI); Classroom Environment Scale (CES); Individualized Classroom Environment Questionnaire (ICEQ); My Class Inventory (ICEQ); College and University Classroom Environment Inventory (CUCEI); Questionnaire on Teacher Interaction (QTI); Science Laboratory Environment Inventory (SLEI); Constructivist Learning Environment Survey (CLES); and What Is Happening In This Class (WIHIC) questionnaire. The name of each scale in each instrument, the level (primary, secondary, higher education) for which each instrument is suited, the number of items contained in each scale, and the classification of each scale according to (Moos 1974) Scheme for classifying human environments.

**Using the ICEQ Questionnaire Instrument for this Study**

The ICEQ is designed to measure student or teacher perceptions of actual and preferred classroom learning environment along dimensions which differentiate individualized classrooms from conventional ones. These dimensions are Personalization, Participation, Independence, Investigation, and Differentiation. This paper reports data analyses which provide information about: (1) the validity of the ICEQ; (2) differences between scores on different forms of the ICEQ; (3) relationships between student learning outcomes and perceptions of classroom individualization; and (4) relationships between student learning outcomes and actual/preferred congruence. A copy of the ICEQ is appended (Fraser, 1981).

The ICEQ assesses those dimensions which distinguish individualized classrooms from conventional ones. The initial development of the ICEQ (Rentoul & Fraser 1979) was guided by: the literature on individualized open and inquiry-based education; extensive interviewing of teachers and secondary school students; and reactions to draft versions sought from selected experts, teachers and junior high school students. The final published version of the ICEQ (Fraser 1980) Contains 50 items altogether, with an equal number of items belonging to each of the five scales. Each item is respond to on a five-point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items. Typical items are: ‘The teacher considers students’ feelings’ (Personalization) and ‘Different students use different books, equipment and materials’ (Differentiation). The published version has a progressive copyright arrangement which gives permission to purchasers to make an unlimited number of copies of the questionnaires and response sheets.

**The Test of Chemistry-Related Attitude (TOCRA)**

This study investigated associations between Actual and Preferred students’ perceptions of their chemistry laboratory environment classes in Khattiayawongsa School. A Test of Science-Related Attitude (TOSRA) previously by Fraser (1981) was modified, adapted, and selected to the Test of Chemistry-Related Attitude (TOCRA) for this study. Because the scale was intended to measure student’s in all subjects, the item was modified from the TOSRA is designed to measure eight distinct science-related attitudes among chemistry laboratory environment classes in BorabuPittayakan students. The eight items are suitable for group administration and all can be administered within the duration of Actual and Preferred Students’ Perceptions of their chemistry laboratory environment classes. Furthermore, the TOCRA has been carefully developed and extensively field tested and has been shown to be highly reliable that it has been translated to Thai version in this study.

The purposes of this study used the ICEQ at determine students’ perceptions of the chemistry laboratory classroom situation. General description - the ICEQ is a useful tool for teachers to get feedback about their teaching methods, innovation and the most appropriate classroom situation that facilitates learning. There are several versions of the test available, Actual Classroom-Short Form, and Preferred Classroom-Short Form. Target Population - The test can be used by upper secondary education school students. Administration - The ICEQ is administered as a group test.

A distinctive feature of most of the instruments is that they have, not only a form to measure perceptions of ‘actual’ or experienced classroom environment, but also another form to measure perceptions of ‘preferred’ or ideal classroom environment. The preferred forms are concerned with goals and value orientations and measure perceptions of the classroom environment ideally liked or preferred. Although item wording is similar for actual and preferred forms, slightly different instructions for answering each are used. For example, an item in the
actual form such as 'There is a clear set of rules for students to follow' would be changed in the preferred form to 'There would be a clear set of rules for students to follow'.

**Research Purposes**

1. To assess student’s perceptions of their chemistry laboratory environment classes at Grade 10-12 in Khattiyawongsa School, Roi-Et Province.
2. To compare between student’s perception of their actual and preferred chemistry laboratory environment classes at Grade 10-12 in Khattiyawongsa School, Roi-Et Province.
3. To associate student’s attitudes of their perceptions to their actual chemistry laboratory environment classes at Grade 10-12 in Khattiyawongsa School, Roi-Et Province.

**Literature Reviews**

Igwebuike and Akpita (2013) studied in his purpose was to determine if there would be any difference in perceptions of psychosocial classroom environment between biology students (grade 12) and their teachers. Individualized Classroom Environment Questionnaire (Actual) was administered on the students (n = 400) and their teachers (n = 50). Analysis of data through t-test for independent samples indicated that the teachers and their students did not differ in their perceptions. Similarly, neither the male nor the female students differed with their teachers in their perceptions. Implications of the result were discussed.

Weldall, Beaman, and Mok (2013) Data from 1,467 high school students in New South Wales schools on the ICEQ were analyzed using multilevel variance components models to derive intraclass correlations to determine the degree to which ICEQ scores may validly be said to measure aspects of classroom climate as against individual student attitude. The results showed that the class variable accounted for large and noteworthy proportions of overall variance in all five ICEQ scales. Subsequent analyses showed that only small and nonsignificant proportions of variance were attributable to the school variable. In these terms, the ICEQ may be considered to be a relatively good measure of classroom climate.

Igwebuike and Akpita (2012) reported of several studies on the relationship between science students’ perceptions of their classroom environments and their cognitive and affective achievements indicate strong association between the perceptions and the achievements. This study, therefore, sought to find out if the constructivist instructional strategy can enhance cognitive and affective achievements of students in non-conducive environments, respectively. Findings do not support the stand that the constructivist instructional strategy is more effective than the traditional (expository) teaching strategy for improving cognitive achievement. But with respect to affective achievement, the evidence supports the use of the constructivist strategy for instruction in non-conducive classroom environment. Implications of the study are discussed and recommendations given.

Lim (2006) Assessment of students’ perceptions of classroom environment and their learning styles provided a framework within which to study factors related to perceptions of students in learning. Two instruments, the ICEQ and the Learning Style Inventory 1985 (LSI), were administered in Singapore to a stratified random sample of 1733 Secondary 4 students (equivalent to Grade 10) from nine secondary schools (good, average and below average schools). The study showed that school type (the category of schools that the students come from), had the most influence on the students’ perceptions of both actual and preferred classroom environment. Gender had an influence too, but mainly on perceptions of actual classroom environment. Learning styles of students had the least influence.

Fraser and Azmi (2003). Extensive research conducted in developed countries has established classroom learning environment as a thriving field of study. The present investigation makes a contribution to classroom environment research in that it involved the translation into Indonesian of scales previously available only in English, and the subsequent validation and use of these translated scales among Indonesian students. The new Indonesian instrument consists of nine seven-item scales based upon the Individualized Classroom Environment Questionnaire and the Classroom Environment Scale. Analyses of data collected from a sample of 373 Indonesian students from nine schools supported the new instrument’s internal consistency, discriminant validity, ability to differentiate between classrooms, and predictive validity (i.e. ability to predict student outcomes). Potential applications of the new instruments in Indonesian classrooms are suggested.

**Materials and Methods**

**Research Procedure**

Using the ICEQ was follows as for assessing students’ perception of their actual form on the 10th week, and preferred form on the 15th week and the TOCRA on the 15th week for associating chemistry laboratory classroom learning environments in chemistry classroom learning environment for upper secondary educational students at Grade 10 in Khattiyawongsa School, Roi-Et Province.
Each scale of the ICEQ was composed with the 5-item, minimum scoring is 5 and maximum is 25. The first scale, Cohesiveness is composed the item of 1, 6, 11, 16, and 21; the second scale, Friction is composed the item of 2, 7, 12, 17, and 22; the third scale, Difficulty is composed the item of 3, 8, 13, 18, and 23; the fourth scale, Satisfaction is composed the item of 4, 9, 19, and 24; the fifth scale, Competitiveness is composed the item of 5, 10, 15, and 25.

**Data Analyses**
Assuming that the scaling of the items approximated a 5-point ranking scale, internal consistency reliabilities (alpha coefficients) were computed for each of the derived factors of the actual and preferred ICEQ forms and the Attitude scale as specified in Fraser (1989). Factorial validity and adequacy of fit for the dimensionality of the ICEQ were assessed through principal component analyses. The multiple correlations were significant of students' perceptions of their school climate for the Actual Form of the ICEQ with students’ attitudes to associate were analyzed.

**Sample**
This study is improved and developed chemistry laboratory classroom learning environment for upper secondary educational students at Grade 10-12 in BorabuPittayakhan School classes of their chemistry laboratory learning classroom environments to actual and preferred student’s perceptions with sample size of 90 students in 4 classes at Grade 10-12 in Khattiyawongsa School, Roi-Et Province.

**Results**

**Validity and Reliability of Research Instruments**

*Validation of the ICEQ*

Description of quantitative data of analyzing responses for Master of Science teacher student’s assessments is reported in Table 1. The results given in Table 1 shows that on average item means for each of the five ICEQ scales, that they contain five items, so that the minimum and maximum score possible on each of these scales is 5 and 25, respectively. Because of this difference in the number of items in the five scales, the average item mean for each scale was calculated so that there is a fair basis for comparison between different scales. These means were used as a basis for constructing the simplified plots of significant differences between forms of the ICEQ. For the remaining five scales, namely; Personalization, Participation, Independence, Investigation, and Differentiation scales.

**Table 1.**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Mean score</th>
<th>Mean</th>
<th>Variance</th>
<th>Standard validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>22.40</td>
<td>4.49</td>
<td>0.28</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.80</td>
<td>4.55</td>
<td>0.18</td>
<td>0.42</td>
</tr>
<tr>
<td>Participation</td>
<td>Actual</td>
<td>21.30</td>
<td>4.25</td>
<td>0.26</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>23.00</td>
<td>4.61</td>
<td>0.12</td>
<td>0.35</td>
</tr>
<tr>
<td>Independence</td>
<td>Actual</td>
<td>21.40</td>
<td>4.19</td>
<td>0.18</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>21.50</td>
<td>4.30</td>
<td>0.23</td>
<td>0.47</td>
</tr>
<tr>
<td>Investigation</td>
<td>Actual</td>
<td>18.30</td>
<td>3.67</td>
<td>0.19</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>20.70</td>
<td>4.14</td>
<td>0.23</td>
<td>0.34</td>
</tr>
<tr>
<td>Differentiation</td>
<td>Actual</td>
<td>21.30</td>
<td>3.43</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>22.40</td>
<td>4.48</td>
<td>0.12</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Table 2 provides information about each scale's internal consistency reliability (alpha coefficient) and discriminant validity (using the mean correlation of a scale with the other scales in the same instrument as a convenient index), and the ability of a scale to differentiate between the perceptions of students in different classrooms.
The internal consistency reliability of the version ICEQ used in this study was determined by calculating Cronbach alpha coefficient for the 25 items of the ICEQ using both actual and preferred environmental climates’ perceptions scores. Table 2 reports the internal consistency of the ICEQ, which ranged from 0.67 to 0.80 when using the students’ actual climate scores and from 0.81 to 0.89 when using the students’ preferred climate scores. This characteristic was explored using a series of one-way analyses of variance on the scales of the ICEQ, which suggests that each scale of the ICEQ was able to differentiate significantly ($p<0.001$) between students’ perceptions in my school and my dream school environmental climates in the same school. The $t$-test statistic which is the ratio of “between” to “total” sums of squares and represents the proportion of variance in scale scores accounted for class by membership, ranged from 2.67 to 15.41 for different scales, respectively.

**Factor loading Analysis of the ICEQ**

The Actual and Preferred Forms of the ICEQ were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student’s score.
Table 3: Factor Loading for Items in the Actual Form of the ICEQ.

<table>
<thead>
<tr>
<th>Item</th>
<th>Pe</th>
<th>Pa</th>
<th>Id</th>
<th>Iv</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>0.91</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>0.87</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>0.87</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>0.73</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>11</td>
<td>0.59</td>
<td>0.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td>0.64</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>0.61</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>22</td>
<td>0.58</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.56</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>7</td>
<td>0.38</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>0.81</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>0.68</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>0.54</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.50</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0.30</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>0.92</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>14</td>
<td>0.67</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>0.64</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>9</td>
<td>0.64</td>
<td>0.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>24</td>
<td>0.41</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>0.77</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>0.65</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.63</td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>10</td>
<td>0.57</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>0.30</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of variance

<table>
<thead>
<tr>
<th>Item</th>
<th>Pe</th>
<th>Pa</th>
<th>Id</th>
<th>Iv</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>0.91</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>0.87</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>0.87</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>0.73</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>11</td>
<td>0.59</td>
<td>0.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td>0.64</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>0.61</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>22</td>
<td>0.58</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.56</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>7</td>
<td>0.38</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>0.81</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>0.68</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>0.54</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.50</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0.30</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>0.92</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>14</td>
<td>0.67</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>0.64</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>9</td>
<td>0.64</td>
<td>0.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>24</td>
<td>0.41</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>0.77</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>0.65</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.63</td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>10</td>
<td>0.57</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>0.30</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Circumplex Nature of the ICEQ

To investigate the circumplex nature of the ICEQ, correlations between the scales were calculated. The result is presented in Table 4. As expected, the results show that the correlation between a scale next it generally is high for scales further away from that scale. This is illustrated using the each scale has been confirmed.

Table 4: Scale Intercorelations for the ICEQ Using the Actual and Preferred Forms

<table>
<thead>
<tr>
<th>Scale</th>
<th>Form</th>
<th>Pe</th>
<th>Pa</th>
<th>Id</th>
<th>Iv</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalization</td>
<td>Actual</td>
<td>0.71**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>Preferred</td>
<td>0.59**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>Actual</td>
<td>0.11</td>
<td>0.36*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Preferred</td>
<td>0.72**</td>
<td>0.45**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td>Actual</td>
<td>0.67**</td>
<td>0.84**</td>
<td>0.30*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preferred</td>
<td>0.78**</td>
<td>0.56**</td>
<td>0.79**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)
Validation of the TOSRA
To measure Master of Science teacher students’ attitudes towards Information Communication Technology class, the present study adapted the eight-item Attitude Scale (Fisher, Rickards, Goh, & Wong, 1997), (Kijkosol& Fisher, 2005), (Santiboon& Fisher, 2004), (Santiboon 2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014), (Sittikosol& Malone, 2008)\(^1\), which was based on the Test of Science-Related Attitude (TOSRA) (Fraser, 1981). Using internal consistency reliability the Attitude Scale had a value of 0.84 which was considered satisfactory for further use in this study.

Comparisons between Student’s Perceptions of their Actual and Preferred Forms in Information Communication Technology Classes Classroom Environment
Tables 1 and 2 are comparing differences between the students’ perceptions of their actual and preferred science classroom learning environment constructivists for lower secondary educational students at Grade 10 in Khattayawongsa School environment classes show in Figure 1, it was found that students' preferred perceptions an environment with upper levels of Personalization, Participation, Independence, Investigation, and Differentiation scales than students’ actual perceptions.

The results of this study also indicate that using the ICEQ helps science educational management instructors to gain better picture of learning environment and the perceived learning needs of their students. It also provides support for the idea that lecturers needed to take differences into consideration when planning and designing the science educational management curriculum for students in the chemistry laboratory environment. Figure 1 illustrates the differences between the Actual and Preferred Forms and indicates that students would prefer more than actual and enhanced in all of scales in chemistry laboratory classes (see in Figure 1).

**Figure 1.** Significant differences between science students’ perceptions of their actual and preferred scores on the ICEQ.

 Associations between Students’ Perceptions of Actual Science Classroom Learning Educational Constructivist Environments with the TOCRA
In this study, it was also considered important to investigate associations between Master of Science teacher students’ perceptions of their Information Communication Technology classroom learning environment with their attitude toward science. The cronbach alpha reliability of the selected Attitude Scale was 0.84, when using individual student as the unit of analysis. This suggests that the scale is reliable for measuring students’ attitudes in chemistry laboratory classes in Khattayawongsa School. These involved: simple correlation and multiple regression analyses of relationships between the set of actual and preferred environment scales as a whole and the Attitude Scale that it’s reported in Table 5.

In Table 5, a main method of data analysis was used to investigate this environment-attitude relationship. The sample correlation values (r) are reported which show statistically significant correlations (p<0.05) between students attitudinal outcomes and their Information Communication Technology classroom environment on all scales. These associations are positive for all scales of the Actual and Preferred Forms in their classes where the students perceived greater personalization, participation, independence, investigation, and differentiation environment there was a more favorable attitude towards their Information Communication Technology class.

In the other hand, the sample correlation values (r) are reported which does not show statistically significant
correlations between students’ attitudinal outcomes and their Information Communication Technology classroom environment on all scales of the Actual Form. Table 5 is compared to investigate associations between science students’ perceptions of their chemistry laboratory classroom environments with their attitude toward chemistry classes. Using the ICEQ instrument in the higher education level, Khattayawongsa School, Thailand, will help instructors to evaluate their learning environments in physic laboratory environment classes, in order to improve their education process. Furthermore, the information from the ICEQ could be useful as the guide to enhance the effectiveness of chemistry laboratory classes.

**Table 5.** Associations between ICEQ scale and attitude scale to Chemistry class in term of simple and multiple correlations (r) and standardized regression coefficient (β)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Actual From</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple Correlate. Attitude (r)</td>
<td>Std. Regress. Weight Attitude(β)</td>
</tr>
<tr>
<td>Student Cohesiveness</td>
<td>0.21**</td>
<td>0.22**</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>0.23**</td>
<td>0.24**</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.25**</td>
<td>0.25**</td>
</tr>
<tr>
<td>Investigation</td>
<td>0.18*</td>
<td>0.21*</td>
</tr>
<tr>
<td>Task Orientation</td>
<td>0.22**</td>
<td>0.22**</td>
</tr>
<tr>
<td>Multiple Correlation (R)</td>
<td>0.5611**</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.3187**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The effectiveness in Chemistry class is very important because the improving work is high cost and time consuming. Therefore, evaluation of the Chemistry teaching is important for improving and developing students’ learning achievement successfully.

**Conclusions**

The actual and preferred perceptions of chemistry students of their chemistry laboratory classroom environments were measured with the ICEQ. The comparisons of the Actual Forms with the Preferred Form indicated that students would prefer more personalization, participation, independence, investigation, and differentiation in their chemistry laboratory environment classes. In general, students’ perceptions of their preferred classroom physic laboratory environment classes in physic laboratory environment classes to be greater than what they actually perceive to be provided. The results of this study also indicate that using the ICEQ helps Khattayawongsa School’s teachers in their educational institutes to gain a better picture of learning environment and the perceived learning needs of their students. An investigation of the association between students’ perceptions of learning environments with their attitudes to their physic laboratory environment classes, with regard to the ICEQ, it was found that all of five scales were positively associated with students’ attitude to physic laboratory environment classes. The multiple correlation R is significant for the ICEQ and shows that when the scales are considered together there are significant associations with the Attitude Scale. The R² values indicate that 32%, with actual form of the variance in students’ attitudes to physic laboratory environment classroom environments. The beta weights (β) show that in classes where the students perceived greater than all scales in their adding, abstract, figures, tables, and reference and manuscript article of full paper lessons.

**Discussions and Implications**

Learning environment is an important aspect in education process. It not only influences the students’ outcomes, but also instructor performances. Instructor could use the information from learning environment assessments to improve their education process. Furthermore, one instrument which could evaluate learning environments Individualized Classroom Environment Questionnaire (ICEQ). This instrument provides the physic laboratory environment classes of students’ perceptions on actual and preferred physic laboratory environment classroom learning environments. The information from this instrument could be used for improvement and effectiveness teaching in physic laboratory environment classes.
As described in the results section, Khattayawongsa School’s students show similar answering patterns to those from other countries as reported in previous studies when they are asked to reply to the ICEQ questionnaire. Overall, Khattayawongsa School’s students show relatively favourable perceptions of their physics laboratory environment classes, with the lowest score occurring for the Differentiation scale. It seems that chemistry laboratory environment classes’ activities related to chemistry laboratory environment classes are operated rather as supplementary to theory classes rather than being independently important in their own right. Overall, this study replicated previous studies using the ICEQ, with the findings being consistent with the situation in Khattayawongsa School in Thailand. It is also noteworthy that this study showed distinctive and more positive learning environment perceptions among students from the physics laboratory environment classes, interestingly.

Acknowledgements

I am heartily thankful to my supervisors; Assist. Prof. Dr. Toansakul Santiboon, Dr. Tanawat Somtoa, Dr. Panwilaichomchid of Master of Science of Education Program, Faculty of Education, Rajabhat Maha Sarakham University, Ajarn Krongthong Ponyieam at Khattayawongsa School who is a trainer of trainee student whose encouragement, guidance and support instruments and computing system for analysis of this research. I am grateful to my family, who are supported my working well done. It is a pleasure to thank those who made this research possible by the Graduate School of Rajabhat Maha Sarakham University.

References


---

*The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development*
*September 17-18, 2015 at Rajabhat Maha Sarakham University*
Using of folk wisdom to manage conflicts in community

Wiyada Mungphol¹ Prasopsuk Rittidetch² Praphatsorn Pree-iam² and Phanida Sittihakoat²

¹Ph.D.student of Educational Administration for Locality Development Program
Rajabhat Maha Sarakham University
²Professor of Educational Administration for Locality Development Program, Faculty of
Education Rajabhat Maha Sarakham University
(*author for correspondence, E-mail: wiyada.of@hotmail.com)

Abstract

The objectives of this research were to 1) to study conflicts in community of Phoyai Sub-district, Panomprai District, Roi Et province and 2) to study need of folk wisdom usage to manage conflict in community of Phoyai Sub-district, Panomprai District, Roi Et province by using Mixed Methods Research based on integrating of quantitative and qualitative method. The instrumentation used in the study include were 1) questionnaires 2) in depth interview with structure and non-structure 3) focus Group Questions and focus. Scopes of the study were as follow; 1) Population was as follows- knowledgeable group, doers group and general group, 14 people in total. 2) Location of the study was as follows- villages in Phoyai Sub-district, Panomprai District, Roi Et province, 14 villages in total by using basic statistical analysis ; mean, percentage, standard deviation.

The results of this study were as follows:
The findings revealed that conflicts in community; 1) environmental side was the highest level of problems. Personal debt, in fragment, stealing, quarrel problems were in high level. The causes of conflicts were occurred by conflict of interest (COI), relation, values and using of regulation or law data.
2. The findings revealed that the need of folk wisdom use to manage conflict in community, the most needed thing was to have ‘ChoaKoat’ to reconcile the conflicts. The high needed was to have witnesses during reconciliation and wrote down the report of reconciliation agreements then read the report. The moderate needed was to apologize to victims after reconciliation.

Keywords: Using of folk wisdom, Reconciliation, Community

Introduction

Globalization trends have effected to economics, society, and crime or national dispute. It is due to the present era is the era of competition on benefits, values, ideologies, religions and cultures which cause conflicts in society.Ever since there have been changes in administration in1932, people in community have managed their conflicts less than before due to replacement of the administration of justice. When there are conflicts occurring in community they will pass to sectors in judgment process as follows – police, prosecutor, court, attorney and royal decree which causes community to be lack of responsible realization to solve problems. The conflicts will be submitted to government officers to solve. It therefore has too many cases for the government to handle and this causes inefficient conflicts solving especially in the court including small cases that are able to compromise. In each year, there are plenty of cases are brought up to the court. And when the cases of conflicts are finally judged by judgment process, it comes the result; lost or win. Any side has to compensate to the other one. This causes litigants to be lack of virtue, morality and mercy. They solely want to defeat but their feelings are not integrated. Hence litigants are not able to be generous to each other. They moreover need to pay large expenses until the cases are settled. (KitiTayakkanan.1992:25, WitoonKlongmeekun. 2009 : 50-51).
According to the 1932 Local Administration Act section 27, it was defined that village headmen had to provide justice and built compromising and unity to the villages. Also they had to reconcile disputes among community in the village level. The regulation of Ministry of Interior had been legislated in BE 2530 that village headmen and village committee were the ones who settled disputes in their own village to make peace in community according to the 1932 Local Administration Act section 28. Types of conflicts in community were as follows – quarrel, breaking loan contract, trespass, using community forest or public swamp which were conflicts that people in community know how to compromise. (PalisaSomphamitra. 2003: 120, DaruneeJongprasertkun.2001 : 13)

Reconciliation those conflicts mentioned above, people in northeastern community pay high respect to doyens and teachers of folk wisdom and some communities pay respect to ‘ChoaKoat’. These people have wisdom of virtue and morality therefore they are the ones who solve these social problems. They will set up the
negotiations and compromising for people having conflicts with each other. It is sometimes called the use of folk wisdom to manage conflicts in community through Chao Koat process (PhrathepdilokThityano. 2002:49, UdomBuasri. 1997:15)

Using of folk wisdom to manage conflicts in community, researchers have surveyed in Phoyai Sub-district, Panomprai District, Roi Et province by using interview with non-structure. The interview was concerned about the sources of conflicts in community and had been revealed that conflicts occurring were as follows – 1) using community forest together is due to people in community trespassed on preserved forest or public forest of community and used the forest area as their own to do farming and planting eucalyptus. Additionally 2) some conflicts occurred in household especially. It was a conflict on the legacy benefits or benefits among relatives that they did not allocate lands according to the prior agreement.

The results of filed interview in Phoyai Sub-district, Panomprai District, Roi Et province revealed that there had social phenomena. There were conflicts in community but there were no sample uses of folk wisdom to manage the conflicts. However community in Phoyai Sub-district, Panomprai District, Roi Et province had ChoaKoat process and doyen process including teacher of folk wisdom still. People in this sub-district played high respect to these people to reconcile any conflicts in the relative and community level. Despite doyen and ChoaKoat process was tremendously useful for conflict reconciliation in community, it was not as yet recorded in writing and presented in a clear form.

Hence it makes researchers interested in study of use of folk wisdom to manage conflicts in community. It should have persons in their own community to act as court of justice. Doyen process and Chao Koat process should mainly rue the community as if they are the attorneys of community. It is to manage any small conflict cases among community and to make the people live peacefully and harmonizationally.

Objectives

1. To study the conflicts in community of Phoyai Sub-district, Panomprai District, Roi Et province.
2. To study the need of folk wisdom use to manage conflicts in community of Phoyai Sub-district, Panomprai District, Roi Et province.

Material and Method

1. Instrumentation used to collect data is composed of 1) Questionnaires 2) Interview with structure and non-structure 3) Focus Group Questions 4) Focus Group Discussion Report
2. Research procedure; It uses Mixed Methods Research: integrating of quantitative and qualitative method.
3. Population and samplings; Researchers chose purposive sampling composed by knowledgeable group, doers group and general group, 14 people in total.
4. Scope of data; To study the conflicts and needs of folk wisdom use to manage conflicts in community.
5. Location of Study; PhoyaiSub-district, Panomprai District, Roi Et province, 14 villages in total.
6. Period of Study; It started from January 2015 until April 2015.
7. Data Collection; Data Collection is as follows 1) Data collection from documents and related researches. 2) Field data collection by in-depth interview and questions for focus group discussion.
8. Data Analysis; To analyze data on problems and needs of folk wisdom use to manage conflicts in community.
9. Statistics used in data analysis; Statistics used in analysis was percentage, mean and standard deviation.

Results

1. Conflicts in community was revealed that the highest level of the problems weighed on environmental side for 80 percent. Personal debt, infringement, stealing, quarrel problems weighed 78 percent considered as high level. The causes of the conflicts were conflict of interest (COI), relation, values and using of regulation or law data.
2. The need of folk wisdom use to manage conflict in community was revealed that the most needed thing was to have ‘ChoaKoat’ to reconcile the conflicts weighed 100 percent. The high needed was to have witnesses during reconciliation and wrote down the report of reconciliation agreements then read the report weighed 78 percent. The moderate needed was to apologize to victims after reconciliation weighed 68 percent.
Researchers have investigated the mentioned data on the results of the study of problems and needs of folk wisdom use to manage conflicts in community by setting up the discussion with knowledgeable, doers and general group, 14 people in total. The agreements have come to this: mostly the conflicts in Phoyai Sub-district were trespass on preserved forest or public forest of community and used the forest area as their own. Otherwise some conflicts occurred in household level on legacy allocation. Relatives and doyen or someone calls ChoaKoat would assist to reconcile on legacy allocation and quarrel between couples. Furthermore there were reconciliation on stealing in the village. (Focus group discussion on February 10th 2015 at Office of the Village Headman, Phoyai Sub-district, Panomprai District, Roi Et province)

Discussion

The study of problems and needs to use folk wisdom to manage conflicts in community reveals as follows; Problems and needs: Conflicts in community was found that 1) the highest level of the problems was on environmental side. Personal debt, infringement, stealing, quarrel problems were considered as high level. The causes of conflicts were the conflict of interest (COI), relation, values and using of regulation or law data.

The need of folk wisdom use to manage conflict in community was revealed that the most needed thing was to have ‘ChoaKoat’ to reconcile the conflicts. The high needed was to have witnesses during reconciliation and wrote down the report of reconciliation agreements then read the report. The moderate needed was to apologize to victims after reconciliation.

This relates to UdomBuasri’s concept (1997:15) which reflects conflicts reconciliation of most northeastern people in community. They pay high respect to doyen likewise ChoaKoat. ChoaKoat is an elder who is the leader of community or the senior who has a lot of knowledge and experiences including virtue and morality. ChoaKoat is a person that people in community pay high respect to. When conflicts are raised among community, it is able to negotiate a compromise likewise using folk wisdom. But it is the wisdom of folk law that northeastern people call ChoaKoat process. The process reconciles any conflicts among community to meet the peace and harmony.

Suggestion on Application

1. This study can be applied to manage conflicts in other communities.
2. Should continuously train and enhance community headmen experience on how to reconcile and exchange the knowledge of law with community justice network. Additionally government organizations should participate solemnly.

Suggestion for Further Study

The using folk wisdom to manage conflicts of the use of public land by ChoaKoat process.

References

Sex Determination from Greater Sciatic Notch and Acetabulum in Thai Population

Suphawan Latthitham

33 Sukhumvit 3 Bumrungrad International Hospital Bangkok, 10110
Thailand
E-mail: Suphawan9785@gmail.com; Tel.0924045859; Fax: 026679278

Abstract

The purpose of this research was to find index in testing sex identification from Greater Sciatic Notch and Acetabulum. The sample group for bone investigation was Thai citizen. The target group was 200 Thai citizen principles’ hip bones, by aged 20-76 years, in anatomy laboratory, faculty of medicine, Siriraj Hospital.

Independent sample t-test and Discriminant function analysis were used in investigation. The research focused on three points which were 1) measuring Greater Sciatic Notch from ischial spine to pyramidal process for WIDTH 2) measuring vertical acetabulum for DIAMETER 3) measuring the compared index of above between male and female. As a consequence, it was found that male had lower index of width than female but higher in index of DIAMETER from sex identification. The index of above in measuring Greater Sciatic Notch can clearly identify sex.

Keywords: Sex, DIAMETER, Acetabulum, Siriraj Hospital

Introduction

The evidence about a person from the skeleton is very important, especially in the field of forensic science to identify the sex of a skeleton key that is absolutely essential preliminary to lead to the identity of the skeleton.

In the skeleton used to identify the gender of bone each piece with precision to identify sex, especially cranial (skull) and pelvis (pelvisbone) , which can be identified by gender, by viewing with the naked eye, including by a skull and pelvis (Giles and Elliot, 1963, Stewart, 1954).

According to the study of Chomsorn Phudendane (2008) said. "Measurement of the skull and pelvis are not more reliable than the naked eye watching. The report showed that the reliability of the examination with the naked eye from the bones of modern humans (Modern human skeleton) equal to 97% of the measured bone, skull and pelvis are reliable in identifying the sex of 92 % and 96 %, respectively. (Meindlet al., 1985).

Although the reliability of neked eye watching is high credibility, but the disadvantage is unable to detect any position .While ,the measuring of the skull and pelvis can detect in any position although some bone pieces are not perfect

The researcher has studied research abroad, with several research studies to identify sex by measuring the pelvis. And used as the basis of gender, ethnic group, who studied the skeletons.

Basic information on the gender structure body using the skeleton should be settled within the same ethnic group because of there are different between the body structure, the size and shape, genetic, environmental, nutritional, lifestyle, and habit in each population. The error’s in study across the population.

Found in the pelvis from being buried for a long time . The body supine Found that the way forward will be destroyed. But also the back of the pelvis. The rest are usually enough to identify the gender include Greater Sciatic Notch, which is wider and shallower in females than in males.

Therefore, the researcher is interested to study of gender identify by measuring the pelvis bone to obtain more reliable data.

Materials and Sampling selection

1) The researcher focused on principals’ 200 hip bones granted from Siriraj Hospital, Faculty of Medicine, Mahidol University. The sample group was recruited by Simple Random Sampling. The researcher did not know the sex of sample group before as preventing inaccuracy measuring. Greater Sciatic Notch was measured and each personal background was analyzed later.

2) 1 Vernier Caliper
The symbol of measuring was referred from Pedro A. Barrio and Jose’A. Sa’nchez (2006). “Metacarpal Sexual Determination in a Spanish Population.” Journal of Forensic Science 2006, (Sep: 51). There were 4 points that measured.

From A to B is measuring WIDTH of Greater sciatic notch and ischial spine.

From C to D is measuring DIAMETER acetabulum.

Index measuring is measuring WIDTH and DIAMETER of Greater Sciatic Notch altogether.

Data analyzing and statistic

Researcher analyze the data using descriptive statistic and Inferential Statistics. The statistic used to describe the data were:

1) Frequency, Percentage, Mean and Standard deviation
2) Independent sample t test and p value were used to compare different between ale and female’s hip bones.
3) Discriminant function analysis was used for accuracy of sex identification.

Results

The research of identifying sex from hip bone is descriptive design research. And, the data were simplified and classified into parts.

1) The variances of Greater Sciatic Notch were classified into percentage average and standard deviation
2) Comparing the different between male hip bone and female hip bone
3) Analyzing accuracy of Thai male and female hip bone identification

The details of data analyzing were:

1. Classifying variances of Greater Sciatic Notch into percentage average and standard deviation

After measuring 200 hip bones of sample group, the narrowest is at 22.92 millimeters, and the widest is at 57.74 millimeters. The average of width is at 40.49 millimeters. The narrowest diameter of hip bone (Greater Sciatic Notch) is at 44.30 millimeters, and the widest is at 93.35 millimeter. The average of diameter’s wideness is at 83.14 millimeters. After having measured index, the lowest is at 47.50 millimeters, and the highest is at 127.97 millimeters. The sample group had 134 males which were 67 percent and 66 females which were 33 percent. The youngest one in sample group was 20 years old and the oldest was 83 years old. The average of age was 45.36 years old.
2. Comparison between index of male and female hip bone in Thailand

Independent sample t test was used for comparison of the index of male and female hip bone. This was for sex identification.

2.1 Comparison between Thai male and female hip bones.

The researchers classified indexes of hip bones into types.

**WIDTH** Seventy one males had wide net of hip bones between 30.01 – 40.00 millimeters. That was 35.5%. Forty two female had wideness between 41 – 50 millimeters. That was 21 percent.

**DIAMETER** Almost of men (88 of them) had diameter of hip bones between 51.01 - 60.00 millimeters. That was 44 percent. The diameters of 58 females’ hip bone were less than 50 millimeters. That was 29 percent.

**INDEX** The indexes of 59 males’ hip bone were between 70.01 - 80.00 centimeters. That was 29.5 percent. The index of 26 females hip bones were between 81.01 – 90.00 centimeters.

### Schedule No 2.1 Comparison between indexes of Thai male and female hip bone

<table>
<thead>
<tr>
<th>Position</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WIDTH</td>
<td>Amount</td>
<td>Percentage</td>
<td>Amount</td>
<td>Percentage</td>
</tr>
<tr>
<td>Less than or equal 30 mm</td>
<td>2</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30.01 – 40.01 mm</td>
<td>71</td>
<td>35.50</td>
<td>22</td>
<td>11.00</td>
</tr>
<tr>
<td>40.01 – 50.00 mm</td>
<td>59</td>
<td>29.50</td>
<td>42</td>
<td>21.00</td>
</tr>
<tr>
<td>50.01 – 60.00 mm</td>
<td>2</td>
<td>1.00</td>
<td>2</td>
<td>1.00</td>
</tr>
<tr>
<td>DIAMETER</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 50 mm</td>
<td>45</td>
<td>22.50</td>
<td>58</td>
<td>29.00</td>
</tr>
<tr>
<td>50.01 – 60.00 mm</td>
<td>88</td>
<td>44.00</td>
<td>8</td>
<td>4.00</td>
</tr>
<tr>
<td>61.01- 70.00 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>71.01 – 80.00 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>81.01 –90.00 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>More than 90.01 mm</td>
<td>1</td>
<td>0.50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>INDEX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 50 mm</td>
<td>1</td>
<td>0.50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50.01 – 60.00 mm</td>
<td>1</td>
<td>0.50</td>
<td>1</td>
<td>0.50</td>
</tr>
<tr>
<td>61.01- 70.00 mm</td>
<td>22</td>
<td>11.50</td>
<td>4</td>
<td>2.00</td>
</tr>
<tr>
<td>71.01 – 80.00 mm</td>
<td>59</td>
<td>29.50</td>
<td>4</td>
<td>2.00</td>
</tr>
<tr>
<td>81.01 – 90.00 mm</td>
<td>33</td>
<td>16.50</td>
<td>26</td>
<td>13.00</td>
</tr>
<tr>
<td>More than 90.01 mm</td>
<td>18</td>
<td>9.00</td>
<td>31</td>
<td>15.50</td>
</tr>
</tbody>
</table>

1. Using Independent sample t test and testing accuracy by Discriminant function analysis in comparison between index of Thai male and female hip bone

The result illustrated that WIDTH and DIAMETER between male and female group had significantly different at 0.05. The sample group with different sex had no different on index as shown in table 2.3
Table 2.3 Comparison of sexes, ages, width and diameter in Thai citizen

<table>
<thead>
<tr>
<th>Position</th>
<th>Sex</th>
<th>Mean</th>
<th>Std deviation</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIDTH</td>
<td>Male</td>
<td>39.62</td>
<td>4.67</td>
<td>-3.581</td>
<td>.001*</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>42.27</td>
<td>5.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIAMETER</td>
<td>Male</td>
<td>51.12</td>
<td>4.84</td>
<td>6.622</td>
<td>.001*</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>45.84</td>
<td>6.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INDEX</td>
<td>Male</td>
<td>83.19</td>
<td>57.31</td>
<td>-1.205</td>
<td>.229</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>91.83</td>
<td>14.11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significantly different at 0.05

2. Analyzing sex identification from Thai citizens’ hip bones

After having analyzed the accuracy of sex identification from hip bones, WIDTH and DIAMETER of hip bone could not identify sex clearly. But index can give more accurate outcome as demonstrated in 3.1.

One hundred four out of 134 of male sample group was identified correctly. That was 77.6 percent. And, 55 out of 66 of female sample group was identified correctly as shown in table 3.2.

Schedule 3.1 Analyzing accuracy on hip bone sex identification

<table>
<thead>
<tr>
<th>Position</th>
<th>SEX</th>
<th>Frequency</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIDTH</td>
<td>male</td>
<td>134</td>
<td>39.62</td>
<td>4.67</td>
<td>.000*</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>66</td>
<td>42.27</td>
<td>5.39</td>
<td></td>
</tr>
<tr>
<td>DIAMETER</td>
<td>male</td>
<td>134</td>
<td>51.12</td>
<td>4.84</td>
<td>.000*</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>66</td>
<td>45.84</td>
<td>6.13</td>
<td></td>
</tr>
<tr>
<td>INDEX</td>
<td>male</td>
<td>134</td>
<td>83.19</td>
<td>57.31</td>
<td>.229</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>66</td>
<td>91.83</td>
<td>14.11</td>
<td></td>
</tr>
</tbody>
</table>

Schedule 3.2 Equation of Discriminant function analysis in parameter of male and female

<table>
<thead>
<tr>
<th>Greater Sciatic Notch</th>
<th>Sex identifying equation</th>
<th>Predicted Group Membership</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>male(n = 134)</td>
<td>-88.246+1.776+1.950+0.018</td>
<td>104</td>
<td>77.6%</td>
</tr>
<tr>
<td>female(n = 66)</td>
<td>-83.407+1.866+1.767+019</td>
<td>55</td>
<td>78.8%</td>
</tr>
</tbody>
</table>

Conclusion

1. Classifying percentage, average and standard deviation of Greater Sciatic Notch index

After having measured hip bones, the narrowest one was 22.92 mm and the widest one was 57.74 mm. The average of width is at 40.49 mm. The shortest diameter of Greater Sciatic Notch is at 44.3 mm, and the widest is at 93.35 mm. The average of diameter is at 40.37 mm.

The lowest index was 47.50 mm, and the highest one was 127.97 . The average index was at 83.14 mm. One hundred thirty four males was 67 percent, and 66 females was 33 percent. The youngest was 20 years old, and the oldest was 83 years old. The average age was 45.36 years old.

2. Comparison between the index of Thai male and female hip bones.

WIDTH) Seventy one males(35.50 percent) had hip bone’s width was between 30.01 –40.00 mm. And, 42 females (21.00 percent) had hip bone width between 40.01 –50.00 mm.

DIAMETER) Eighty eight males (44 percent) had hip bone’s diameter between 51.01 -60.00 mm. Fifty eight females (29.00 percent) had hip bone’s diameter less than or equal fifty.

When having used Independent sample t test to compare the index of male and female hip bone, the WIDTH and DIAMETER of different sex was significantly different at 0.05.

One hundred four (77.6 percent) out of 134 of male sample group members were identified correctly. Fifty five females (78.8 percent) out of 66 of female sample group members were identified correctly.
Discussion

The result illustrated that male has narrower hip bone than female. In fact, female is the one who become pregnant and give a birth, so they have bigger hip bone. But, male hip bone has longer diameter. Female hip bone has oval shape pelvic inlet similar side to pelvic outlet. Female greater pelvis is big, and subpubic angle is curved backward. Female hip bone is circular and shorter than male’s. It is thinner, lighter and smoother. Male side hip reaches forward a bit further than female’s. Female pubis is wider and shorter than male. Female coccyx can move. The distance between costa border and pelvis in female is longer than in male, so female has smaller waist. Finally, hip bone can identify sex and make difference between male and female among humanity.

After having analyzed accuracy of sex identification for Thai citizens’ male and female hip bones by using Discriminant function analysis, WIDTH and DIAMETER could not identify clearly. However, Index can identify male. The accuracy of using index to identify male is 77.6%, and female is at 78.8%. This is similar to the study of PhitakPhuwat, and SutatDuangjit (2013). That study focus on sex identification from Thai citizen leg bone. Moreover, result illustrated that male had average DF and IF than female at significantly different at (p<0.05). The parameter which had highest sex identification is DF and IF at leg bone. The accuracy is 79.70 and 78.13 respectively. Male has those average per than parameter levels higher than female by significantly difference. This is similar to other study.

Acknowledgements

Thanks to Assistance professor ParnjaiTarntassawong, the dean of graduated school. Thank you to Assistance professor DrThongchaiTaechovisarn, asst, prof, drTanapornRungruang, Pol Col DrSaritSuebponsiri and Associate Prof.Suneekanyajit for giving advice.

Thank to NoppolPiamput from anatomy laboratory, Faculty of Medicine Siriraj, Mahidol University. Thank to who allow using the laboratory material providing.

Thank to NattayaAmormmetajit from anatomy laboratory, Faculty of Medicine Siriraj, Mahidol University who have been very supportive.

Thank to principal teachers who gave hip bones and 6th alumnus from Faculty of Science, Silapakporn University who provided moral support.

Thank to mother and father and my family who kindly gave moral support and money and those whoever have been cooperated on this research well.

References

Utilization Potential of Rice Husk in Fired Clay Bricks for Construction Material

Nonthaphong Phonphuak*, Siwadol Kanyakam, Wongphaka Phimpha and Nantika Chaikanha

Department of Engineering Management, Faculty of Engineering, Rajabhat Maha Sarakham University, Maha Sarakham 44000 Thailand

(*author for correspondence, E-mail: phonphuak@gmail.com; Fax: 043-742620)

Abstract

The aim of this study was to investigate the physical and mechanical properties of fired clay bricks due to effects of rice husk used to add into raw brick clay at various of firing temperatures. Rice husk were conducted with different concentrations of 0, 5, 10, 15 and 20% by weight. The clay brick specimens were fired in gas kiln furnace at 900 and 950 °C. Results revealed that a rise in rice husk obtained the increase in open porosity while the bulk density and compressive strength were decreased. Conclusively, rice husk could be regarded as a potential additive to raw materials in the manufacturing of lightweight fired clay bricks.

Keywords: Fired clay brick, Rice husk, Eco-bricks, Porosity, Waste incorporation

Introduction

Bricks have been widely used as construction and building material all around the world for a long time [1]. The infrastructure such as buildings for housing and industry, and the facilities for handling water and sewage will require large amounts of construction materials [2]. Since that time, the fired clay masonry bricks are being widely used for building due to following factors: (1) good physical and mechanical properties; (2) durability; (3) beauty; (4) less maintenance; and (5) low cost [3]. However, the higher quality of fired clay bricks is essential for modern construction. Several studies have reported that bricks have been designed to become homogeneous, harder, stronger and porous due to the ceramic bond from the fusion phase of silica and alumina clay constituents [4]. One way to increase such capacity of bricks is to create porosity in the clay body through the addition of pore former materials which are either organic or inorganic pore generators. Organic pore formers are generally cheaper than inorganic ones and also have the advantage of ensuring a heat contribution to the firing [5]. Thus, it is more fuel efficient and environmentally friendlier than firing pure clay bricks or with inorganic pore formers. However, inorganic pore formers are also used as they contribute to low environmental problems. The pore formers used in clay brick manufacturing can be classified into two groups, organic and inorganic pore generators [6,7]. Rice husk is an organic waste and is produced in large quantities. It is a major by-product of from the rice milling and agro-based biomass industry. Rice husk a cellulose-based fiber and contains approximately 20% silica in amorphous form and it is a cellulose-based fiber [8]. Recycled rice husk (RH) in fired clay brick could be a new low cost material; an alternative disposal method for rice husk waste solving the pollution problem. Furthermore, by incorporating the rice husk into the brick, the gas emission will be in controlled manner during the firing process. This reduces the effect of burning of rice husk openly [9]. The main objective of the study was to investigate the feasibility of using rice husk (RH) as additive to clay body. The effects of firing temperature and the rice husk content in the clay mixture were discussed in terms of physical and mechanical properties.

Materials and Methods

Properties of brick raw material

The clay used in this study was obtained from one of the local brick plants. Chemical analysis of clay and rice husk were carried out using X-ray fluorescence technique (Horiba Mesa-500 w). The chemical composition of raw materials is given in Table 1. The particle-size distribution of the clay was analyzed by laser diffraction (Mastersizer, Melvern Instrument Ltd) and this distribution is given in Fig. 1. The mineralogical compositions of clay and rice husk were achieved using an X-ray diffraction technique (XRD: X’ Pert PRO MPD, Philips, Netherland) (Fig. 2). The rice husk used in this research is in the form of amorphous structure (Fig. 3).
Table 1. Chemical composition of raw materials.

<table>
<thead>
<tr>
<th>Composition</th>
<th>Clay, wt %</th>
<th>Rice Husk, wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>58.76</td>
<td>95.40</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>21.34</td>
<td>Slightly</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>5.10</td>
<td>Slightly</td>
</tr>
<tr>
<td>CaO</td>
<td>0.21</td>
<td>0.36</td>
</tr>
<tr>
<td>K₂O</td>
<td>3.10</td>
<td>1.02</td>
</tr>
<tr>
<td>Na₂O</td>
<td>-</td>
<td>0.80</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>-</td>
<td>0.60</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.93</td>
<td>-</td>
</tr>
<tr>
<td>MnO</td>
<td>1.18</td>
<td>Slightly</td>
</tr>
<tr>
<td>MgO</td>
<td>-</td>
<td>0.25</td>
</tr>
<tr>
<td>LOI (Loss on ignition)</td>
<td>8.74</td>
<td>-</td>
</tr>
</tbody>
</table>

Fig. 1. Particle size analysis of clay.

Fig. 2. X-ray diffraction patterns of (a) clay and (b) rice husk used in experiments. (Q; quartz, M; muscovite, R; rutile)

Fig. 3. SEM micrograph of rice husk.
Sample preparation

In order to determine the extent of the effects of different amounts of rice husk (0, 5, 10, 15 and 20 wt.%), each batch of specimens was mixed in a porcelain ball mill to ensure homogenous mixing. Then, 20-25% of water was added and mixed to obtain plastic condition of mixture. Soft-mud rectangular clay bricks with dimension of 140 mm x 65 mm x 40 mm were formed using brick hand molding. The clay brick specimens were air-dried at room temperature (25-30 °C) for 24 hrs, and then over dried at 110 ± 5 °C for another 24 hrs to remove water content. The green samples were fired then at two temperatures 900 and 950 °C.

Testing method for the physical and mechanical properties of samples

Shrinkage was determined by direct measurement of sample length before and after firing. The linear drying shrinkage and total linear shrinkage were measured and compared to the length before shrinkage in accordance with the standard of ASTM C326-09 (2014) [10]. Archimedes method based on ASTM C373-14a (2014) [11] was used to determine the water absorption, bulk density, apparent density and apparent porosity. The compressive strengths of samples were measured in accordance with ASTM C773-88 (2011) [12].

Results and Discussion

Bricks characterization

The physical and mechanical properties investigated and reported are firing shrinkage, water absorption, bulk density, apparent porosity and compressive strength.

The linear shrinkage of the bricks is a significant parameter, since large contractions may lead to tension and even to broken pieces [13]. In general, shrinkage used in shaping clay bricks occurs due to the leaving of water from clay body. In other words, when water between clay particles leaves particles come closer and shrinkage occurs. To minimize shrinkage, firing temperature which is an important parameter affecting the degree of shrinkage must be controlled during the firing process. [7]. Increasing of firing temperature increases the vitrification in the structure, so increases the shrinkage values as well. In this study, clay bricks were fired at the temperatures 900 and 950 °C. The results indicated that shrinkage occurred in the fired clay bricks was in the range of 4.12– 6.06% (900 °C) and 4.34 – 5.96% (950 °C). An increase in the content of the rice husk addition leads to a decrease in the total linear shrinkage (Fig. 4).

Fig. 4. The total linear shrinkage ratio of brick samples (%).

The density of clay bricks depends on several factors including specific gravity of the raw material used, method of manufacturing and degree of burning. As the density of a clay brick decreases, its strength also decreases, whereas its water absorption increases. In this study, the bulk density of fired clay bricks was inversely proportion to the quantity of rice husk added in the mixture. Generally, as the firing temperature increased, the densification parameter of the fired products gradually improved which in turn reflected positively on the mechanical properties [14]. The bulk density of sample decreased with an increae in the amounts of rice husk ranging from 5 to 20%. As a result, they bulk density in the ranges of 1.15-1.57 g/cm³ (900 °C) and 1.17 to 1.58 g/cm³ (950 °C). The bulk density is related to durability and water absorption of bricks (Fig. 5).
Fig. 5. Density of brick samples.

Water absorption is an important factor for the durability of clay bricks. When water infiltrates brick, it decreases the durability. Thus, the internal structure of brick must be sufficiently dense to avoid the intrusion of water. According to Fig. 6, the water absorptions of clay bricks fired at the temperatures between 900 and 950 °C were in the range of 18.70-37.01% and 17.69-36.29% respectively.

Water absorption is a key factor affecting the durability of bricks and is indirectly proportional to apparent porosity. Therefore, similar trends were observed in water absorption and apparent porosity [15]. The study showed that the apparent porosity of fired clay bricks depended on the amount of rice husk addition. The highest porosity was 42.52% with no rice husk addition fired at 900 °C, and the lowest was 28.0% with 5% of rice husk addition fired at 950 °C. This result showed that high percentage of rice husk in samples caused high porosity in samples. Thus porosity in clay bricks samples was caused when rice husk burning out during firing process (Fig. 7).

Fig. 6. Water absorption of brick samples (%).
The compressive strength of clay brick is the most important engineering-quality index for building materials. In this study the result indicated that the strength of fired clay bricks greatly depended on the amount of rice husk addition and firing temperature. According to the TISI.77-2001[16] standard, the compressive strength of bricks must be 3.5 MPa. In this study the result indicated that the strength of clay bricks greatly depended on the amount of rice husk addition. The result of the compressive strength (Fig. 8) indicated that compressive strength of fired clay bricks decreased with increasing amount of rice husk. A decrease in compressive strength was due to an increase in porosity and a decrease in bulk density. The results revealed that the compressive strengths were in the ranges of 1.10 to 10.1 MPa when rice husk addition increased from 5 to 20% and firing temperatures from 900 to 950 °C (Fig. 8). Generally, in traditional ceramic system as the porosity increases, the strength properties decrease [17].

Fig. 7. Apparent porosity of brick samples (%).

Fig. 8. Compressive strength values of brick samples (MPa).

Conclusion

In this study, the properties of clay bricks with rice husk are investigated. Clay brick and rice husk combination provides results which can be potentially used in the production of lighter and more porous burnt clay bricks. While the, value of apparent porosity and water absorption for samples increased linearly with an increase in the amount of mixed rice husk. At a certain temperature, compressive strength decreased with an increase in the amount of rice husk. The addition of rice husk is limited to 5 wt%. In order to reach an equilibrium between positive (weight decrease and porosity increase) and negative (increase of water absorption
and mechanical resistance decrease) effects. Thus, rice husk could be used as a pore former in clay bricks. Conclusively, the results revealed that rice husk could be regarded as a potential addition to raw materials used in the manufacturing of clay bricks production.

Acknowledgements

This work was financially supported by Research and Development Institute Rajabhat Maha Sarakham University. The authors also would like to acknowledge the support of Rajabhat Maha Sarakham University.

References

[68] TISI (2001). 77 Standards specification for building brick (Solid masonry unit made from clay or shale) Thai Industrial Standards Institute, pp. 3, TISI.
Effect of Malaria Infection on Blood Cell Parameters

Manas Kotepui1,2, Kwuntida Uthaisar1, Bhukdee Phunphuech1 and Nuoil Phiwklam2

1School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat, 80161
2Medical Technology Laboratory, Phop Phra Hospital, Tak, 63160
Thailand
(*author for correspondence, E-mail: manas.ko@wu.ac.th; Fax: 075672106)

Abstract

Malaria is the commonest disease in Western Thailand with high mortality rate. This study aimed to determine the hematological changes of people who suspected with malaria infection by analyzing complete blood count (CBC) parameters from BC-5200 Haematology Analyzer (Mindray, Nanshan, Shenzhen, China) and thick/thin from blood smear for malaria detection. Hematological parameters of 2,000 patients, including 230 malaria-infected and 1,770 non-malaria infected-patients admitted IPD/OPD at Phop Phra Hospital, Tak Province, an area of malaria endemic transmission in Thailand during 2009. The following parameters were significantly changed in malaria-infected patients (P-value<0.05); platelets (malaria 97,700±57747 vs non-malaria 227,300±92,122 cells/µl), monocyte percentage (malaria 7.6±3.59% vs non-malaria 7.02±3.53%) and white blood cell count (WBC) (malaria 6.217±5.769 vs non-malaria 9.157±10.371 cells/µl). Patients with platelet counts of <150,000/uL were 25.7 times (odds ratio) more likely to have malaria infection. Patients infected with malaria exhibited important changes in many hematological parameters with platelet count, white blood cell, and lymphocyte change being the most important predictors of malaria infection in these patients.

Keywords: Malaria, Complete blood count, Phop Phra

Introduction

Malaria is the commonest disease in Western Thailand especially infection of Plasmodium falciparum and Plasmodium vivax. Plasmodium falciparum can cause severe malaria resulting in high mortality rate whereas infection of Plasmodium vivax can cause relapses after treatment. During malaria infection, hematological parameters changes were lower platelets, white blood cells (WBC), lymphocytes, eosinophils, red blood cells (RBCs) and Hb level, while monocyte and neutrophil counts were significantly higher in comparison to non-malaria infected patients [1-3].

The present study aimed to determine hematological changes in patients infected with malaria in Phop Phra Hospital, Tak Province, Thailand. Hematological parameters including WBCs, RBCs, platelets, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and red cell distribution width (RDW), and Hb level of people infected with malaria were compared with uninfected people. Presence of thrombocytopenia in people from endemic areas may be useful as supportive diagnostic criteria for malaria in case with low level of parasite number. Therefore, when used with other clinical and microscopy parameters, it can significantly improve malaria diagnosis and timely further treat for malaria infection.

Materials and Methods

Data collection used in this study was approved by The Phop Phra Hospital and the Ethic Committee of Walailak University. The data were collected and mined from the Medical Technology Laboratory Unit, Phop Phra Hospital, Tak Province during January to December 2009. The venous blood sample was drawn into EDTA tubes for preparation of the thick and thin smears and automated for determination of CBC. Blood counts were performed using BC-5200 Hematology Analyzer (Mindray, Nanshan, Shenzhen, China). The Analyzer provided data on leukocyte count, red blood cell count, hemoglobin level, platelet counts, MCV, MCH, MCHC, and RDW. Blood slides were prepared and stained with Giemsa. Microscopic abnormality of blood in smear and presence or absences of malaria were determined. Data analysis was performed using SPSS ver. 11.5 (SPSS Inc., Chicago, IL, USA) with p value less than 0.05 considered statistical significant.
Results

There were 230 patients with malaria infection and 1770 patients with non-malaria infection admitted IPD/OPD at Phop Phra Hospital, Tak Province, an area of malaria endemic transmission in Thailand during 2009. There was significant different of hematological parameters between two groups of patients such as platelet count, white blood cell count, red blood cell count, and monocyte percentage. The following parameters were significantly changed in malaria-infected patients (P-value<0.05): platelet count (malaria 97,700±57747 vs non-malaria 227,300±92,122 cells/µl), monocyte percentage (malaria 7.76±3.59% vs non-malaria 7.02±3.53%) and white blood cell (WBC) count (malaria 6,217±5,769 vs non-malaria 9,157±10,371 cells/µl). Patients with platelet counts of <150,000/µL were 25.7 times (odds ratio) more likely to have malaria infection.

Conclusions and Discussion

This study confirmed that hematological abnormalities in malaria infection were common. Leucopenia was the most frequently seen in the malaria-infected patients which was confirmed by other studies that have demonstrated leucopenia [3,4]. However, a study that had demonstrate leucocytosis [1]. Monocyte percentage was the most important leukocytic changes associated with malaria infection. The observation of increased monocytes counts in this study was correlated with previous studies [1,5]. Mononuclear cells, which are activated by Plasmodium during malarial infection, produce inflammatory cytokines, such as tumor necrosis factor (TNF), interleukin-1 (IL1) and interleukin-6 (IL6). These cytokines can stimulate the hepatic synthesis of acute phase inflammatory proteins, including CRP, which increase during malaria infection [6].

Platelet abnormalities in malaria were also common. In this study, platelet counts were significantly lower in malaria-infected people. This result may imply that thrombocytopenia may be a marker of Plasmodium infection. The association of platelet count and malaria infection has previously been described [5,7]. Lower platelet count or thrombocytopenia may occur through peripheral destruction [8], excessive removal of platelets by spleen pooling [9,10] as well as platelet consumption by the process of disseminated intravascular coagulopathy (DIC) [11]. Patients with platelet count less than 150,000/µl may have a chance to infect with malaria than those patients with platelet count more than 150,000/ul (25.7 times). Patients with malaria have abnormal hematological parameter such as platelet count, white blood cell count, and monocyte percentage which were used as indicator for malaria infection. Further study should excluded data of patients who had history of blood disorder to gain more precise finding.

Acknowledgements

The authors are grateful to specifically thank to the Medical Technology Laboratory Unit, Phop Phra Hospital, for their data, which was important to this research.

References


[56] Beale PJ, Cormack JD, Oldrey TB (1972) Thrombocytopenia in malaria with immunoglobulin (IgM) changes. *British medical journal, 1*, 345-349.


Liver disease can be caused by a variety of factors that damage the liver, such as viruses and alcohol use which can lead to liver failure, a life-threatening condition. This study was aim to investigate the incidence of HAV, HBV, HCV infection and other liver disease at PhopPhra Hospital, Tak Province, Thailand. We investigated 193 blood specimens collected from the Medical Technology Laboratory Unit, PhopPhra Hospital, Tak Province during January 2012 to September 2014. The result show 60.8% of liver disease is hepatitis from viral infection and another 39.4% is cirrhosis. This study was the first to report the incidence of liver disease in the PhopPhra District, Tak Province, Thailand. The hepatitis viral detection rates and cirrhosis indicate the potential contamination of the environment, life-style and other risk factor with adverse effects on public health.

Keywords: Liver diseases, Incidence, PhopPhra Hospital

Introduction

Liver disease such hepatitis may be caused by various factors such as hepatitis virus, alcohol, and drug. Hepatitis A virus (HAV), Hepatitis B virus (HBV) and Hepatitis C virus (HCV) infection can leads to a wide spectrum of liver disease including fulminant hepatic failure which will develop to chronic hepatitis, cirrhosis, and finally hepatocellular carcinoma (HCC) in the end(1). Hepatitis in long term can lead to liver cirrhosis which is characterized by tissue fibrosis and the conversion of normal liver architecture into structurally abnormal nodules. Chronic HCV infection and heavy alcohol consumption represent the most common causes of cirrhosis. Other common causes of cirrhosis include hepatitis B, hepatitis D, primary biliary cirrhosis and autoimmune hepatitis (2). Two billion people worldwide have been infected by HBV; 400 million are chronically infected while 520,000 people die due to HBV related conditions (3). Approximately 170 million people are affected with HCV worldwide, comprising 3% of the global population (4). However, there are no any reports about the incidence of liver disease at Tak Province. This study wasaim to determine the incidence of HBV, HCV, HAV and other liver disease at PhopPhra Hospital, Tak Province, Thailand. Our data may be the useful information and may be the gateway for liver disease diagnosis in the future.

Material and Methods

Data collection protocol of this study was approved by The PhopPhra Hospital and The Ethical Clearance Committee on Human Rights Related to Researches Involving Human Subjects of Walailak University (EC number 57/075). The data were collected from the Medical Technology Laboratory Unit, PhopPhra Hospital, Tak Province during January 2012 to September 2014 (N = 198). Diagnosis of liver diseases was based on medical doctor evaluation. Data analysis was performed as a descriptive statisticusing SPSS ver. 11.5 (SPSS Inc., Chicago, IL, USA).

Results

One hundred and ninety-eight patients were included in this study, 117 (60.8%) tested positive for acute hepatitis, 58 (30.1%) tested positive for HAV antibodies. Twenty five specimens (13.0%) had indeterminate results for HBV and 4 (2.1%) tested positive for HCV whereas anti-TB induced hepatitis was found 4 (2.1%) tested as well. Of the 198 participants, cirrhosis was found as 76 (39.4%), alcoholic cirrhosis patients were found 21 (10.9%) cases, cirrhosis hepatic encephalopathy 8 (4.1%) cases, cirrhosis HBV 3 (1.6%) and cirrhosis TB lung 1 (0.5%) as shown in Table 1.
Table 1 Incidence of liver disease

<table>
<thead>
<tr>
<th>Liver diseases</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV</td>
<td>4</td>
<td>2.1</td>
</tr>
<tr>
<td>Acute hepatitis</td>
<td>26</td>
<td>13.5</td>
</tr>
<tr>
<td>Alcoholic cirrhosis</td>
<td>21</td>
<td>10.9</td>
</tr>
<tr>
<td>Anti-TB induced hepatitis</td>
<td>4</td>
<td>2.1</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>43</td>
<td>22.3</td>
</tr>
<tr>
<td>Cirrhosis HBV</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>Cirrhosis hepatic encephalopathy</td>
<td>8</td>
<td>4.1</td>
</tr>
<tr>
<td>Cirrhosis TB Lung</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>HAV</td>
<td>58</td>
<td>30.1</td>
</tr>
<tr>
<td>HBV</td>
<td>25</td>
<td>13.0</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

In this study, we provide conclusive evidence of the presence of liver diseases in blood samples from the Tak Province. Results indicated that general incidence of liver disease in PhobPhra Hospital carried out studies were 60.8% for hepatitis and 39.4% for cirrhosis.

The prevalence of HAV among hepatitis positive cases was found to be highest (30.1%) incidence. Hepatitis A virus (HAV) is the principal cause of acute hepatitis and is currently recognized as one of the most important human food-borne pathogens in the world (5). It can be transmitted via the fecal–oral route, either by person-to-person contact or by the ingestion of contaminated water and food, especially in endemic areas (6). The prevalence of HCV (2.1%) was lower than HBV (13%). HCV is spread primarily through direct contact with the blood or body fluids of infected individuals (7) whereas HBV transmission can occur vertically from infected mother to child, horizontally (e.g. child-to-child transmission within a household), sexually or parenterally (e.g. via injecting drug use, sharps injury or contaminated blood products). The majority of acute HBV infections are asymptomatic. In adults, 30% will present with jaundice and hepatitis and 0.1–0.5% develop fulminant liver failure (8). From this study, the high prevalence of cirrhosis was found from several causes such as Alcoholic cirrhosis, Cirrhosis HBV, Cirrhosis hepatic encephalopathy and Cirrhosis TB Lung.

According to results obtained from this study may have value information to prevent liver diseases especially giving knowledge of cause and effect of liver diseases to people not only in Tak province but any population should know. However, a similar study with a bigger sample size is recommended.

Acknowledgements

The authors are grateful to specifically thank to the Medical Technology Laboratory Unit, PhopPhra Hospital, for their data, which was important to this research.

References

Swamp Buffalo Production in Natural Wetland of Thale Noi Non-Hunting Area: Traditional Practice, Problems and Constraints

Aporn Songsang1*, Nantida Sutummawong2, Benjawan Buakwan3 and Ong-arge Insung4

1Animal Science Department, Faculty of Technology and Community Development, Thaksin University, Phatthalung, Thailand.
2Faculty of Science, Thaksin University, Phatthalung, Thailand
3The College of Local Wisdom, Thaksin University, Phatthalung, Thailand
4Faculty of Agriculture, Rajamangala University of Srivijaya, Nakhon Si Thammarat Campus, Nakhon Si Thammarat, Thailand.

(*) author for correspondence, E-mail: asongsang@hotmail.com; Fax: 074-693996)

Abstract

The objective of this research was to investigate the traditional practice, production problems and constraints of Swamp Buffalo Production in the Natural Wetland of Thale Noi Non-hunting Area. The research method was based on a survey and quantity research. The data was collected from a questionnaire survey of the buffalo farmers, field visit observations, and group discussions. The Global Positioning System (GPS) was used to identify the grazing area and the barn housing locations. The result showed that buffalo ranching occupied 74,985,743 square metres and 109 barns. There were 3,714 swamp buffalo belonging to 160 farmers which were classified into 11 groups. The members of the group took turns in taking care of the herd. The buffalo relied on natural vegetation which grew abundantly in this wetland. No concentrate feed was supplied. The heavy rainy season was considered to be a critical period for them according to feed available and shelter. The herd is well recognized for their under water grazing abilities. Limited health management is provided. Income from buffalo production was mainly spent on developing the farmers’ quality of life such as education and housing. The major constraint on the buffalo production was the regulations of the protected area as the buffalo farmers were not allowed to use machines to elevate the ground of the buffalo housing to provide a safe shelter during the monsoon season. This led to a major loss of the buffalo production in Thale-Noi.

Keywords: Swamp buffalo, Buffalo production, Thale-Noi Non-hunting Area, Natural wetland

Introduction

Thale Noi is a fresh water lake located in Phattalung, Songkhla, and Nakhon Si Thammarat Provinces in the south of Thailand. In 1975, it was gazetted as a non-hunting area, which is one type of the protected area in Thailand. Thale Noi covers 450 square kilometers with six percent of water body. Most parts of Thale Noi are lakeside plains consisting of rice paddy fields, peat swamp forests, and grassland. The lake is five kilometers in width and six kilometers in length. The lake is the most important habitat for aquatic flora and fauna. More than 187 species of birds and waterfowls, both migratory and resident species, are found here. Thale Noi has been recognized as an important wetland for migratory birds. A peat swamp forest in the lake called “Khuan Khi Sian” was designated as the first Ramsar Site of Thailand [1]. The villagers around the wetland also harvest plants and fish from the lake as well as use it for their water way transportation. Local people have got benefits from providing tourism services. Grassland of Thale Noi is used by the villagers as a livestock raising area, especially swamp buffalo. In 2007, the elevated road linking Khuan Kanun District, Phattalung Province, and Ranod District, Songkhla Province was constructed across the wetland. The road passes over the buffalo grazing areas. The herds of buffalo were then known to the public. In the past, the buffalo played an important role in the Thai traditional agriculture system and Thai culture. The farmers would keep their buffalo in a mixed farming system. The animals were used for draught power especially a plough in farmlands. The by-products of the agricultural activities and weeds in the fields could be used as buffalo feed. The manure then was used for fertilizer in the crop fields. However, the replacement of the machines had reduced the functions of the buffaloes in Thai agricultural practices. This led to a drastic reduction of the buffalo numbers in Thailand. During the past 20 years, the numbers had declined from 4,611,692 in 1989 to 1,190,886 in 2010 [2]. Therefore, a big herd of buffalo is not commonly seen. To see the large herds of the buffalo also intrigue the public and tourists. The buffalo at Thale Noi have adjusted themselves into the wet land environment as they can graze under water in the rainy period. However, the future of these buffalo is uncertain as they are kept in protected area. Due to limited information on buffalo production in Thale Noi, this study aimed to investigate the characteristics of the
farmers and the buffalo herd, the traditional production practices, problems and constraints of the buffalo production in Thale Noi. The results could be used for local development of sustainable management of the wetland buffalo production.

Materials and Methods

Population and sampling technique

The information of the buffalo farmers who kept the buffalo in Thale Noi wetland was provided by the Livestock Offices of Ranod District and Khuan Khanun District. The informal networking of the buffalo farmers was also used to create a list of the members. The farmers live in the villages around the wetland. Some lived in the east of the wetland in Bankao Sub-district, Ranod District. The others lived in the west in Thale Noi Sub-district and Panang Tung Sub-district, Khuan Khanun District. Since the group of farmers is small, the census was thus used for data collection. Every buffalo farmer was a unit of analysis of this study. The GPS was used to identify the grazing areas and the barn housing locations.

Data collection

The research method was based on a survey and quantity research. For the survey research, the data was obtained from a combination of primary and secondary data. The secondary data were gathered from the related literature including government documents. The primary data were collected from a questionnaire survey of the buffalo farmers, a daily practice from field visit observations, and the discussions with the local government officers and the informal farmer network. The farmers’ questionnaire components were the characteristics of the farmers, numbers of buffalo owned, management practices, purposes of buffalo rearing and the returns, problems and constraints. A descriptive statistical analysis (percentage) was employed.

Results and Discussion

Farmer/buffalo/head composition

The result of this study found that the buffalo were kept here before the site was designated to be a protected area. The practice was passed from generation to generation. There were 3,714 buffalo ranched in Thale Noi. There are 160 farmers and they classified themselves into 11 groups according to the grazing areas of their own herd. A total of 1040 male and 2674 female were recorded (Table 1). The average ratio of male and female was 1:2.57. 42% of the farmers owned up to 10 heads of buffalo. 36% owned from 10 to 40 heads of buffalo, and 22% of them owned more than 40 heads (Table 2).

The buffalo farmers had different primary occupations and their incomes are from several sources. However, the majority of buffalo farmers still worked on small pieces of rice paddy fields and other crops. This indicated that buffalo keeping and rice farmers were still in relation. The farmers had formed a group to help each other to take care of the buffalo, in order to maintain the several sources of income. The members of the group took turns in taking care of the herd. The observation frequency of the herd by the farmers during dry periods is presented in table 3. The intensive observation of the buffalo takes place during rainy periods.

Ranching areas

The buffalo ranching occupied 74,985,743 square metres. The grazing areas are mainly lake side plains (Figure 1) and swamp forest areas. However, the available areas for grazing can vary during the rainy period as almost all grazing areas are under water. It has been reported that during the last ten years, there was a rapid changed of land use in Thale Noi, especially a decrease of forest and grassland areas [3]. Furthermore, the invasion of bog forests for agricultural purposes was also reported [4]. This might have been accelerated by the elevated road pass by the wetland and grazing areas.

Housing barns

There were 2 types of buffalo barn housing: 1) Dry barn housing which was used mainly during the heavy rainy period as a shelter during night time. They had roofs and were elevated 1-2 metres above ground. 2) Wet barn housing which had no roofs and were easy to remove and reconstruct. They were mainly used during dry seasons only for some special activities, for example sale activities. However, some farmers also used wet barns for shelter during rainy periods. There were 109 barns in the area consisting of 59 wet barn housing and 50 dry barn housing distributed in ranching areas. There are no feeder and water supply facilities in the housing. Some of the dry housing barns may have a sleeping and cooking place connected with the barn as the farmer has to watch and secure their buffalo during rainy periods.
Buffalo production practices

An annual circle of the buffalo production practices in this area were classified into two periods. 1) Dry period from March–October, when the buffalo freely grazed in the natural wet-land, both days and nights, for the whole period and the members of the group took turns in taking care of the herd. One of the members in the group observed the herd once a week or every 2 weeks. Some of the farmers kept their buffalo in barns at the night time. This option is only possible for the herd grazing near the elevated roads, where the transportation is more convenient for the owners. 2) Heavy rainy period from November – February; the heavy rain caused the water level to rise and flood the areas (1-2 meters height). At night the buffalos needed to stay in barn housing which was lifted above the ground by approximately 1.5 – 2 metres. A daily caretaking was necessary for the young and the sick animals because the feed plants were mostly under water. The healthy ones were led to find other grazing locations. Some herds swam 2 – 2.5 km. to the grazing areas. Boats were the important vehicle to lead the buffalo to and from their grazing areas and the barns (Figure 2). The small boats are needed for leading the buffalo to the grazing area especially when it has to go through the swamp forests. The big boats are used for feed plant carrying for young and sick animals.

Breeding

The breeding method used by all farmers was natural mating. The farmers select the breeder mainly from their herd at the age from 4 years. Some farmers (24.2%) allowed their buffalo to mate randomly with the bulls from the other herds in the grazing areas as they did not keep their own breeding bulls. The selected criteria are based on physical appearances of the buffalo. Size, conformation, and health condition were among the criteria. Aggressiveness of the bulls is also taken into account to avoid fighting each other or danger to the owners. To avoid the problem of inbreds, some farmers will bring in a bull from another group within the area by buying or exchanging. The ratio of female breeder and male breeder (bull) was 1:12 and the calving rate was 49.61% (Table. 1). The farmers also mentioned that the animals which are brought in from outside could not adapt well to the raising condition in the wetland.

Feed resources

The herds relied on natural vegetation in the wetland. No concentrate feed was supplemented. The dry season was the optimum of the feed resource for buffalo grazing. The rainy season was critical when floods occurred. During heavy rainfalls or floods, cut and carry may be fed to the young or the sick animals. Agriculture residues, mainly rice straws, were used if necessary. Assuming that the buffalo consumed 10% of their body weight, 110 tons per day of aquatic weeds were approximately consumed by the buffalo. It was suggested by Clark (2008) that buffalo grazing may have a major role in scrub control on that natural conservation sites.

Under water grazing is well-known among Thale-Noi buffalo. It took from 5-23 seconds with an average of 10.33 seconds each time for underwater grazing. However, the factor affecting the length of under water grazing time might be the plants available as well as buffalo age. The buffalo can utilize a wide range of plant species, however the major feed sources for the buffalo are Cynodon dactylon (L.) Pers., Panicum repens Linn., Oryza rufipogon Griff., Ischaemum aristatum Linn., Leersia hexandra Sw., Hymenachne acutigluma (Steudel) Gilliand., Eleocharis ochrostachys Steud., Cyperus pulcherrimus Willd.ex Kunth.

Health management

The farmers usually observed the health conditions of their buffalo when they took care of the herds in the dry period. Normally, the intensive health observation was done during the rainy season when the animals came back to the barns. Parasite control, if it is needed to be done, usually took place at this time. Minimum antibiotics were used for treating the animals. Some medicinal plants were also used as a treatment. However, some farmers did not apply any treatments on the sick animals. No regular vaccinations were provided. According to the farmers’ opinion, the diseases did not pose a major threat to the buffalo production. The major loss was from the floods. It has been reported that relatively low prevalence of blood parasites was found in the herd [5].

Function of the buffalo

The purpose of the Thale-Noi buffalo production was mainly for meat production. It was perceived as food security in the areas. The farmers sold live animals directly to the customers or the middleman. The price could be negotiated depending on the size and the physical appearances of the buffalo. The mature buffalo (3 – 5 years old) cost 20,000 – 30,000 baht (670 – 1,000 USD). Income from buffalo selling was mainly spent on developing quality of life. Education, house construction, and traditional ceremonies such as an ordination and a
wedding were paid by the animal sales. The farmers’ motivations to keep the buffalo are good returns (profits) at the highest rank. The buffalo also served as a saving account for the farmers’ family. Some of them perceived the buffalo production as their family tradition, and for indigenous buffalo conservation.

Production problems and constraints

The study revealed that the constraints of the buffalo production in the area are:
1. The regulations of the non-hunting area did not allow the farmers to use the machines to elevate the ground of the buffalo housing. Thus, the buffalo could face risks during the monsoon season or heavy rainy period.
2. The changes of land use and land encroachment in the natural wetland not only reduced the grazing areas, but also raised conflicts among the communities. The buffalo were accused of destroying the crop products. Furthermore, the farmers had to spend more time to take care of their herds in order to avoid conflicts. It disrupted their routine work.
3. The migration of young generations to urban areas. Graduating with higher education than their parents gave them an opportunity to choose other jobs. This could lead to the end of the family knowledge, which had been passed from generation to generation. Therefore, some of the farmers had trained their neighbors or friends who had an interest in the practice.

Conclusions

There were 160 farmers who owned 3,714 buffalo in Thale Noi. The majority of buffalo keepers are still doing rice farming. The buffalo were freely grazing in 74,985,743 square metres of natural wetland. The raising practice of the buffaloes is classified into 2 periods: 1) Dry period from March-October, when the buffalo freely grazed in the natural wetland for the whole period. 2) Heavy rainy period from November – February, when at night the buffalos needed to stay in barn housing which was lifted above the ground by approximately 1.5 – 2 metres. There were 109 barn house consisting of 2 types; 1) Dry barn housing which had roofs and were elevated 1-2 metres above ground. 2) Wet barn housing which had no roofs. The breeding method was random natural mating. The average ratio of male and female was 1:120. The calving rate was 49.61%. The herds relied on roughage in natural pasture. No concentrate feed was supplemented. The rainy season was the critical period when floods occurred. Therefore under water grazing is well-known among Thale-Noi buffalo. No regular health control program was provided. The buffalo production was mainly for meat production. Income from the buffalo production served as a saving account that the farmers could use for improving their quality of life. The major loss of the buffalo was from floods due to a lack of appropriate shelter for their evacuation. The major constraints for the buffalo production are the lack of safe shelters to prevent losses during the Monsoon season as the regulation of the non-hunter area did not allow the farmer to use machines for the ground elevation, the changes of land use and land encroachment and the migration of young generation to urban areas.

References

Figure 1. Buffalo in a grazing area of the Phanangtung group

Figure 2. The farmer leads a buffalo herd to a grazing area during a heavy rain period.
Table 1. The group list of farmers, numbers and herd characteristics of buffalo.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pru-klongchang</th>
<th>Klongkok</th>
<th>Tangдум</th>
<th>Ko-sai</th>
<th>Bann-pran</th>
<th>Huapakeaw</th>
<th>KhuanKisean</th>
<th>Huapalan</th>
<th>Thale-Noi</th>
<th>Sauthong</th>
<th>Phanangtung</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farmers</td>
<td>9</td>
<td>16</td>
<td>7</td>
<td>8</td>
<td>17</td>
<td>33</td>
<td>34</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>18</td>
<td>160</td>
</tr>
<tr>
<td>Number of Buffalo</td>
<td>483</td>
<td>431</td>
<td>80</td>
<td>188</td>
<td>268</td>
<td>460</td>
<td>693</td>
<td>237</td>
<td>182</td>
<td>209</td>
<td>483</td>
<td>3714</td>
</tr>
<tr>
<td>Breeder (Male)</td>
<td>19</td>
<td>14</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>21</td>
<td>25</td>
<td>10</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>126</td>
</tr>
<tr>
<td>Breeder (Female)</td>
<td>198</td>
<td>151</td>
<td>41</td>
<td>76</td>
<td>106</td>
<td>193</td>
<td>327</td>
<td>76</td>
<td>69</td>
<td>87</td>
<td>178</td>
<td>1502</td>
</tr>
<tr>
<td>Male (&gt; 1 year)</td>
<td>63</td>
<td>67</td>
<td>5</td>
<td>21</td>
<td>55</td>
<td>62</td>
<td>80</td>
<td>46</td>
<td>24</td>
<td>22</td>
<td>96</td>
<td>542</td>
</tr>
<tr>
<td>Female (&gt; 1 year)</td>
<td>115</td>
<td>88</td>
<td>16</td>
<td>43</td>
<td>46</td>
<td>113</td>
<td>121</td>
<td>54</td>
<td>46</td>
<td>39</td>
<td>118</td>
<td>799</td>
</tr>
<tr>
<td>Male (&lt; 1 year)</td>
<td>44</td>
<td>44</td>
<td>9</td>
<td>21</td>
<td>32</td>
<td>37</td>
<td>78</td>
<td>24</td>
<td>17</td>
<td>35</td>
<td>31</td>
<td>372</td>
</tr>
<tr>
<td>Female (&lt; 1 year)</td>
<td>44</td>
<td>67</td>
<td>8</td>
<td>20</td>
<td>22</td>
<td>34</td>
<td>62</td>
<td>27</td>
<td>21</td>
<td>18</td>
<td>50</td>
<td>373</td>
</tr>
<tr>
<td>% calving</td>
<td>44.44</td>
<td>73.51</td>
<td>41.46</td>
<td>53.95</td>
<td>50.94</td>
<td>36.79</td>
<td>42.81</td>
<td>67.11</td>
<td>55.07</td>
<td>60.92</td>
<td>45.51</td>
<td>49.60</td>
</tr>
<tr>
<td>Male breeder:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female breeder</td>
<td>10.42</td>
<td>10.79</td>
<td>41.00</td>
<td>10.86</td>
<td>15.14</td>
<td>9.19</td>
<td>13.08</td>
<td>7.60</td>
<td>13.80</td>
<td>10.88</td>
<td>17.80</td>
<td>11.92</td>
</tr>
</tbody>
</table>
Table 2. Number of buffalo per farmer.

<table>
<thead>
<tr>
<th>Herd size</th>
<th>% of farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10 head</td>
<td>42</td>
</tr>
<tr>
<td>11-20 head</td>
<td>22</td>
</tr>
<tr>
<td>21-30 head</td>
<td>14</td>
</tr>
<tr>
<td>31-40 head</td>
<td>8</td>
</tr>
<tr>
<td>41-50 head</td>
<td>6</td>
</tr>
<tr>
<td>&gt;50 head</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 3. The observation frequency of the herd by the farmers during dry period.

<table>
<thead>
<tr>
<th>Observation frequency</th>
<th>% of farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every day</td>
<td>20.55</td>
</tr>
<tr>
<td>Every 5 - 10 days</td>
<td>60.27</td>
</tr>
<tr>
<td>Every 11 - 15 days</td>
<td>13.70</td>
</tr>
<tr>
<td>Every 16 - 20 days</td>
<td>4.11</td>
</tr>
<tr>
<td>Every 21 - 25 days</td>
<td>1.37</td>
</tr>
</tbody>
</table>
Food Product Development for Pre-Biotic Healthy from by Product of Product of Germinated Brown Fermentation Process for the Enterprise Community Production

Mali Nachaisin
Program of Physics, Faculty of Science and Technology
Rajabhat Maha Sarakham University
Thailand
E-mail: Sanawong_14@hotmail.com; Fax: 043-722118

Abstract

The objective of this research was to studied Thai local wisdom in the development on the high-grade sanitary fermentation process of germinated. Additionally, food product development for pre-biotic healthy of yoghurt. To be expanding the product varieties can differ from each other in terms of either quality or several commercial and need of the consumers. Increasing the value on the agricultural product of enterprise community in Maha sarakham province. The germinated brown rice and nutrients in form of synbitotic on synthetic food products were selected in the process of yoghurt. This research was design packaged of food that can extend to a healthy yoghurt occer on delicious and always fresh. The statistics used in this study to compare the difference of data was DMRT (Duncan new’s multiple range test). The results were as follows: To the guideline of sanitary fermentation process and cleanliness of germinated. The yoghurt adding to germinated brown rice and nutrients. The color of yoghurt was the brightness \( (L) = 79.13 \), the green \( (a) = -0.46 \) and the yellow \( (b) = 54.11 \) respectively. The sensory evaluation was considered acceptable to compare yoghurt on the commercials.

Keywords: Germinated brown rice, Yoghurt, Synbitotic, Sensory

Introduction

Yoghurt is considered as the most popular vehicle for the delivery of probiotics for the consumer. Yoghurt is produced by adding two starter cultures, Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus to milk[1]. A food product containing both probiotics and prebiotics is named as symbiotic resulting in an increase in the probiotic counts and the reduction of pathogen microorganisms in the gut.[2] Prebiotics are non-digestible substances such as fructooligosaccharide, which provide beneficial physiological effect on the host by selectively stimulating the favourable growth or activity of a limited number of indigenous bacteria.[3] Prebiotics pass by the small intestine to the lower gut and become accessible for probiotic bacteria without being utilised by other intestinal bacteria. Lactulose, galactooligosaccharides, fructooligosaccharides, inulin and its hydrolysates, malto-oligosaccharides, and resistant starch are prebiotics normally used in the human diet.[4] At the present time, inulin and oligofructose are utilised in the pure form as ingredients in many food products. The utilisation of prebiotics as food components has multiple advantages, in the dairy market, dietary products.

Germinated brown rice is obtained by soaking brown rice grains in excess water at ambient temperature. After hydration, the grains undergo a metabolic change and stored starches are broken down into metabolizable forms by enzymes[5]. With germination, vitamins E, B6, B12, lysine and magnesium, along with bio-available forms of protein and fiber increased substantially[6]. In Thailand, rice is a material for the One Tambon One Product (OTOP) project, an entrepreneurship stimulus project organized by the Thai government to promote local products and establish sustainable self-reliance of village communities.

Prebiotics exhibit imperative technological properties as well as attractive nutritional value. This research aims to prepare germinated brown rice and nutrients in form of synbitotic on synthetic food products were selected in the processing of yoghurt.

Materials And Methods

Production of yoghurt

Yoghurt was prepared as per method described by Capela et al.2006.[7] Soy milk samples thus prepared contained, total solid 12%, total soluble solids 10 Brix, dutchic french style yoghurt, Oligosaccharide, germinated brown rice. Synbitotics on synthetic food was mixed in soy milk before steaming. Samples were incubated at the experimental temperature \( (40^\circ C) \) until pH reached 4.5 (selected as the end point of fermentation). After incubation, samples were kept at \( 4^\circ C \) for further analysis.
Germinated brown rice preparation

Paddy rice cv. Khao Dok Mali 105 was obtained from local farm in Maha sarakham province. The rice was dehusked to obtain brown rice and the brown rice was then soaked in water at ambient temperature (approximately 20°C) for 24 hr with water being changed every 6 hr. After soaking, a small bud appeared at the rice germ leading to the term “germinated brown rice”. The germinated brown rice was washed thoroughly in water to remove dust particles. The clean rice was then soaked in hot water (80°C) with mass ratio rice : hot water of 1:2 for 30 min. For the cooking process, samples were cooked in a perforated steam under atmospheric pressure, for 20 min. The germinated brown rice cooked as shown in Figure 1.

Figure 1: Germinated brown rice

Physical properties investigation
Color determination

Colors of the samples before and after experiment were measured in terms of $L$, $a$ and $b$ by a Hunter Lab colorimeter (MiniScan XE Plus, Hunter Associates Laboratory, Inc., USA). The color indices represent light to dark ($0 \leq L \leq 100$), green to red ($-60 \leq a \leq 60$), and blue to yellow ($-60 \leq b \leq 60$). Total color difference ($\Delta E$) is another important color index. It can be calculated from as follows:

$$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$$

$$\Delta L = L - L_0, \quad \Delta a = a - a_0, \quad \Delta b = b - b_0$$

(1)

Where $L$, $a$ and $b$ are lightness, redness and yellowness of the sample after experiment and $L_0$, $a_0$, and $b_0$ are the values before experiment. Each sample was measured three times from different parts of the total sample and averages were calculated from 30 samples.

Sensory evaluation

A nine point hedonic scale (1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = neither like or dislike, 6 = like slightly, 7 = like moderately, 8 = like very much, 9 = like extremely), originally designed to measure consumer acceptability of food[8,9] was used to evaluate preference of yoghurt germinated brown rice and yoghurt from the commercials. Prior to the sensory test, 30 voluntary consumers were trained by a staff from the Food Research Institute, Bankok, Thailand who had been screened for perception as a basic taster. After training, the voluntary consumers rinsed their mouths with water, tasted samples and recorded degree of satisfaction with regard to color, odor, flavor, texture and overall acceptance.

Statistical analysis

Results are reported as mean ± standard deviation. Analysis of variance (ANOVA) was used to analyze experimental data. Multiple comparisons of the mean values were determined using Duncan’s new multiple range test, at a confidence level of 95%.
Results

Thai local wisdom in the development on the high-grade sanitary fermentation process of germinated. Additionally, food product development for pre-biotic healthy of yoghurt. The results were to the guideline of sanitary fermentation process and cleanliness of germinated. The yoghurt adding to germinated brown rice and nutrients. The color of yoghurt was the brightness (L*) = 79.13, the green (a*) = -0.46 the yellow (b*) = 54.11. One of the best indices for explaining color changes of the product during processing is total color difference (ΔE) = 81.35 respectively. Yoghurt germinated brown rice are presented in Figure 2 (a). Similar correlations between lightness and yellowness values of the culture yoghurt as shown in Figure 2 (b).

![Figure 2 (a) : The yoghurt germinated brown rice](image)

![Figure 2 (b) : The culture yoghurt](image)

Table 1 showed sensory of evaluation of germinated brown rice yoghurt was considered acceptable to compare the yoghurt commercials. It can be seen from the Table 1, overall acceptances for all samples were ‘like slightly (6)’ or ‘like moderately (7)’. It was suggested that sensory acceptability for the products was considered acceptable to compare yoghurt on the commercials.

Table 1 : The 9 point hedonic scales of the yoghurt germinated brown rice

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Color</th>
<th>Odor</th>
<th>Flavor</th>
<th>Texture</th>
<th>Overall acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoghurt commercial (Ref.)</td>
<td>6.20ab</td>
<td>8.10d</td>
<td>7.84c</td>
<td>7.28b</td>
<td>7.08c</td>
</tr>
<tr>
<td>Yoghurt germinated brown rice repeated 1</td>
<td>5.73a</td>
<td>5.77a</td>
<td>5.71a</td>
<td>6.44ab</td>
<td>6.39ab</td>
</tr>
<tr>
<td>Yoghurt germinated brown rice repeated 2</td>
<td>5.26a</td>
<td>6.60ab</td>
<td>5.69a</td>
<td>6.30ab</td>
<td>7.71c</td>
</tr>
<tr>
<td>Yoghurt germinated brown rice repeated 3</td>
<td>6.40ab</td>
<td>7.74a</td>
<td>5.82a</td>
<td>6.86ab</td>
<td>6.21ab</td>
</tr>
</tbody>
</table>

Means within the same row with different letters are significantly different (P<0.05).
Conclusions and Discussion

Thai local wisdom in the development on the high-grade sanitary fermentation process of germinated. Additionally, food product development for pre-biotic healthy of yoghurt. To be expanding the product varieties can differ from each other in terms of either quality or several commercial and need of the consumers. Increasing the value on the agricultural product of enterprise community in Maha sarakham province.

Color changes can be attributed to the occurrence of Maillard reaction between carbonyl groups of reducing sugars and amino groups of amino acids (mainly lysine), peptides, or proteins.[11] The sensory acceptability for the products was considered acceptable. The resulting yoghurt germinated brown rice could be used as a special nutrient for potential for biotechnological processes. Due to its excellent source of nutrients, yoghurt germinated brown rice would be a good choice to yoghurt in the industry.

Acknowledgements

The authors would like to gratefully acknowledge the Office of National Research Council of Thailand (NRCT, Thailand) for financial support; Contract No. 2556A14792006.

References

Efficiency Enhancement of Green Briquettes Fuel Corncob Residue Materials 
Using Macadamia Charcoal

Suminya Teeta

Program of Physics, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Maha Sarakham 44000, Thailand
E-mail: suminya99@gmail.com

Abstract

This research were to determine the green briquettes fuel from corncob residue agricultural material and investigate fuel efficiency by the amount ratio of green briquettes. The properties of green briquettes fuel were analyzed according to ASTM standards as follows: heating value, moisture and ash content. The different briquette samples were produced by blending varying compositions of corncobs residue material and macadamia charcoal at the following ratios of 90:10, 80:20, 70:30, 60:40 and 50:50 (corncobs residue: macadamia charcoal) using the tapioca starch as binder at concentration of 6.0% by weight. Green briquettes fuel was produced using a hydraulic press without heat.

The result indicated to that in the case of ratio (corncob 50: macadamia charcoal 50) was the highest heating value as 21.06 kJ/kg, moisture content 10.09 %, bulk density 0.63 g/cm$^3$, exhibited optimum heating value quality when compared with other composition of briquettes produced.

Keywords: Green fuel, Briquette, Macadamia, Corncop, Residues agricultural

Introduction

Rising energy demand is one of the major challenger facing the world today in order to find solution to match demand and supply of energy sources. Therefore the need for conserving energy and developing alternative energy is a must. Community of Thailand has the fore in crisis energy such as high costing energy, the use of charcoal and wood to fuel. These fuel from deforestation accordingly. The way to reduce the deforestation is obviously to find the energy source to replace charcoal and wood. The energy source that can be replaced with the fuel from fossil maybe the energy from biomass resources, especially agricultural residues such as waste or residue materials, wood. The basic fuel is the high cost of fuel, quantity which is easy to apply and the method to utilization not complex. The green briquettes fuel is the solution to the alternative energy replacement with charcoal or wood from natural. It is the outcome from the finding research of green fuel bars production from corn stalks with pressing hot, heating value 4,247.25 cal/g and the heating value as 4,216 cal/g . The researcher (Sirinuch) suggested that the heating value of water hyacinth was 2,800 – 3,000 cal/g and from wood as 5,026 cal/g. Several research shown that many production from the residue or waste agricultural but the comparison fuel produced was lower the heating value than wood charcoal.Therefore this research is for the improvement of the thermal efficiency by adding charcoal macadamia. Assoc. Prof. Dr. Jit Adda. Professor, Department of Chemistry, Faculty of Science, Mahidol University, reported that the macadamia chacoal have benefits over conventional wood stove is to capture free electrons to free radicals such as super oxide exists in nature and can radiate far infrared (Far Infrared Ray), which is 6-14 micron wavelength radiation with a high penetrating power. It can be used in cooked faster, energy savings of almost 20 percent.

Therefore, this research was evidently to study green briquettes fuel from corncop residue agricultural material to improve fuel quality by using macadamia charcoal. The tapioca starch was binder at concentration of 6% by weight. The properties of green briquettes fuel were analyzed according to ASTM standards, heating value, ash content , moisture content and bulk density also. This research not only increasing quality to the green fuel, but also to add value to agricultural residue materials, as well as to reduce the use of firewood and charcoal from nature. In brief, this will benefit society the overall economy of the country.
Materials And Methods

Corncobs were utilize in this research were obtained from residue agricultural material

Materials for green briquettes fuel:
1. corncob  1 kg.
2. water       1000 ml.
3. macadamia charcoal 2 kg.

Preparation of the materials:
1. The waste material corn cob was sun dried to reduce its an average moisture content of 15%, broken into smaller size using a hammer. As shown in Figure 1.

![Figure 1](image1.jpg)

**Figure 1.** The small corncob after broken

2. The tapioca starch was dissolved in 100 ml of warm water. The binder was mixing water ratio 5:100 by weight.
3. The nut macadamia was carbonization at temperature about 850 °C and following by Figure 2. The mixing corncob residue material and briquetting

![Figure 2](image2.jpg)

**Figure 2.** The macadamia charcoal before and after broken

The two materials were combined at mixing ratios of 90 :10, 80:20, 70:30, 60:40 and 50:50 (corncorp residue : macadamia charcoal) using the tapioca starch at concentration of 6 % by weight and following by Figure 3.
Figure 3. The mixing between corncob and macadamia charcoal

4. Briquetting and Drying
In each ratios were press by a hydroric pressed without heat. The diameter of the mould was 3 cm. The samples were sun dried to reduced moisture content about 15%. Figure 4. shows a sample of the dried green briquettes fuels.

Figure 4. The samples of the dried the green briquettes fuel

5. Testing method for the physical and chemical properties of samples.
The density of briquettes from each was determined and this was calculate from the ratio of the mass to the volume of briquette green fuel.
The moisture content was determined using moisture content analysis with the ASTM D3173. Five sample weighing 2 g were place in a laboratory hot air oven at a temperature of 103°C. Each sample was dried until the different in mass between two successive weighings separated by an interval of 2 hours was 0.01 g or less.
The heating value was determined using Oxygen Bomb Calorimeter with the according to standardization on ASTM D2015-6. Each experiment was replicated three times at the final product.
As content of briquettes green fuel was determined by following ASTM D3174. Each sample was measured three times from different parts of the total sample.

Results

In this research, investigations were carried out on properties of briquettes green fuel from corncobs residue material and analysed physical and chemical were bulk density, heating value, moisture content and ash content. The results of the determination of physical and chemical character as shown in Table 1.

Table 1. Physical and Fuel Characteristics of green briquettes fuel of different composition

<table>
<thead>
<tr>
<th>Properties of Green Briquettes Fuel</th>
<th>Corncop Residue: Macadamia Charcoal (W/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90:10</td>
</tr>
<tr>
<td>Bulk density (g/cm³)</td>
<td>0.34</td>
</tr>
<tr>
<td>Heating value (kJ/kg)</td>
<td>17.41</td>
</tr>
<tr>
<td>Ash content (%)</td>
<td>3.62</td>
</tr>
<tr>
<td>Moisture content (%)</td>
<td>13.85</td>
</tr>
</tbody>
</table>
The samples were analyzed to test for bulk density heating value, moisture content and ash content. Table 1 shows the summary of the results.

![Graph showing bulk density of green briquettes fuel for different composition.](image)

**Figure 5.** The bulk density of the green briquettes fuel for different composition.

The bulk density of the green briquette fuel was observed to increase with the charcoal macadamia ratios from 0.30 to 0.63 g/cm$^3$. The bulk density profile as a function of composition is shown in Figure 5.

![Graph showing heating value of green briquettes fuel for different composition.](image)

**Figure 6.** The heating value of the green briquettes fuel for different composition.

The heating value was observed to increase with the ratio of charcoal macadamia. The highest heating value was 21.06 MJ/kg by 50:50 wt.%. The average heating value for the briquette green fuels in each sample is shown in Figure 6.
The ash content of the green briquettes fuel is the amount of ash that remains after the charcoal is burned. The results were shown that the ash content decrease as the ratio of charcoal macadamia to a minimum of 2.17% at 50:50 wt.% (corn cob residue: charcoal macadamia). The ash content is shown in Figure 7.

Figure 7. The ash content of the green briquettes fuel for different composition.

The moisture content as composition between waste material corn cob and macadamia charcoal as shown in Figure 8. The briquetting of waste material corn cob and charcoal macadamia reduces the moisture content. The percentage of moisture content lower is 10.09 at ratio 50:50 wt.% (corn cob residue: macadamia charcoal).

Figure 8. The moisture content of the green briquettes fuel for different composition.
Conclusions and Discussion

The research analyzes physical and chemical properties of briquette green fuel. The appropriate ratios was 50:50 wt.% for tapioca starch bides at 6%, the heating value of 21.06 MJ/kg, moisture content 10.09 %, ash content 2.17 % and bulk density 0.63 g/cm³. The comparison between the briquette green fuel and when adding the macadamia charcoal in composition, the heating value, bulk density, percentage of moisture content and ash content were increasing. All properties passed ASTM standards. Therefore, this study the charcoal macadamia can be efficiency enhancement of briquettes that is the effective alternative energy to replace wood.

Acknowledgements

The authors would like to gratefully acknowledge the Office of National Research Council of Thailand (NRCT, Thailand) for financial support. (Contact No.2558A14702050)

References


713
Screening and Potential of Antagonistic Fungi for Growth Inhibition of Chilli Anthracnose

Kanchalika Ratanacherdchai1,*, Paphon Khumkainoon1, Ruchiraporn Sinsopha1 and Nattachai Juntachum2

1Faculty of Agricultural Technology, Rajabhat Maha Sarakham University, Maha Sarakham 44000, Thailand
2Program in Research and Curriculum Development, Faculty of Education, Rajabhat Maha Sarakham University, Maha Sarakham 44000, Thailand
(*author for correspondence, E-mail: kan_cha_lica@yahoo.com; Fax: +66-4372-5349)

Abstract

The screening and potential of antagonistic fungi for growth inhibition of chilli anthracnose (Colletotrichum spp.) was examined. Nineteen isolates of fungi were obtained from rhizosphere soil from agricultural field in Kalasin province, Thailand and tested for inhibit mycelial growth and sporulation of C. acutatum J06 by bi-culture antagonistic test. Results showed that Trichoderma harzianum NP02, T. harzianum NP05, Gliocladium sp. NP13 and T. hamatum NP14 gave significantly (P≤0.05) inhibited mycelial growth of C. acutatum J06 at 65.69, 61.39, 60.83 and 59.31%, respectively compared to the control. Moreover, all 4 isolates, T. hamatum NP14, Gliocladium sp. NP13, T. harzianum NP02 and T. harzianum NP05 also gave significantly (P≤0.05) inhibited sporulation of C. acutatum J06 at 97.77, 97.21, 96.65 and 94.97%, respectively. It is proved that these fungi become the promising antagonistic fungi as a biological agent against plant pathogenic fungi.

Keywords: Anthracnose, Antagonistic fungi, Biological control

Introduction

Anthracnose is reported as one of the most serious disease in chilli cultivation. It causes by Colletotrichum spp., of which C. acutatum, C. capsici, C. coccodes, C. dematium and C. gloeosporioides have been reported to cause chilli anthracnose [1,2,3]. However, C. acutatum, C. capsici and C. gloeosporioides have been reported in Thailand [4,5,6,7]. This disease can infect and show symptoms on all part of chilli plant include leaves, stems and especially on fruits and reduces both quality and quantity of yield up to 50% [8]. The losses due to anthracnose causes by Colletotrichum can be reduced by using one of, or integration of, the following: resistant cultivars, cultural practices, biological control and chemical fungicides. Although, the use of chemical fungicides such as difenoconazole is an effective way to control anthracnose disease [9], however, the use of chemical fungicides has resulted in the residual toxic including risks to the environment and consumers as well as induction of chemical resistant pathogens. Therefore, enquiry and application of biological control agents, antagonistic fungi, seems to be one of the promising methods. Biological control implicates the use of natural products such as non-pathogenic microorganisms. These microorganisms are able to inhibit the growth of pathogen and reduce the disease symptom. Antagonistic fungi such as Trichoderma spp., Chaetomium spp., Gliocladium sp. and Emericella spp. are reported as effective bio-agent for growth inhibition of many plant pathogens such as Colletotrichum, Phytophthora and Fusarium [10,11,12,13,14]. In this study, the screening and potential of antagonistic fungi, which isolated from rhizosphere soil from agricultural field in Kalasin province, Thailand for growth inhibition of chilli anthracnose, caused by Colletotrichum spp. was examined.

Materials and Methods

Isolation of Colletotrichum species

Colletotrichum strains were isolated from anthracnose of infected fruits of chilli (Capsicum annuum) from agricultural field in Kalasin province, Thailand. Isolation was carried out by two methods depending on fungal sporulation on the sample. Conidia were picked directly from sporulating samples and then cultured on water agar (WA). The Colletotrichum isolates were then transferred to plates of potato dextrose agar (PDA). Alternatively, isolates were obtained from fruit without visible sporulation by culturing three 5 mm×5 mm pieces of tissue taken from the margin of infected tissue on WA. Before culturing on WA, the surface of infected tissues was sterilized by dipping in 1% sodium hypochlorite for 3 minutes, and rinsed three times with sterile water. The growing edge of any fungal hyphae developing from the disease tissue was then transferred
aseptically to PDA [2]. The pure cultures which grown on PDA were identified under compound microscope and multiplied on PDA for further study.

**Pathogenicity testing**

Preparation of inoculum – Pure cultures of each *Colletotrichum* isolate were grown on PDA for 14 days at room temperature (28–30°C). Plugs (5 mm diameter) were cut from actively-sporulating areas near to colony periphery by using a sterilized cork borer.

Preparation of hosts – Freshly harvested chilli fruits were obtained from the field. Chilli fruits were washed under running tap water for 60 seconds followed by surface sterilization by immersing the fruits in 70% ethanol for 3 minutes, 1% sodium hypochlorite solution for 5 minutes and then rinsed three times in sterile distilled water for 2 minutes and dried with sterile tissue paper and then air drying.

Inoculation – Surface sterilized fruits were placed in a plastic box with tissue paper then sprayed with sterilized water to maintain at least 95% relative humidity [4]. The samples were inoculated using the plug inoculation method [6] which included pin-pricking the fruits to a 1 mm depth with a sterile needle in the middle portion of fruit and then placing agar plug onto the wound. Wounded chilli fruits inoculated by placing only a PDA plug over the wound were used as a control. The inoculated samples were incubated in the containers at room temperature (28–30°C) for 10 days.

Lesion development on fruit were assessed by measuring the disease area in centimeters on each fruit; and analyses of variance (P< 0.05) with DMRT for multiple range tests from statistic software using randomized complete block design (RCBD) with four replications.

**Isolates of fungi**

Antagonist strains were isolated from rhizosphere soil from agricultural field in Kalasin province, Thailand using soil plate technique. A hundred milligrams of sample were grown on PDA in the dark environment. The different morphological colonies were transferred on PDA to obtain pure culture and identified under compound microscope. Pure cultures were multiplied on PDA for further study.

**Screening for against *Colletotrichum* isolate**

In this experiment, bi-culture antagonistic tests were conducted to evaluate the antagonistic fungi against *Colletotrichum* isolate. Pathogen isolate used in this study was obtained from pathogenicity test which was the most aggressive isolate. Hyphal plugs of isolate and each antagonistic fungus were placed to the middle of a half of petri dishes (9 cm diameter) and incubated at room temperature (28–30°C). Data were collected to measure mycelial growth and sporulation of *Colletotrichum* isolate then computed as percent growth inhibition. The mycelial growth was examined by measuring the colony diameter of *Colletotrichum* isolate. While, the sporulation of *Colletotrichum* isolate was examined by counting the number of spores using haemacytometer. Percentage of growth inhibition (PGI) of pathogen was evaluated in the formula (cc-cd)/cc × 100; cc equals colony diameter/ number of spores of plant pathogenic fungi in control petri dish and cd equals colony diameter/ number of spores of plant pathogenic fungi in bi-culture petri dish [12]. Data were computed analyses of variance using completely randomized design (CRD) with four replications.

**Results and Discussion**

**Isolation of *Colletotrichum* species**

Fourteen isolates of the anthracnose pathogen of chilli were isolated and identified as *Colletotrichum* spp. including 3 species, *C. acutatum*, *C. capsici* and *C. gloeosporioides* (Table 1). With this, these pathogens were reported causing anthracnose of chilli in Thailand [5,7].
Table 1 Isolates of the anthracnose pathogen of chilli

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of isolate</th>
<th>Isolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colletotrichum acutatum</td>
<td>5</td>
<td>J01, J06, J07, J09, J14</td>
</tr>
<tr>
<td>Colletotrichum capsici</td>
<td>7</td>
<td>J02, J04, J08, J10, J11, J12, J13</td>
</tr>
<tr>
<td>Colletotrichum gloeosporioides</td>
<td>2</td>
<td>J03, J05</td>
</tr>
</tbody>
</table>
Pathogenicity testing

All isolates of Colletotrichum spp. were proved to be pathogenicity to the host species. The inoculated fruits showed the anthracnose symptoms within 7 days after inoculation. Symptoms were found as small brown spots initially appeared on wound, and the spots gradually enlarged and coalesced [7]. The result showed that isolate of C. acutatum J06 gave the most aggressive causes to anthracnose symptom (Fig. 1).

Isolation of fungi

Nineteen isolates of fungi were isolated from rhizosphere soil from agricultural field in Kalasin province, Thailand. Fourteen isolates were isolated from rhizosphere soil of non-pathogenic chilli plants, while, five isolates were isolated from rhizosphere soil of pathogenic chilli plants. The fungi isolates were identified as Aspergillus sp. 5 isolates, Penicillium sp. 4 isolates, Trichoderma spp. 4 isolates, Eurotium sp. 2 isolates, Mucor sp. 2 isolates, Emericella sp. 1 isolate and Gliocladium sp. 1 isolate (Table 2).

Table 2: Isolates of fungi which isolated from rhizosphere soil from agricultural field in Kalasin province

<table>
<thead>
<tr>
<th>Rhizosphere soil</th>
<th>No. of isolate</th>
<th>Species</th>
<th>Isolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-pathogenic chilli plant</td>
<td>14</td>
<td>Emericella sp.</td>
<td>NP01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trichoderma harzianum</td>
<td>NP02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aspergillus sp.</td>
<td>NP03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aspergillus terreus</td>
<td>NP04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trichoderma harzianum</td>
<td>NP05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aspergillus sp.</td>
<td>NP06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penicillium sp.</td>
<td>NP07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eurotium sp.</td>
<td>NP08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penicillium sp.</td>
<td>NP09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penicillium sp.</td>
<td>NP10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eurotium sp.</td>
<td>NP11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aspergillus sp.</td>
<td>NP12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gliocladium sp.</td>
<td>NP13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trichoderma hamatum</td>
<td>NP14</td>
</tr>
<tr>
<td>Pathogenic chilli plant</td>
<td>5</td>
<td>Aspergillus terreus</td>
<td>P01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mucor circinelloides</td>
<td>P02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mucor hiemalis</td>
<td>P03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trichoderma hamatum</td>
<td>P04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trichoderma harzianum</td>
<td>P05</td>
</tr>
</tbody>
</table>

Screening for against Colletotrichum isolate

The 19 isolates of the promising antagonistic fungi were used for screening for against C. acutatum J06. Bi-culture showed that all isolates of promising antagonistic fungi could inhibit C. acutatum J06 in term of mycelial growth and sporulation (Table 3). Trichoderma harzianum NP02, T. harzianum NP05, Gliocladium sp. NP13 and T. hamatum NP14 gave significantly (P≤0.05) inhibited mycelial growth of C. acutatum J06 at 65.69, 61.39, 60.83 and 59.31%, respectively compared to the control (Fig. 2). Moreover, all 4 isolates, T. hamatum NP14, Gliocladium sp. NP13, T. harzianum NP02 and T. harzianum NP05 also gave significantly (P≤0.05) inhibited sporulation of C. acutatum J06 at 97.77, 97.21, 96.65 and 94.97%, respectively. Thus, in this study expressed the potential of T. harzianum to control chilli anthracnose caused by C. acutatum. T. harzianum was reported that could control chilli anthracnose caused by C. capsici, which effectively inhibited mycelial growth of the pathogen as 81.96% [10]. Moreover, the antifungal metabolite which purified from T. harzianum at the concentration of 100 mg/l also showed the efficacy for inhibition of spore germination of C. capsici as 83.40% when compared with control [11]. However, in this study also expressed the potential of Emericella sp. to control chilli anthracnose caused by C. acutatum. With this, E. nidulans was reported that this antagonistic fungus could control vanilla anthracnose caused by C. gloeosporioides [12] and tomato wilt caused by Fusarium oxysporum f.sp. lycopersici [13].
Fig. 1  Lesion diameter of chilli anthracnose causing by Colletotrichum spp. on chilli fruits

Table 3  Effects of promising antagonistic fungi on growth of Colletotrichum acutatum J06 in Bi-culture

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Colony diameter of C. acutatum (cm)</th>
<th>% inhibition of growth of C. acutatum</th>
<th>Number of spores (1×10^4 spores/ml)</th>
<th>% inhibition of sporulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>9.00^a</td>
<td>-</td>
<td>17.90^a</td>
<td>-</td>
</tr>
<tr>
<td>Emericella sp. NP01</td>
<td>6.33^b</td>
<td>29.72^e</td>
<td>1.90de</td>
<td>89.39^d</td>
</tr>
<tr>
<td>Trichoderma harzianum NP02</td>
<td>3.09^d</td>
<td>65.69^a</td>
<td>0.60hij</td>
<td>96.65^ab</td>
</tr>
<tr>
<td>Aspergillus sp. NP03</td>
<td>5.68^bc</td>
<td>36.94^fg</td>
<td>1.30efg</td>
<td>92.74^de</td>
</tr>
<tr>
<td>Aspergillus terreus NP04</td>
<td>4.45^cf</td>
<td>50.56^g</td>
<td>1.40efg</td>
<td>92.18^de</td>
</tr>
<tr>
<td>Trichoderma harzianum NP05</td>
<td>3.48^gh</td>
<td>61.39^ih</td>
<td>0.90fghij</td>
<td>94.97^abcd</td>
</tr>
<tr>
<td>Aspergillus sp. NP06</td>
<td>4.71^de</td>
<td>47.64^he</td>
<td>2.30cd</td>
<td>87.15^fg</td>
</tr>
<tr>
<td>Penicillium sp. NP07</td>
<td>5.79^bc</td>
<td>35.69^fg</td>
<td>0.70ghij</td>
<td>96.09^abc</td>
</tr>
<tr>
<td>Eurotium sp. NP08</td>
<td>6.48^b</td>
<td>28.06^g</td>
<td>2.80c</td>
<td>84.36^f</td>
</tr>
<tr>
<td>Penicillium sp. NP09</td>
<td>5.73^bc</td>
<td>36.39^fg</td>
<td>2.40cd</td>
<td>86.59^g</td>
</tr>
<tr>
<td>Penicillium sp. NP10</td>
<td>5.93^bc</td>
<td>34.17^fg</td>
<td>2.70c</td>
<td>84.92^g</td>
</tr>
<tr>
<td>Eurotium sp. NP11</td>
<td>5.41^cd</td>
<td>39.86^f</td>
<td>0.50ij</td>
<td>97.21^a</td>
</tr>
<tr>
<td>Aspergillus sp. NP12</td>
<td>5.73^bc</td>
<td>36.39^fg</td>
<td>1.20fgh</td>
<td>93.30^bcd</td>
</tr>
<tr>
<td>Gliocladium sp. NP13</td>
<td>3.53^gh</td>
<td>60.83^ab</td>
<td>0.50ij</td>
<td>97.21^a</td>
</tr>
<tr>
<td>Trichoderma hamatum NP14</td>
<td>3.66^gh</td>
<td>59.31^ab</td>
<td>0.40ij</td>
<td>97.77^a</td>
</tr>
<tr>
<td>Aspergillus terreus P01</td>
<td>5.69^bc</td>
<td>36.81^fg</td>
<td>1.10fghi</td>
<td>93.85^abcd</td>
</tr>
<tr>
<td>Mucor circinelloides P02</td>
<td>6.20^bc</td>
<td>31.11^fg</td>
<td>1.50^ff</td>
<td>91.62^ae</td>
</tr>
<tr>
<td>Mucor hiemalis P03</td>
<td>5.73^bc</td>
<td>36.39^fg</td>
<td>1.40^ff</td>
<td>92.18^ae</td>
</tr>
<tr>
<td>Trichoderma hamatum P04</td>
<td>4.65^de</td>
<td>48.33^ae</td>
<td>6.40^b</td>
<td>64.25^b</td>
</tr>
<tr>
<td>Trichoderma harzianum P05</td>
<td>4.30^ef</td>
<td>52.22^bcd</td>
<td>0.50^d</td>
<td>97.21^a</td>
</tr>
</tbody>
</table>

Means are based on data of four replications. Means followed by same superscript in each column are not significantly different by Duncan’s Multiple Range Test (DMRT) at P=0.05.
Fig. 2  Bi-culture antagonistic test
Conclusions

It could be concluded from the results of this study that the anthracnose pathogens of chilli were identified as *Colletotrichum* spp. including 3 species; *C. acutatum*, *C. capsici* and *C. gloeosporioides*. Fungi which were isolated from rhizosphere soil showed the potential for against *Colletotrichum* spp. causing chilli anthracnose. It proved that *Trichoderma harzianum*, *T. hamatum* and *Gliocladium* sp. become the promising antagonistic fungi as a biological agent against plant pathogenic fungi.

Acknowledgements

We would like to acknowledge to Faculty of Agricultural Technology, Rajabhat Maha Sarakham University for providing instrumental support and all other facilities.

References


Effect of Growing Media and Release on Growth and Yield of Broccoli

Taweesab Chaiyarak

Faculty of Agricultural Technology, Rajabhat Maha Sarakham University 44000, Thailand
E-mail: taweesab_tam@hotmail.co.th; Fax: 043-725439

Abstract

One of the important factors for flower and ornamental plant production is growing media. This study aimed at researching on effect of growing media on releasing available macronutrients. The test plant was broccoli grown under nursery condition in Faculty of agricultural technology, Rajabhat Mahasarakham University. The experiments were conducted using completely randomized design with 3 replications. The experiments are 6 treatments namely; T1: bare soil (control), T2: soil + cattle manure, T3: soil + charcoal, T4: soil + peanut shells, T5: soil + leaf compost and T6 : soil + cattle manure + charcoal + leaf compost + peanut shells. Used in the ratio of 1:1 by volume, soil and plant material and analysis of major nutrients (N, P, K) and some chemical properties released from different plant materials. The result revealed that growing media and plant nutrients in T4 (soil + peanut shells) as follows; pH (6.94), Electricity conductivity (0.09 dS/m), organic matter (0.55%), total nitrogen (0.02 g/kg), available Phosphorus (36.64 mg/kg) and available Potassium of 51.38 mg/kg. Therefore broccolis at harvest (63 days after planting) are growing most flowers and fresh weight of 12.63 cm/flower and 183.23 g/flower, respectively. The results did not difference with the plant material is fermented leaves. While T2 (soil + cattle manure) and T3 (soil + charcoal) mineralization least make a useful plant nutrient uptake was slow. The yields were smaller.

Keywords: Growing media, Nutrient, Cattle manure, Charcoal

Introduction

Decomposition of soil in different areas are resulted from the diversities of environmental factors in soil composition thus the soil in each area providing different matters to support plant growth. Regularly, the soil with one meter vertical depth or more is the best appropriate to plants and the surface layer of 20-30 centimeters depth has desirable structure composite with appropriate organic matters for crop growing. Nowadays, using the soil from natural source to plant crops is not recommended due to its lacking of adequate physical structure and the possibility to contaminate with germs and grains, causing problems to pottery plants. To improve the soil physical structure is to add organic or inorganic matters. To grow crops in the pottery, the producers try to add light weight substance mix with the soil or other materials either organic or inorganic. The organic matters; thus, play a vital role in the pottery plant production system; both as a composite and a planting material. The organic matter is the source of nitrogen, phosphorous and sulfur, which will be released gradually supplying to plant growth, is able to absorb plant nutrient, and modifies the soil physical conditions such as being well-drained and water holding. It is required more attention to control the planting materials in the nursery or container such as pots or plastic bags since it is important for the plant rooting system. According to Siripong, et al., (2008)

Materials and Methods

The experiment was conducted in the 34-cms diameter plastic pots at the nursery of the Faculty of Agricultural Technology, Rajabhat Maha Sarakham University, Mueng District, Maha Sarakham Province, during December 2013 to February 2014. It employed the Completely Randomized Design: CRD) of six treatments ratio of addition bare soil: growing media:1:1by volume); T1 : bare soil (control), T2 : soil + cattle manure, T3 : soil + charcoal, T4 : soil + peanut shells, T5 : soil + leaf compost and T6 : soil + cattle manure + charcoal + leaf compost + peanut shells. The plant material mixtures were prepared 20 days prior the
experiment. The 25-day Top Green 067 broccoli sprout was designated as a testing crop and was planted in each treatment. Data were collected every 7 days till 63 days after transplantation; there were 8 data collections in total. The collected data consisted of the diameters of the flower, fresh and dry trunk weights and flower weight. Soil samples were collected (as shown in table 1) before and after the experiment to conduct chemical quality analysis; Soil pH, Soil organic matter, Total N, Available P and Exchangeable K. Statistics used in collected data analysis were to find analysis variance with 95 percent of Duncan’s Multiple Range Test (DMRT).

Table 1 Available plant nutrients before the experiments

<table>
<thead>
<tr>
<th>Treatments</th>
<th>pH</th>
<th>EC (dS/m)</th>
<th>OM (%)</th>
<th>Total N (%)</th>
<th>P (mg/kg)</th>
<th>K (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: bare soil (control)</td>
<td>6.06&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.03&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.33&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>4.47&lt;sup&gt;c&lt;/sup&gt;</td>
<td>5.61&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>T2: soil + cattle manure</td>
<td>7.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.03&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.04</td>
<td>125.86&lt;sup&gt;b&lt;/sup&gt;</td>
<td>84.88&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>T3: soil + charcoal</td>
<td>7.03&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.07&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.58&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.03</td>
<td>113.96&lt;sup&gt;b&lt;/sup&gt;</td>
<td>84.07&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>T4: soil + peanut shells</td>
<td>6.11&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0.19&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.59&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.04</td>
<td>148.39&lt;sup&gt;b&lt;/sup&gt;</td>
<td>246.50&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T5: soil + leaf compost</td>
<td>6.58&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.07&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.68&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.03</td>
<td>142.77&lt;sup&gt;c&lt;/sup&gt;</td>
<td>47.85&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>T6: soil + cattle manure + charcoal + leaf compost + peanut shells</td>
<td>7.34&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.71&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.03</td>
<td>196.66&lt;sup&gt;a&lt;/sup&gt;</td>
<td>147.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>F-Test</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>ns</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>CV. (%)</td>
<td>0.96</td>
<td>5.02</td>
<td>7.95</td>
<td>16.19</td>
<td>2.58</td>
<td>1.18</td>
</tr>
</tbody>
</table>

Remarks:
1/ Mean in column having the same capital letter(s) are not significantly different at the 95% by DMRT
ns = non significance
** = significantly different at 99% level

Results and Discussion

Broccoli growth rate and plant materials

The study of plant materials and the broccoli growth rate revealed that all 6 treatments support growth of the broccoli height, trunk size and number of leaves in every experimental phrase; the broccoli grown in T4: soil+peanut shells; T5: soil+leaf compost and T6: soil + cattle manure + charcoal + leaf compost + peanut shells tended the highest trunks. After 63 days harvesting, the broccoli in the T6: soil + cattle manure + charcoal + leaf compost + peanut shells showed the highest trunk of 26.00 cm, while the others trunks heights of T5: soil+leaf compost, T4: soil+peanut shells, T3: soil + charcoal, T2 soil+cattle manure and T1: soil were 24.73, 24.53, 22.00, 19.00 and 19.50 cm respectively. (Figure 1)

Though the different planting materials did not release nitrogen differently, the material like soil + cattle manure + charcoal + leaf compost + peanut shells released the highest rate of phosphorous and potassium in average. The planting materials of soil+charcoal and soil+cattle manure had similar amount while the soil+charcoal gave available phosphorous and exchangeable potassium at the lowest rate. This was because of the charcoal possessed lower total nitrogen than peanut shells and cattle manure; so more charcoal but less cattle manure were mixed in the planting material in order to adjust similar total nitrogen. The available phosphorous and exchangeable potassium in the soil+cattle manure were higher than the soil+peanut shells because the manure had higher total phosphorous and potassium comparing to the peanuts.
Performances of planting materials on broccoli yields

Broccolis planted in different planting materials gave statistical different yields (Table 2). After harvesting at 63 days, the broccoli flowers were statistically significant different as the T4 soil+peanut shells and T5 soil+leaf compost gave the biggest size flower head of 12.63 and 11.90 cm. respectively; other treatments 6, 3, and 1 had average flower sizes of 9.40, 7.10, and 6.93 cm. respectively and the treatment 2 caused the smallest flower head of 2.30 grams in average. The broccoli yields in treatment 4-6 showed the best flower head sizes, fresh and dry weights comparing to the control. That’s the results of the planting materials in T4-6 had peanut shells, leaf compost and other organic matters together released available nutrients facilitating the plant growth. Moreover, the organic matters decomposition can increase cation exchange more than clay 5-10 times to transform the nutrients in soil into absorbable form for plants’ benefit before being rinsed by rain. (Rataneeeto, 2009)[3]

Figure 1  Planting materials performances on broccoli’s trunk height (A), stem (B) and number of leaves (C)
Table 2. Broccoli's flower sizes, fresh and dry weights from different planting materials

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Flower size (cm/flower)</th>
<th>Fresh weights (grams/flower head)</th>
<th>Dry weights (grams/flower head)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: bare soil (control)</td>
<td>2.30^c</td>
<td>43.04^c</td>
<td>9.43^b</td>
</tr>
<tr>
<td>T2: soil + cattle manure</td>
<td>6.93^b</td>
<td>56.30^c</td>
<td>10.02^b</td>
</tr>
<tr>
<td>T3: soil + charcoal</td>
<td>7.10^b</td>
<td>55.50^c</td>
<td>9.94^b</td>
</tr>
<tr>
<td>T4: soil + peanut</td>
<td>12.63^a</td>
<td>183.23^a</td>
<td>24.59^a</td>
</tr>
<tr>
<td>T5: soil + leaf compost</td>
<td>11.90^a</td>
<td>119.33^b</td>
<td>14.70^b</td>
</tr>
<tr>
<td>T6: soil + cattle manure + charcoal + leaf compost + peanut shells</td>
<td>9.40^ab</td>
<td>115.60^b</td>
<td>17.04^ab</td>
</tr>
</tbody>
</table>

F-test  **  **  *  
c.v. (%)  16.74  24.32  34.75

Remarks:
1/ Mean in column having the same capital letter (s) are not significantly different at the 95% by DMRT
* = significantly different at 95% level, ** = significantly different at 99% level

Available nutrients in the planting materials after the experiment

Chemical properties study of the planting materials after the experiments revealed that the 6 treatments had pH, Electricity Conductivity, Organic Matters, Available Phosphorous, Exchangeable Potassium were statistically different. (Table 3) It was discovered that the planting materials in T2-6 had similar amount of nutrients while the T1 had the least nutrient after the experiment. The broccoli absorbed more potassium than nitrogen and phosphorous in all treatments. The T4 (soil + peanut shells) had tendency to absorb the most of nutrients by comparing between before and after experiment. This tendency correlated with the sizes and weights of the broccoli since it was significant in carbohydrate production process and protein synthesis to increase protein value and flower head quality. Potassium was crucial in plant production development thus inadequate potassium could cause burns on plant leaves or declined quality and yields of the plants. (Lamoolpug and Kongkaew, 2011)[4]. The planting materials in T2-T5 all had different organic matter values (0.55-0.91%) though higher than the treatment 1 (0.36%); this resulted on the increase of main nutrients especially of the potassium since the organic matters were available potassium resources in soil (Duiker and Beegle, 2006)[5]. This correlated with the organic matters in soil created the soil pH appropriately to the plant growth encouraging the microorganism activities in soil to increase decomposition and release of available phosphorous (Nweke, 2013)[6].

Table 3. Available nutrients in the different planting materials after the experiment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>pH (after the experiment)</th>
<th>EC (dS/m)</th>
<th>OM (%)</th>
<th>Total N (%)</th>
<th>P (mg/kg)</th>
<th>K (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: bare soil (control)</td>
<td>6.29^a</td>
<td>0.06^b</td>
<td>0.36^c</td>
<td>0.01</td>
<td>5.56^d</td>
<td>35.15^d</td>
</tr>
<tr>
<td>T2: soil + cattle manure</td>
<td>7.85^a</td>
<td>0.22^a</td>
<td>0.91^c</td>
<td>0.04</td>
<td>124.36^bc</td>
<td>65.42^bc</td>
</tr>
<tr>
<td>T3: soil + charcoal</td>
<td>7.40^b</td>
<td>0.08^ab</td>
<td>0.65^b</td>
<td>0.02</td>
<td>127.56^bc</td>
<td>72.16^b</td>
</tr>
<tr>
<td>T4: soil + peanut shells</td>
<td>6.94^c</td>
<td>0.09^ab</td>
<td>0.55^b</td>
<td>0.02</td>
<td>136.64^b</td>
<td>51.38^c</td>
</tr>
<tr>
<td>T5: soil + leaf compost</td>
<td>6.90^c</td>
<td>0.15^a</td>
<td>0.62^b</td>
<td>0.02</td>
<td>132.13^d</td>
<td>21.83^d</td>
</tr>
<tr>
<td>T6: soil + cattle manure + charcoal + leaf compost + peanut shells</td>
<td>7.35^ab</td>
<td>0.16^ab</td>
<td>0.58^b</td>
<td>0.02</td>
<td>178.04^a</td>
<td>127.89^a</td>
</tr>
</tbody>
</table>

F-Test  **  *  ns  **  **
c.v. (%)  2.05  59.90  12.29  11.11  2.76  1.09

Remarks:
1/ Mean in column having the same capital letter (s) are not significantly different at the 95% by DMRT
ns = non significance
* = significantly different at 95% level, ** = significantly different at 99% level
Conclusions and Discussion

The study showed that the plant material in the treatment 4 (soil+peanut shells) provided beneficial Soil pH, Soil organic matter, Total N, Available P and K of 6.94, 0.09 dS/m, 0.55%, 0.02%, 36.64 mg/kg, 51.38 mg/kg respectively. The broccoli with 63 day harvesting range showed the highest growth rate with the flower size and weight of 12.63 centimeters and 183.23 grams respectively and it showed similar result with the leaf compost material. While the treatment 2 (soil+cattle manure) released the least plant nutrients thus causing slow nutrients absorbance and smaller yield.

Acknowledgements

This research could not have been possible without the funding granted by the Institute of Research and Development, Rajabhat Maha Sarakham University and I would like to thank the Plant Production Technology Program, the Faculty of Agricultural Technology for providing the laboratory and instrument in conducting and collecting data of this experimental research.

References

Multimedia Website Designing and Developing to Promote Group of “Roi-Kaen-Sarn-Sin” Travelling

Potsirin Limpinan

Department of Multimedia Technology and Animation, Faculty of Information Technology, Rajabhat Maha Sarakham University 44000, Thailand
E-mail: potsirin@hotmail.com, Potsirin@rmu.ac.th

Abstract

The objectives of this research are: 1) to study a proper form of multimedia to promote group of “Roi-Kaen-Sarn-Sin” travelling, 2) to evaluate the suitability of multimedia developed from the study, and 3) to promote the cultural tourist attraction information of “Roi-Kaen-Sarn-Sin”. The study population was divided into two groups: group 1 expert interview and group 2 study evaluated multimedia sites. The research tools included 1) Multimedia website designing and developing to promote group of “Roi-Kaen-Sarn-Sin” travelling, 2) an evaluation form Multimedia website designing and developing to promote group of “Roi-Kaen-Sarn-Sin” travelling; and 3) an evaluation form “Roi-Kaen-Sarn-Sin” website. The data were analyzed by mean, average, and standard deviation.

The study was found that the virtual reality media formats that appropriate for promote group of “Roi-Kaen-Sarn-Sin” travelling. Virtual reality media was developed following a study and found appropriate at a high level and the website evaluation found that the multimedia websites to promote cultural tourism group of “Roi-Kaen-Sarn-Sin” were at a high level. Virtual Reality (VR) brings about the convenience for all people. The visitor can watch the ancient places similar to the real situation. Moreover, the visitor can change their own view that show the environment as the dynamic movement. The movement can adjust by following the needs of visitor.

Keywords: Multimedia, Virtual reality, Website, Roi-Kaen-Sarn-Sin, Virtual panoramic

Introduction

The promotion on tourism and useful information for the tourists, as the tour planner, is the obligation that needs to be quickly developed in order that Thai business owners in the field of tourism could be capable to equally compete with the foreign countries. The unfortunate fact is that most of these business owners do not seriously give the attention on the development of multimedia since they basically are confident that the tourism capacity of Thailand is firmly strong. Hence, they have nothing to do with the internet. In contrast, some neighboring countries e.g. Singapore and Malaysia have wisely utilized various kinds of modern technology as a medium to successfully promote the sightseeing in their countries to the world outside. For this reason, the responsible people in tourism industry in Thailand should actively commence some reaction to take back and retain the market share in the regional tourism industry as long as possible.

In particular, an approach to gain the attention from the tour planners so they could choose Thailand as their prior choice is the most important strategy so that the researcher thoroughly studied on this issue in search of the guideline to conduct a successful strategic plan. Practically, this approach newly proposed by the researcher is to make use of the computer network as a medium because it is now an era of information technology where news and information have become an essential resource. Meanwhile, this advanced information technology is growing rapidly, especially computer technology that is recently being developed in different formats. Significantly, the computer network is the most popular medium that are used universally with the highest rate of growth [1]. At the present, a variety of multimedia was created and designed to promote tourism that can be found on search engines e.g. Google, Yahoo, etc.[2]. However, to create a popular and successful multimedia website for tourism promotion requires an in-depth study in order to outline an appropriate model with high performance in providing benefits for the tourists.

This study was conducted on a provincial network called Roi-Kaen-Sara-Sin (Roi-Et, Khon Kaen, Maha Sarakham, and Kalasin) in order to create the multimedia with high performance in promoting the tourist attractions around those four provinces with different locally unique characteristics in both cultural and natural contexts; for example, Phra That Kham Kaen, Phra That Phuay Noi, Khon Kaen National Museum in Khone Kaen, Phra That Na Doon in Maha Sarakham, Prang Ku, Ku Ka Singh, , Phra Maha Chedi Chai Mongkol in Roi–Et, and Kong Dee Muang Kalasin Museum, Phutthasathan Phu Po, and Phra That Ya Koo in Kalasin. There are also many stunning natural attractions e.g. Phu Pha Man Park, Phuvieng National Park, Ubolrattana...
Dam, and Kaen Nakhon Lake in Khon Kaen, Kosamphi Forest Park and Doon Lumphun Non-hunting Area in Maha Sarakham, Bueng Phalan Chai Lake and Pha Nam Yoi (Isaan Buddhist Park) in Roi-Et, Sirindhorn Dinosaur Museum, Lam Pao Dam, and Laem Non Wiset in Kalasin. In Roi-Kaen-Sara-Sin provincial network, there are many highlighted attractions that have not been recognized amongst the tourists due to the ineffective promotion. Moreover, due to low educational background, the community members have not yet aware of an importance of being a good host that should provide the useful information to draw in the tourists to visit their local attractions.

Based on the abovementioned, the researcher aimed to develop a multimedia website as a medium with high performance in promoting the cultural tourist attractions. This study could give basic information for developing an effective approach to promote the tourist attractions in Roi-Kaen-Sara-Sin provincial network. Also, this website would be a good choice for the tour planners who preferred using the internet to prepare the useful information before planning a trip. More importantly, this multimedia website would encourage more tourists to come and visit the cultural tourist attractions in those four provinces in Roi-Kaen-Sara-Sin network.

Materials and Methods

Scope of Content

This study was to design and develop a multimedia website to effectively promote the tourist attraction in Roi-Kaen-Sara-Sin network that covered 4 cultural sites including Phra Maha Jedi Chai Mongkol, Phra That Kham Kaen, Phra That Na Doon, and Phra That Ya Koo.

Scope of Demographic Data

The population in this study was the undergraduate students from 5 majors in Faculty of Information Technology including Information Technology, Animation and Multimedia Technology, Geographical Technology, Computer Technology for Communication, and Technology Management.

The sample group consisted of 120 participants who were the undergraduate students majoring in Animation and Multimedia Technology.

Research Methodology

1. A multimedia website was created to suitably promote 4 cultural attractions in Roi-Kaen-Sara-Sin provincial network following 4 steps as below.

1) Designing the Website

The researcher and team studied and collected the useful information from related documents and research papers from various sources. The collected data on multimedia on different websites used to promote the tourist attractions was thoroughly analyzed and affirmed that “Visual Reality: VR” was the most appropriate medium to promote tourism on a website [3]. In this regard, the researcher’s team purposively selected a Panoramic Image-Based Virtual Reality as the prior choice. In practical, the team conducted an on-site survey to explore those 4 cultural sites as previously mentioned in order to design a diagram of the tourist attractions

![Figure 1. mock up website](image-url)

At the final stage, the website’s content had been verified by three experts before it was edited as a final product.
2) Creation of the Virtual Image

During the creation of the virtual image, a panoramic photography was applied to display all details of the attractions based on the user’s viewpoint. That is, different angles of a photo were captured so they could be seen via a 360° degree viewpoint. After that, all photos had been converted to the equirectangular image before they were evaluated and approved by the experts. The photos were edited following the expert’s suggestion and resulted as the final version.

Figure 2: Phra That Ya Koo equirectangular image.

3) Touring System

This step was to use all equirectangular images to create the touring system; meanwhile, the linkage was created between the tourist attractions and the external locations. Later, the website was evaluated by the experts to affirm its design for further development.

Figure 3: To create a link within the VR.

4) Distribution

All information and photos from step 3 was presented on a Roi-Kaen-Sara-Sin website (http://www.roikaensarasin.com/)

Figure 4: Website Roi-Kaen-Sara-Sin
The research outcome was found as follows.

1. The data analysis was resulted as an appropriate multimedia website that effectively promoted the cultural tourist attractions in Roi-Kaen-Sara-Sin network as discussed in Table 1.

<table>
<thead>
<tr>
<th>Topic of Evaluation</th>
<th>Appropriate Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Multimedia Model</td>
<td>Non – Immersive VR or Desktop VR</td>
</tr>
<tr>
<td>2. Designing Model</td>
<td>Virtual Panoramic</td>
</tr>
</tbody>
</table>
| 3. Software         | - Adobe Flash  
|                     | - Photomatrix Pro  
|                     | - EasyPanorama Tourweaver Professional 5.0  
|                     | - Adobe Photoshop  
|                     | - Adobe Dreamweaver |
| 4. Design of Use    | - Displaying panoramic photo horizontally via a 360° view  
|                     | - Displaying panoramic photos vertically via a 180° view  
|                     | - Controlling the touring routes by computer mouse  
|                     | - Easy to Use  
|                     | - User can select the previous and next photos.  
|                     | - Smooth functions without errors  
|                     | - Clear, simple, and understandable instruction |

2. The assessment media to promote cultural tourism in Roi-Kaen-Sara-Sin network as discussed in Table 2.

<table>
<thead>
<tr>
<th>Topics</th>
<th>X</th>
<th>S.D.</th>
<th>Suitability Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Content</td>
<td>4.42</td>
<td>0.56</td>
<td>high</td>
</tr>
<tr>
<td>2) Design</td>
<td>4.17</td>
<td>0.53</td>
<td>high</td>
</tr>
<tr>
<td>3) Usability</td>
<td>4.37</td>
<td>0.50</td>
<td>high</td>
</tr>
<tr>
<td>Average</td>
<td>4.32</td>
<td>0.53</td>
<td>high</td>
</tr>
</tbody>
</table>

From Table 2, it was found that the expert opinions to the media in the form of virtual reality to promote cultural tourism Roi-Kaen-Sara-Sin on the site were at a high level.

3. The analysis publicity media sites to promote the cultural tourist attraction information of “Roi-Kaen-Sarn-Sin” on the website.

Figure 5 : Website Roi-Kaen-Sara-Sin

Conclusions and Discussion

The finding was affirmed that Virtual Reality (VR) with virtual panoramic photography was an applicable media with high performance in promoting the tourist attractions because panoramic photos presented all angles of the attractions around the user via a 360° degree view. So, the user could view the
attractions in every viewpoint and move a computer mouse to explore the highlighted attractions along each of those four routes. To support this claim, there were several studies that previously affirmed the performance of virtual panoramic photos as discussed below.

Attasart Wiangsong [3] conducted his study on the effectiveness of virtual reality to promote Mahasarakham University and found that it was an appropriate medium since his developed virtual reality efficiently encouraged the users to enjoy themselves with the 3D models, virtual environment, sound, and senses generated by basic computing equipment so that they felt like they were in the real situation. That is, there was an interaction between users and the medium so that this virtual reality was a suitable medium for the successful promotion on Mahasarakham University.

Similarly, Suwan Chotika et. al. [4] who developed the virtual e-museum to promote the ancient buildings in Songkla Municipality using High Dynamic Range (HDR) and Virtual Panoramic Photography. This technique was tested with 13 ancient buildings in the target area in which the audience could enjoy the e-museum feeling like they were flashed back to the ancient time. Specifically, they could switch the viewpoints, move freely to view their interested sites, and zoom in and out the photos. Also, the audience could check and review the information by themselves. In fact, the photos were taken from the actual sites with high-definition and panoramic photography techniques in order to offer virtual photos of the ancient buildings. Practically, the panoramic photos were displayed horizontally via a 360° degree viewpoint and vertically via a 180° degree viewpoint in order that the audience could travel back through the ancient time inside the e-museum.

Another case of virtual museum was a study by Konlawat Klainak [5] that previously developed a virtual museum to promote Thai architecture study: a case study of Thai traditional house. The study aimed at presenting the architectural structure of Thai Lua house and examining the participant’s learning achievement after learning with the virtual museum. The finding was that the virtual museum was an effective medium to enhance the participant’s learning achievement in Thai architecture so that they became more knowledgeable in the plan, internal functions, and housing structure.

From the abovementioned, it was strongly affirmed that virtual reality was the appropriate multimedia to promote tourism industry and education. In the same vein, the virtual medium was a suitable approach that successfully promoted the four cultural tourist attractions in Roi-Kaen-Sara-Sin provincial network including Phra Maha Jedi Chai Mongkol, Phra That Kham Kaen, Phra That Na Doon, and Phra That Ya Koo. That is, these four attractions were presented on the multimedia website with panoramic photos that were displayed horizontally via a 360° degree viewpoint and vertically via a 180° viewpoint which lively interacted with the tourists so they felt like walking back through the past.

Acknowledgements

This study was financially supported by Rajabhat Mahasarakham University. The authors would like to thank collegian of Information Technology faculty for support of this work. Special thanks to my Student for their support.

References

Development Thai Sign Language Multimedia for Students with Hearing Impairments in the North Eastern

Marudis Vachirakomen
Faculty of Sciences and Technology, Rajabhat Maha Sarakham University, Thailand
E-mail: luktavada@gmail.com

Abstract

This research has the following objectives: (1) to develop Thai sign language multimedia. Set inside the meaning word. Computer for hearing impaired students in the Northeast to be effective. (2) the satisfaction of the sample to the media language, developed in Thailand. Using a sample of high school students Grade 8 to school for the deaf in the Northeast of multimedia tools for learning and queries. The statistics used in this research is the mean and standard deviation. The results were as follows:

1) The quality of the Thai sign language multimedia program regarding the assessment of the experts was in the high level.
2) The average level of the satisfaction of the students toward the multimedia program was in the mostly satisfied.

In conclusion, the CD-ROM multimedia is efficient and practical for the hearing impaired students add the multimedia help hearing impaired students to learn. The program should be promoted to schools for the deaf.

Keywords: Multimedia, Sign Language, Hearing impairments

Introduction

Education is necessary to have knowledge of information technology. With normal people and disabled people to achieve equality and human rights. To living in a society that is happy. By the agencies responsible for education must be taught. Courses related to information technology and computers to students. And students at all levels of education, which is a function of the basic education is the responsibility of the Office of Basic Education. Deaf School Education. a unit of the Office of Basic. Who have taken courses from basic education curriculum for students with hearing impairment using the basic education curriculum as well as students who are physically normal. The high school students will need to strand 4: Information technology. High School students, especially students Grade 8 will begin lessons on the vocabulary and computer technology. Interviews of teachers, information technology courses. Deaf School Education, KhonKaen Province. use Sign language along with teaching. as a medium for learning. The problem, especially junior high school to start strand 4: Information technology. most students do not understand. Computer technology and content

Materials and Methods

1. Study and analyze Thai sign language Multimedia.
2. Choose a video and a series of Thai sign language lexical meaning inside computer.
3. Provide the information content and the computer terminology, with an image. to consult a professional interpreter and Thai sign language. Gesture, language, basic computer terminology Thai. and record animations. with a video camera.
4. Image data and computer animation, recorded to offer expert opinions, which expert you have three motion pictures, and provide feedback. The consistency between images with gestures. To improve the content of complete and accurate.
5. Study and analysis of the presentation of the following media types.
   5.1 character data.
   5.2 still images.
   5.3 video data.
   5.4 Data symbols such as keypad options menu.
   All of the above is a procedure to develop Thai Sign language multimedia program. Using the following software;
   1) Adobe Flash cs6 program used to design and build all media.
   2) Adobe Photoshop cs6 program used to design and create graphics such as buttons, background imaging devices for use in the media.
3) The program Ulead Video Studio 10 in montage VDO to translate sign language.
4) SwishMax 2.0 program used to create animations. Create touches to the piece adds interest to return to work.

6. The content and format of the media to be analyzed in order to determine the content and form of presentation design flowchart (Flow Chart) and the storyline (Storyboard) for the development of a mobile multimedia Thai set of computer terminology. Highlighted by the media, is easy to use, ability to meet the needs of the target audience. Bugs recording media into the computer and the CD.
7. Offers all three media professionals, check their accuracy, and suggestions to improve the storyline (Storyboard).
8. The media has been revised. and the experimental group. Deaf students of high school, audiovisual consisted of three students at the level, medium, and good.
9. Update fixed the experiments with student samples auditory Education province Roi E, Surin, Mukdahan, Udonthani, Khon Kaen, Chaiyaphum.
10. The statistics used in data analysis were mean (\( \bar{x} \)) and standard deviation (S.D.). Percentage is a statistic used to determine the efficiency of Thaisign language multimedia program.
10.1 Average (Mean) is given by the formula.
\[
\bar{x} = \frac{\sum x}{N}
\]  
(1)
\( \bar{x} \) = On the average.
\( \sum x \) = The sum total of the data.
\( N \) = Represent the number of all data.

10.2 The standard deviation is given by the formula.
\[
S.D. = \sqrt{\frac{N\sum x^2 - (\sum x)^2}{N(N-1)}}
\]  
(2)
\( SD \) = On the standard deviation of the sum of all scores.
\( \sum x \) = The sum of all squared.
\( \sum x^2 \) = The sum of all squared.
\( N \) = Represent the number of all people.

Results
1. Program of Basic Computer Terms in Technology and Computer Equipment. By experts of 5 members.
Table 1 expert reviews of the performance. Thai media of Thai sign language. Set of computer terminology.

<table>
<thead>
<tr>
<th>List</th>
<th>( \bar{x} )</th>
<th>S.D.</th>
<th>Comment levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The content.</td>
<td>4.33</td>
<td>.19</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2. Aspects of multimedia features</td>
<td>4.13</td>
<td>.51</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>Totalaverage</td>
<td>4.23</td>
<td>.35</td>
<td>Very satisfied</td>
</tr>
</tbody>
</table>

From Table 1 shows that performance reviews for us of experts on the Thailand set of multimedia Thai Sign language vocabulary and the Total average computer in the appropriate level. Considering the sort is descending on the mean(\( \bar{x} \)=4.33) and the median(\( \bar{x} \)=13.4).
2. Analysis satisfied the first year of secondary school students samples of three people on the Thai sign language multimedia. Set of computer terminology.

Table 2: the satisfaction of students with Thai Sign language. Set of computer terminology.

<table>
<thead>
<tr>
<th>List</th>
<th>X</th>
<th>S.D.</th>
<th>Comment</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The content.</td>
<td>4.17</td>
<td>.38</td>
<td></td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2. Aspect of multimedia features</td>
<td>4.08</td>
<td>.49</td>
<td></td>
<td>Very satisfied</td>
</tr>
<tr>
<td><strong>Total average</strong></td>
<td>4.13</td>
<td>.44</td>
<td></td>
<td>Very satisfied</td>
</tr>
</tbody>
</table>

From Table 2 shows that student satisfaction with Thai sign languageset of computer terminologyTotal average. When considering the descending order of the content(X =4.17) and the media(X =4.08).

3. The analysis of satisfaction with Thai Sign language. The basic computer terminology. Technology and computer equipment. for the deaf. to sample.

Table 3 precent of the average standard deviation and the level of satisfaction with the multimedia Thai Sign language. the basic computer terminology. computer technology. for deaf people and content.

<table>
<thead>
<tr>
<th>The Satisfaction of the Hearing Impaired Students with Finger Language Multimedia Program of Basic Computer Terms in Technology and Computer Equipment</th>
<th>Percentage of satisfaction level. (n = 53)</th>
<th>X</th>
<th>S.D.</th>
<th>Satisfaction levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most</td>
<td>Very</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>1. Content easy to understand.</td>
<td>49.1</td>
<td>34.0</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>2. This translation Thai sign language obvious.</td>
<td>17.0</td>
<td>62.3</td>
<td>17.0</td>
<td>3.8</td>
</tr>
<tr>
<td>3. Translation This translation Thai sign language Fits in with the content.</td>
<td>26.4</td>
<td>56.6</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>4. Appropriate time in the presentation.</td>
<td>49.1</td>
<td>37.7</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>5. After finish from the media. Media users know basic computer terminology and computer technology.</td>
<td>20.8</td>
<td>45.3</td>
<td>32.1</td>
<td>1.9</td>
</tr>
<tr>
<td>6. Multimedia is a basic computer terminology and computer technology have made the media a great sense of fun and learning.</td>
<td>26.4</td>
<td>41.5</td>
<td>30.2</td>
<td>1.9</td>
</tr>
<tr>
<td>7. Overall, the media that media is the basic computer terminology and computer technology valuable.</td>
<td>37.7</td>
<td>34.0</td>
<td>26.4</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Total average</strong></td>
<td>32.36</td>
<td>44.49</td>
<td>21.84</td>
<td>1.36</td>
</tr>
</tbody>
</table>

From Table 3 Analysis of satisfaction with Thai sign language. The basic computer terminology. Computer technology. The content for deaf people find that overall satisfaction is high ( X =4.07) were classified as the article found. Satisfaction was high and 7 respectively. the average is much less. Adequacy of the presentation time( X =4.35) content easy to understand( X =4.32) and Thai sign language. Are appropriate to the contents( X =4.09).
The media has found that Total average satisfaction is high ($\bar{X} = 4.21$) were classified as the article satisfied. Prof. Monthol Vachirakomen * Marudis Vachirakomen Faculty (2555: abstract) in the study, satisfaction with the Thai Sign language Multimedia Program of basic computer terms in technology and computer equipment computer technology. For the deaf. The media, content in overall satisfaction level ($\bar{X} = 4.06$) were classified as the article high. The media has found that Total average satisfaction is high ($\bar{X} = 4.47$), the color of the background ($\bar{X} = 4.45$) and the density of the text and images to fit ($\bar{X} = 24.4$). Satisfaction level in all 9 items sorted in descending average is. Text is easy to read ($\bar{X} = 4.47$), the color of the text proper ($\bar{X} = 4.21$) were classified as the article found. Satisfaction was high and 7 respectively. The average is much less. The suitability of the proposed time ($\bar{X} = 4.35$) content easy to understand ($\bar{X} = 4.32$) and Thai Sign language. Are appropriate to the contents ($\bar{X} = 24.4$). The suitability of the proposed time ($\bar{X} = 4.06$) were classified as the article satisfied. The media has found that overall satisfaction is high ($\bar{X} = 4.21$) were classified as the article satisfied. The media has found that overall satisfaction is high ($\bar{X} = 4.47$), the color of the background ($\bar{X} = 4.45$) and the density of the text and images to fit ($\bar{X} = 24.4$).

### Table 4 Average percent age standard deviation and level of satisfaction with Thai sign language. The basic computer terminology. Computer technology. For the deaf. The media.

<table>
<thead>
<tr>
<th>The satisfaction of the Hearing Impaired Students with Finger Language Multimedia Program of Basic Computer Terms in Technology and Computer Equipment Computer technology. For the deaf. The media.</th>
<th>Percentage of satisfaction level ($n = 53$)</th>
<th>$\bar{X}$</th>
<th>S.D.</th>
<th>Satisfaction levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most</td>
<td>Very</td>
<td>Moderate</td>
<td>Low</td>
<td>Least</td>
</tr>
<tr>
<td>1. Text readability.</td>
<td>58.5</td>
<td>30.2</td>
<td>11.3</td>
<td>4.47</td>
</tr>
<tr>
<td>2. Appropriate font size.</td>
<td>34.0</td>
<td>47.2</td>
<td>18.9</td>
<td>4.15</td>
</tr>
<tr>
<td>3. The density of the text proper.</td>
<td>35.8</td>
<td>52.8</td>
<td>11.3</td>
<td>4.24</td>
</tr>
<tr>
<td>4. Appropriate background color.</td>
<td>60.4</td>
<td>26.4</td>
<td>11.3</td>
<td>1.9</td>
</tr>
<tr>
<td>5. The color of the font.</td>
<td>34.0</td>
<td>50.9</td>
<td>13.2</td>
<td>1.9</td>
</tr>
<tr>
<td>6. Clearer picture.</td>
<td>20.8</td>
<td>60.4</td>
<td>13.2</td>
<td>5.7</td>
</tr>
<tr>
<td>7. View images easy.</td>
<td>45.3</td>
<td>37.7</td>
<td>13.2</td>
<td>1.9</td>
</tr>
<tr>
<td>8. Interesting pictures.</td>
<td>41.5</td>
<td>41.5</td>
<td>17.0</td>
<td>1.9</td>
</tr>
<tr>
<td>9. Picture size to the screen.</td>
<td>30.2</td>
<td>37.7</td>
<td>32.1</td>
<td>3.98</td>
</tr>
<tr>
<td>Total average</td>
<td>40.06</td>
<td>42.76</td>
<td>15.72</td>
<td>1.27</td>
</tr>
</tbody>
</table>

From Table 4 Analysis of satisfaction of the hearing impaired students with Thai sign language program of basic computer terms in technology and computer equipment computer technology. For the deaf. The media. The media has found that Total average satisfaction is high ($\bar{X} = 4.21$) were classified as the article found. Satisfaction level in all 9 items sorted in descending average is easy to read ($\bar{X} = 4.47$), the color of the background ($\bar{X} = 4.45$) and the density of the text and images to fit ($\bar{X} = 24.4$).

**Conclusions**

Analysis of satisfaction of the hearing impaired students with Thai Sign language program of basic computer terms in technology and computer equipment computer technology, for the deaf. The media, content in overall satisfaction level ($\bar{X} = 4.07$) were classified as the article found. Satisfaction was high and 7 respectively. The average is much less. The suitability of the proposed time ($\bar{X} = 4.35$) content easy to understand ($\bar{X} = 4.32$) and Thai Sign language. Are appropriate to the contents ($\bar{X} = 4.09$). The media has found that overall satisfaction is high ($\bar{X} = 4.21$) were classified as the article found. Satisfaction level in all 9 items sorted in descending average is. Text is easy to read ($\bar{X} = 4.47$), the color of the background ($\bar{X} = 4.45$) and the density of the text and images to fit ($\bar{X} = 24.4$).

**Discussion**

Students are satisfied with the development of multimedia with Thai Sign language program multimedia equipment sets the terms for the hearing impaired students. Overall satisfaction levels and is on the high level. Because of development of multimedia with Thai sign language program there is a very fast. The selection of content, images, and animations to meet the needs of individual freedom, no one is made to feel the excitement. Interacting with the media as well. This is consistent with studies of Asst. Prof. Monthol Vachirakomen * Marudis Vachirakomen Faculty (2555: abstract) in the study, satisfaction with the Thai...
Sign language sets basic computer terminology, technological and computer equipment for the deaf. The results showed that the students are satisfied with the media, the educational program was developed by and specifically in the study.

Acknowledgements

This research was funded by the Research and Development Institute, Rajabhat Mahasarakham University. Development Thai sign language Multimedia, set meaningful words inside your computer. For students with hearing impairments in the North Eastern. Thanks to the director of personnel and college activities. Mahidol University, Director of Personnel and Special Education. Rajabhat Mahasarakham University, Assistant Professor Dr. Dr. Areerasdra Tasun, Prof. Dr. Areerasdra Varapapa, Dr. Apichard Nalinrat, Prof. Dr. Songsanit Songsak, Mrs. Cunarak Chlorine. Experts who monitor and advise on the creation of a research tool.

Respectfully request the Director, Deaf School students and faculty Roi Et, Mukdahan, Surin, Udonbhan, Khon Kaen, Chaiyaphum, You for your cooperation in preparing a place in this study. Thank you, students to one school Deaf Roi Et, Mukdahan, Surin, Udonbhan, Khon Kaen, Chaiyaphum and all who cooperated in the study, and respondents as well.

References

Preparation of Reactor Generation Clean Energy from Waste Aluminum

Pornchai Chinnasa* and Tanachai Ponken

Program of Physics, Faculty of Science and Technology, Rajabhat Maha Sarakham University, Thailand

(*author for correspondence, E-mail: chinnasa@hotmail.com)

Abstract

In this work, fabrication of hydrogen (H₂) gas generator has been the attractive for alternative energy generator. H₂ gas production was prepared from the reaction between aluminum plate and water. Rate and yield of H₂ gas were studied from the difference parameters as follows; the ratio of water and aluminum, the concentration of NaOH-based activator, water temperature and types of water, respectively. The ratio of water and aluminum were 7.5, 10, 12.5 and 15. The concentrations of NaOH-based activator were 15, 20 and 25 wt%. Varies of water temperature were 25, 35, 55 and 75 °C used tab, DI and sea water, respectively. Solution for H₂ gas production was mixed in generator reactor which processes of solution mixed aluminum plate, NaOH-based activator and flowed water for different temperature, respectively. The results found that, the optimum condition were the ratio of water and aluminum of 10, the concentration of NaOH-based activator of 20 wt%, water temperature of 35 °C dissolved in tab water, respectively. Maximum rate of H₂ gas production receives of 200-400 ml/min/g Al, at a yield of about 92%. In work further, H₂ gas will be used in proton exchange membrane (PEM) fuel cells for electric energy generator.

Keywords: Hydrogen, Hydrogen storage, Aluminum, Water reaction, Fuel cell

Introduction

In recent years much effort has been made in order to reduce the world dependence on fossil fuels and to meet the increasing energy needs using alternative sources of energy. Hydrogen is the most alternative fuel because of its outstanding reaction energy (with air), three times higher than for hydrocarbon fuels, and its environmental friendly products, water or water vapor. The main disadvantages associated with the use of hydrogen are difficulty of storage and transportation due to its very low density, and safety problem because of its very high reactivity. Overcoming those challenges of hydrogen storage, transportation, and safety is essential for a wide use of hydrogen energy.

Safe and compact hydrogen storage and in-situation hydrogen production from aluminum water reaction can be achieved using a novel, in-house, thermo-chemical treatment of aluminum particles. The method involves a small fraction of a NaOH-based activator (typically 20 wt%) which diffuses into the aluminum particles and modifies the hydroxide/oxide protective film on their surface, allowing a spontaneous and sustained chemical reaction between aluminum and water which produces hydrogen [1]. The stoichiometric reaction (Eq. (1)) yields theoretically 11% hydrogen mass compared to the aluminum mass (equivalent to over 1.2 l of hydrogen per gram of aluminum), making the concept very efficient for hydrogen storage.

\[
\begin{align*}
2\text{Al} (s) + 6\text{H}_2\text{O} (l) & \rightarrow 2\text{Al(OH)}_3(s) + 3\text{H}_2(g) \quad (1) \\
2\text{Al} (s)+ 2\text{NaOH} (s) + 6\text{H}_2\text{O} (l) & \rightarrow 2\text{NaAl(OH)}_4(aq) + 3\text{H}_2(g) \quad (2) \\
\text{NaAl(OH)}_4(aq) & \rightarrow \text{NaOH} (s)+ \text{Al(OH)}_3(s) \quad (3)
\end{align*}
\]

Different attempts and approaches have been applied in the world to activate aluminum. It has been suggested to use alloys of aluminum with different metals such as Ga, In, Zn Sn and Bi [2-7]. Kravchenko et al. [3] and Ziebarth et al. [4] created Al alloys by melting aluminum with various metals and investigated the effect of the concentration of individual components in the alloy on the hydrogen yield. The doping procedure requires high temperatures for melting all the components (700-900 °C), and results in relatively slow reaction with water, even at elevated temperatures. Wang et al. [5], Ilyukhina et al. [6], and Fan et al. [7] created different aluminum alloys using mechanical alloying method. The investigations were typically conducted at atmospheric pressure and room temperature, resulting in a range of hydrogen production yields from 20% to over 90%, where quaternary aluminum alloys (e.g., AlGaInSn), particularly with higher contents of Ga and Sn, exhibited the higher yield range. Activation of aluminum by mechanical treatment of the metal using cutting or ball milling which exposes a fresh and reactive surface of the aluminum particles while increasing the surface area.
area and mixing with additives has also been investigated [2,8-11]. In some experiments [8,10], salt was used as nano-miller and cover; when the aluminum salt powder comes in contact with water the salt particles are washed away and the aluminum reacts with water. This method gives high hydrogen yields when nano-particles of aluminum (which are very expensive) and high temperatures are used. Razavi-Tousi et al. [11] investigated the dependence of the reaction kinetics on the microstructure of the aluminum powder in order to optimize the milling time. Another method uses alkaline solutions, mainly sodium hydroxide, in order to destroy the protective oxide layer on the aluminum surface. The reaction is relatively slow [2, 12, 13], and caution is required for working with strong alkaline solutions. Yet another approach is to use water at very high temperatures (under high pressure) using aluminum powder without additives. Yavor et al. [14] got 60-80% hydrogen yield using 6 mm aluminum powder at water temperature of 120-150 °C, and close to 100% at 200 °C [15]. Vlaskin et al. [16] obtained 70-90% hydrogen yield using 4-7 mm aluminum powder with water temperature of 230-300 °C. Both researches obtained better results for smaller particles and higher temperatures. This paper presents a parametric investigation of the chemical reaction between activated aluminum and water to produce hydrogen in-situ, safely and compactly. The activated aluminum has been prepared via a novel method developed in-house enabling the diffusion of a small fraction of lithium into the aluminum particles. It further studies the application of the hydrogen produced in proton exchange membrane (PEM) fuel cells to generate green electric energy.

**Materials and Methods**

A parametric experimental study has been conducted in order to find the influence of different operating factors and conditions on the activated aluminum water reaction, measuring the reaction rate and efficiency. Effects of water/aluminum mass ratio, fraction of activator used, water temperature, pressure, and the type of water (i.e., tap water, sea water, and distilled water) have been investigated.

![Fig. 1 - Schematic illustration of the experimental facility.](image-url)

Batch type experiments were conducted in an acrylic reactor. The aluminum plate was put in the reactor first, then water was added and a spontaneous reaction started. Since hydrogen has low solubility in water the amount of hydrogen produced from the reaction was measured by water displacement. The hydrogen produced from the reaction was channeled to an acrylic container filled with water driving the water out from the container to a cup placed on an electronic balance. In some experiments the measurements were conducted with a mass flow meter (FLUKE 922, USA). The temperature of the reaction was measured by a thermometer. Schematic illustration of the experimental facility is presented in Fig. 1. The influence of pressure on the reaction was tested using a closed vessel, as described in Fig. 2.
Reactor hydrogen generation 5 parts consists of NaOH tank outside diameter 10 cm thick 0.5 cm high 12.5 cm reactor tank, filter cylinder and gas replaces the water tank. By each part outside diameter 10 cm thick 0.5 cm high 20 cm. The tests applied either 2 mm aluminum particles or 2 mm wide, 0.2 mm thick Al plates (average values).

H₂ gas production was prepared from the reaction between aluminum plate and water. Rate and yield of H₂ gas were studied from the difference parameters as follows; the ratio of water and aluminum, the concentration of NaOH-based activator, water temperature and types of water, respectively. The ratio of water and aluminum were 7.5, 10, 12.5 and 15. The concentrations of NaOH-based activator were 15, 20 and 25wt%. Varies of water temperature were 25, 35, 55 and 75 °C used tap, DI and sea water, respectively. Solution for H₂ gas production was mixed in generator reactor which processes of solution mixed aluminum plate, NaOH-based activator and flowed water for different temperature, respectively. Regularly, the experiments were conducted with 2 g of an Al plate containing 20 wt% of activator. The effect of activator fraction was studied with aluminum plate containing 15% and 25% of activator. The amount of hydrogen produced in the experiments was compared to the theoretical amount of the stoichiometric reaction (Eq. (1)), which produces about 1.24 l of hydrogen per 1 g of aluminum at standard conditions (1 atm, 273 K). For the calculation of the actual yield the hydrogen temperature and pressure at the experiment were accounted for. Water vapor generated at the reactor condenses while cooling down to room temperature during flowing in the pipe and staying in the water displacement vessel. Hence, its maximum volumetric fraction (at saturation) would not exceed 2.5% at atmospheric experiments.

**Results**

**Water aluminum mass ratio**

The influence of the mass ratio between water and activated aluminum plate on the reaction rate and the hydrogen volume produced was tested with 2 g of aluminum plate and different amounts of tap water (15, 20, 25, 30 ml) at room temperature (25 °C). The aluminum hydroxide product of the reaction may absorb water (forming hydrate or gel). In addition, at low water aluminum ratios boiling and evaporation of water take place. Hence, excess water beyond the stoichiometric ratio may be required for complete reaction. In order to compare results of experiments conducted with different amounts of aluminum powders; the results are presented per unit mass (1 g) of aluminum.

![Fig. 3 - Hydrogen production rate vs. time for different water/aluminum mass ratios (2 g Al, 20 wt% activator).](image-url)
Fig. 3 presents the hydrogen production rate vs. time for different water/aluminum mass ratios respectively. As can be seen, the reaction is faster when the water/aluminum mass ratio is lower (mainly due to the effect of temperature increase during the exothermic reaction, which is accelerated for a smaller heated mass). The yield of hydrogen produced is presented in Fig. 4. The maximum attainable hydrogen volume was calculated for the experiment conditions, assuming that the gas entering the water vessel was at room temperature and atmospheric pressure. In-test temperature variations of the hydrogen produced imply possible 2% error in determining the reaction yield.

**Fig. 4 - Hydrogen yield vs. time for different water/aluminum mass ratios (2 g Al, 20wt % activator).**

**NaOH-based activator**

The influence of the mass ratio between water and activated aluminum powder on the reaction rate and the hydrogen volume produced was tested with 2 g of aluminum plate and different amounts of NaOH activator (15, 20, 25 wt%) at room temperature (25 °C).

Fig. 5 presents the hydrogen production rate vs. time for different NaOH activator (2 g Al, H₂O/Al=10).

**Fig. 5 - Hydrogen production rate vs. time for different NaOH activator (2 g Al, H₂O/Al=10).**

Fig. 5 presents the hydrogen production rate vs. time for different water/aluminum mass ratios respectively. As can be seen, the reaction is faster when the water/aluminum mass ratio is lower (mainly due to the effect of temperature increase during the exothermic reaction, which is accelerated for a smaller heated mass). The yield of hydrogen produced is presented in Fig. 6. The maximum attainable hydrogen volume was calculated for the experiment conditions, assuming that the gas entering the water vessel was at room temperature and atmospheric pressure. In-test temperature variations of the hydrogen produced imply possible 2% error in determining the reaction yield.
Water temperature

The reaction was tested using 20 ml of tap water in different initial temperatures (25, 35, 55, 75 °C) reacting with 2 g Al plate which contains 20wt% of NaOH activator. The aluminum water reaction is highly exothermic, increasing the water temperature during the reaction process. Fig. 7 presents the hydrogen production rate during the aluminum water reaction for different initial water temperatures. It can be seen that when the initial temperature of the water is higher the reaction delay is shorter and the maximum hydrogen production rate is higher, as could be expected. The cumulative hydrogen yield is presented in Fig. 8. This figure shows clearly that although the reaction is faster when the initial water temperature is higher, the overall yield of hydrogen produced is similar for all the tested temperatures. The overall hydrogen yield presented in Fig. 9, was similar in all the experiments, 80-82%, almost indifferent with the initial water temperature.
Water type

Tests were conducted with different types of water: tap water, sea water (Mediterranean sea, about 4.2% salt concentration NaCl), and distilled water, revealing that hydrogen production at a similar good yield could be obtained with all types of water. This result is important in particular for marine and underwater vessel applications, which should carry only activated aluminum powder, using the water in the surroundings to produce hydrogen and generate electricity. Fig. 10 describes the hydrogen generation rate per unit mass of Al produced from water of different types.

Application to fuel cell

One of the best applications for hydrogen generation using the activated aluminum water reaction is in proton exchange membrane (PEM) fuel cells. PEM fuel cells produce electricity from hydrogen and oxygen, and the only byproduct of this procedure is water or water vapor. Experiments have been conducted where the hydrogen produced via the activated aluminum water reaction has been channeled to a fuel cell (Horizon H-30), rated at 30 W power, demonstrating stable electricity generation. The fuel cell current, voltage, and power were measured for different loads, in the range of 1.2 -14 Volt, and compared to those published by the manufacturer. A good agreement was found, as shown in Fig. 11 In fact, the actual output of the fuel cell was higher than the nominal manufacturer data, a scan be expected in a new fuel cell.
Conclusions and Discussion

Presented here is a parametric study on hydrogen generation from the reaction between activated aluminum plate and water. The activated aluminum which reacts spontaneously with water has been produced via an original process involving small fraction of NaOH-based activator. Aluminum plate and water are simple and safe to store, hence providing a convenient way of hydrogen production in situation avoiding the complications of hydrogen storage. In addition, the reaction between aluminum and water produces only environmental friendly products. High hydrogen production rates, 200-400 ml/min/g Al, have been achieved, and high efficiency of hydrogen production has been demonstrated, about 92% in most experiments. The main use of this hydrogen generation method should be to generate green energy via fuel cells. This is an environmental friendly method, as the only chemical product of the fuel cell is water (in liquid or vapor state). A clear advantage of it can be seen in marine and underwater propulsion, because there is no need to carry the water. Nevertheless, it can also be applied in electric cars or as battery replacement for electricity supply in remote communication posts, etc.

Acknowledgements

The authors greatly appreciate the generous financial support of Assoc. Prof. Dr. Kejvalee Pruksamthorn Department of Chemical Technology Chulalongkorn University, Assoc. Prof. Dr. EkaphanSwatsitang Department of Physics Khan Kean University in the research and Horizon fuel cell technology company support for H-20 proton exchange membrane fuel cell.

References


The Motivation to Work of the Personnel of Sub-District Administration Organizations in Maha Sarakham Province, Thailand

Nittaya Kaewhanam and Phanita Soonthornchai

Faculty of Management Science, Rajabhat Maha Sarakham University
Thailand

(*author for correspondence, E-mail: p_nita54@hotmail.com; Telephone number: 091-0162873)

Abstract

The objectives of this research were 1) to study the motivation levels to work of the personnel of sub-district administration organizations, and 2) to compare the motivation levels in work performance of the personnel of sub-district administration organizations. The sample was 323 personnel of sub-district administration organizations, selected by Yamane’s formula. The instrument used for collecting data was a five-rating scale questionnaire. The obtained data were subsequently analyzed to find the percentage, mean and standard deviation. T-test (Independent Samples Test) and F-test (One way ANOVA) were also used to test statistical significance at .05 and pairwise comparisons were applied using Scheffe method.

The results indicated that the motivation level in work performance of the personnel of sub-district administration organizations as a whole and individual aspects was at a moderate level ranging from advancement in work, work itself, recognition, responsibilities, interpersonal relations, policy and administration, salary and fringe benefits, working condition and supervision respectively. When comparing the opinions towards the motivation level, as a whole, it was found that the respondents of different genders had different opinions on work achievement, advancement in work, responsibilities, supervision, interpersonal relations, work condition and salary and fringe benefits. However, the opinions were not different in the aspects of recognition, work itself and policy and administration. Besides the respondents of different age groups had different opinions on work achievement, recognition, advancement in work, policy and administration, supervision, interpersonal relations, working condition, and salary and fringe benefits. But their opinions indicated no difference on work itself. The respondents of different educational levels had different opinions on motivation to work in all aspects including work itself, recognition, working condition and policy and administration, advancement in work, responsibilities, supervision, interpersonal relations, working condition, and salary and fringe benefits. In terms of working positions, the respondents of different working positions had different opinions on work achievement, recognition, work itself and policy and administration, advancement in work, responsibilities, interpersonal relations and working condition. However, their opinions showed no difference on interpersonal relations, working condition, and salary and fringe benefits. On the matter of work experience, it was found that the respondents of different years of work experience had different opinions on work achievement, recognition, work itself, advancement in work, responsibilities, supervision and working condition. But they had no different opinions on working condition and salary and fringe benefits. Both motivation and maintenance factors affected efficient work performance because they motivated the personnel to work willingly and enthusiastically. So, motivation to work should be provided to the staff so that their work performance will meet organization objectives.

Keywords: Motivation, Work performance, Administration, Organization, Maha Sarakham

Introduction

Essentially, bureaucratic work must cling to bureaucratic work systems and regulations. Coordinating within government sectors is no less important. Moreover, bureaucratic work performance to meet the objectives of the organization efficiently needs efficient human resource. So the personnel of sub-district administration organizations are one key factor to sub-district administration which will lead to efficient work performance and responses to the needs of local people. Therefore, building motivation for personnel is very vital to work efficiency because motivation arouses interest, selection and self-determination which are seen in human behaviors. Specifically, motivation can enhance work performances, energy and activities which will result in goal achievement (Tayakkhanon. 1990:121).

In sub-district administration organizations, administrators are on top of the hierarchy. Following the organizational policy, sometimes, is in conflict with rules and regulations, and unclear guidelines. Many problems have arisen. For instance officers of high rank do not accept the opinions of officers of lower ranks; opportunities for further studies and training are not equally distributed; promotion of salary and benefits are not fair; colleagues are not cooperative in work and lack unity; supervisors cannot solve problems and give clear,
precise work procedures; work is not rechecked resulting in several mistakes; officers are not encouraged and motivated to work; work condition is unfavorable and work performance is not efficient and does not meet the objectives.

Thus the researcher, an officer in a sub-district administration organization, is interested in conducting studies on motivation in work performance of the personnel of sub-district administration organizations in Maha Sarakham province based on Herzberg’s Theory (Herzberg, Barnard and Synderman, 1959:113-119) in a hope to apply the research results to the organizations to maximize efficiency and benefits. Herzberg, Barnard and Synderman (1959:113-119) proposed two motivation theories called ‘Two Factors Theory’, having ten components in two kinds factors as follows:

1) Motivation factors. These factors are directly related to work performance; they encourage people to love their work and work efficiently. The factors comprise 5 elements, namely, achievement, recognition, advancement in work, responsibility and work itself.

2) Maintenance factors. These factors help people maintain their work motivation all the time. Without these factors in organization; or, if the factors are not in accordance with personnel’s needs, they will not like to perform or fulfill their work. The factors have 5 components; namely, policy and administration, supervision, interpersonal relations, working condition, and salary and fringe benefits.

Materials and Methods

The research entitled “The Motivation to Work of the Personnel of Sub-district Administration Organizations in Maha Sarakham Province, Thailand” is quantitative research. The sample was 232 people selected by Yamane’s formula(Taro Yamane, 1973:727). Data are gathered by a questionnaire of 10 checklists, namely, work achievement, recognition, advancement in work, policy and administration, supervision, responsibilities, interpersonal relations, working condition, salary and fringe benefits, and work itself. The motivation levels are measured following Likert’s five-rating scale. An average scores are interpreted based on Si-saard (2010:99): level 5 average score 4.21-5.00 referring to highest level, level 4 average score 3.41-4.20 referring to high level, level 3 average score 2.61-3.40 referring to moderate level, level 2 average score 1.81-2.60 referring to low level, level 1 average score 1.00-1.80 referring to lowest level.

As for an analysis of demographic information of the respondents and suggestions for motivation, the statistics used is the percentage; motivation levels, the mean and standard deviation. T-test (Independent Samples Test) is executed for testing the hypothesis and comparing the motivation levels between two groups. For more than 3 different groups, the statistics used is F-test (One Way ANOVA). The differences that have a statistical significance at .05 are tested by Scheffe method.

Results

The major findings of the research revealed as follows:

Demographic information of the respondents indicated that most of them were male, aged between 35-40, higher certificate holders in vocational education, division heads/levels 3-6, more than 6-10 years of work experience.

Considering all aspect as a whole and each aspect, the motivation level, both motivation factors and maintenance factors, of the personnel of sub-district administration organizations in Maha Sarakham province was at a moderate level (x=3.15). In order of average scores, motivation factors were arranged as follows: advancement in work (x=3.22), work itself (x=3.16), work achievement (x=3.14), and recognition (x=3.14). As for maintenance factors, the average scores revealed as follows: responsibilities (x=3.12), interpersonal relations (x=3.21), policy and administration (x=3.20), salary and fringe benefits (x=3.20), working condition (x=3.12), and supervision (3.04).

In comparing motivation levels classified by gender, the results pointed out that the respondents of different genders had no different opinions on recognition (Sig=0.467), work itself (Sig=0.217) and policy and administration (Sig=0.146). However, they had different opinions on work achievement (Sig=0.005), advancement in work (Sig=0.000), responsibilities (Sig=0.000), supervision (Sig=0.000), interpersonal relations (Sig=0.000), working condition (Sig=0.000) and salary and fringe benefits (Sig=0.000) with a statistical significance at .05.

Regarding age groups, the result showed that the residents of different age groups had no different opinions on work itself (Sig=0.057), but had different opinions with a statistical significance at .05 on work achievement (Sig=0.014), recognition (Sig=0.000), advancement in work (Sig=0.000), responsibilities (Sig=0.000), supervision (Sig=0.000), interpersonal relations (Sig=0.000), working condition (Sig=0.000), salary and fringe benefits (Sig=0.000) with a statistical significance at .05.
The personnel of sub-district administration organizations in Maha Sarakham province with different genders, age groups, educational levels, work positions and lengths of work experience revealed different opinions. Moreover, their motivation to work which comprised motivation factors and maintenance factors was at a moderate level as a whole and in each aspect. Unfortunately the results were not in accordance with the research hypothesis, but were in line with the studies of Kotthan (1988): Abstract) who studied the morale in work of secondary school teachers under Department of Formal Education, Maha Sarakham province. The research revealed that behavioral factor of administrators affected the motivation to work at a moderate level. Besides, the finding was also in agreement with the studies of Hehasuk (1991: Abstract) who studied administrative performance of administrators that affected the morale in work of primary school teachers under Office of Primary Education of Samutsakhon province. The result indicated that the school administrators expressed administrative performance at a moderate level. Also, a study on the morale in work of the personnel of sub-district administration organizations in Pitsanulok province indicated that the morale as a whole was moderate. But when considering individual aspects, it was found that 7 out of 10 aspects were perceived at a high level. This indicated that local administrators did not take the components of a morale or motivation aspect into consideration in their administration, for example administrative policy, planning, work achievement, assignment and responsibilities. Mostly they paid attention to work itself, not to the personnel. This finding was in accordance with Herzberg (Herzberg. 1959: 63) who stated that the causes of dissatisfaction are due to administrative policy which aimed at work and neglected the well-being of personnel; they imposed restricted control caused conflicts, competitiveness, rivalry and insufficient welfare supplies. All causes mentioned lead to discouragement in work and lack of work stimuli which lessened work outcomes qualitatively and quantitatively.

As for the findings that were not in line with research assumption, an explanation is gained from a study of Prayotrit (2547):Abstract) who found that the personnel of sub-district municipalities of Maha Sarakham province who had different educational levels, working positions and work experience, had no differences in motivation to work as a whole and in each aspect. The reasons may due to their work performance which has been stipulated in Sub-district Council and Sub-district Administration Organization Act of 2537 B.E.( amended version) that the Council will investigate and monitor the personnel’s work performance. Therefore, the personnel must work in team; they must not work alone. Work achievement is contributed to the sub-district administration organization, not any individual person. In addition, the operational personnel have to work under the supervision of the same supervisors or the administrators. So, they have to follow the same working policy and have no prejudices or divided feelings or attitudes.

The findings of the study on the motivation to work of the personnel of sub-district administration organizations regarding motivation factors and maintenance factors will help increase work efficiency because the operational staff are willing and enthusiastic to work. Therefore, it is very essential for any organization to motivate staff so that their work performance will reach the goal.

**Suggestions for Future Research**

For future research, it is suggested to have a study on the factors affecting work efficiency of the personnel of sub-district administration organizations of Maha Sarakham province and a study on practical...
guidelines for work according to good governance principles for the personnel of sub-district administration organizations of Maha Sarakham province

Acknowledgements

This thesis has been completed with kind assistance and guidance of Associate Professor Phanita Soonthornchai, major advisor, to whom I would like to express my deep thanks. My appreciation also goes to Associate Professor Wongphatha Siprasert, chairperson in the oral examination, Assistant Professor Dr. Phoonsak Sirisom, honorary expert and Dr. Nisarat Chotchoei, co-advisor for their help, supports and editing to make this research complete.

I am thankful to the personnel of sub-district administration organizations in Maha Sarakham province for their cooperation in answering the questionnaire and my co-researchers for gathering data and documents to fulfill all academic procedures.

I am grateful to my parents, relatives, colleagues and MBA Group 16 classmates. My special appreciation is given to my parents, teachers and benefactors for teaching and nurturing in me knowledge and wisdom towards my way of success and progress in work and life.

References

A Model for Service Quality Management of Sub-District Municipalities in Kalasin Province, Thailand

Praiya Kongsomjit and Phanita Soonthornchai

Faculty of Management Science, Rajabhat Maha Sarakham University
Thailand

(’author for correspondence, E-mail: p_nita54@hotmail.com; Telephone number: 091-0162873)

Abstract

The objectives of this research were 1) to study the level of service quality management of Sub-district Municipalities in Kalasin Province, 2) to study the organizational success level, and 3) to study a model for service quality management that affects the organizational success. The sample comprised 400 registered residents in Sub-district Municipalities in Kalasin Province in 2014. The research instrument was a questionnaire concentrating on service quality management and organizational success of Sub-district Municipalities in Kalasin Province. The obtained data were analyzed and presented in the form of the percentage, mean and standard deviation. The statistics used for testing the model equation was Multiple Linear Regression Analysis (Stepwise). The major findings revealed that the overall level of service quality management of Sub-district Municipalities in Kalasin Province was high in all five aspects including confidence, responsiveness, concreteness, reliability, and attentiveness respectively. Also, the overall level of the organizational success was high in all four divisions including financial management, personnel administration and sub-district municipality council affairs, general administration, and public services respectively. A model for service quality management revealed that responsiveness aspect was most influential followed by concreteness and attentiveness aspects respectively. As for the level of the organizational success in each division that affects organizational success, it was found that in terms of general administration, responsiveness aspect was most influential; in terms of personnel administration and sub-district municipality council affairs, responsiveness aspect was most influential, followed by concreteness aspect. In terms of financial management, reliability aspect was most influential, followed by concreteness, attentiveness, and confidence aspects respectively. Regarding public services, concreteness aspect was most influential on the organizational success, followed by responsiveness and attentiveness aspects respectively. The implication of the results indicates that in service quality management of Sub-district Municipalities, responsiveness should be taken into consideration. The officers should talk to people politely and distribute written documents showing sample service procedures. They should give clear advice and fulfill their services as needed by people. Besides, the services should be concrete and equipped with materials and equipment showing readiness and attentiveness. The officers are able to recognize people and give advice in simple, understandable language.

Keywords: Model, Management, Municipalities, Kalasin

Introduction

Thailand’s Strategic Plan for Bureaucratic System Reform (2014-2019) has specified the strategic issues focusing on service excellence for Thai population. As a consequence, government sectors, the national main service providers have to improve and develop more efficient working procedures (Department of Local Administration Promotion, 2013: 5). Giving services is vital to both businesses and administration in government sectors. Therefore, the organizations must be responsive to meet the needs of their customers.

Sub-district municipalities are government sectors responsible for serving people under their jurisdiction. In Kalasin province there are 77 sub-district municipalities. In 2013, the assessment of bureaucratic work performance, dimension 2, on service quality showed that the overall work performance was at a ‘Good’ level (Office of Local Administration, Kalasin, 2013: 2-8). However, a number of complaints were made on service quality. Thus the researcher is interested in conducting research on service quality to formulate a model for improving service quality of sub-district municipalities in Kalasin. It is expected that the research results will be used as baseline data as well as guidelines for successful development of sub-district municipalities in Kalasin.

Literature Review

Parasuraman, A., Zeithaml, V.A. & Berry (1990 : 1988) define “quality services” as a gap between customers’ expectation and their acknowledgement of provided services. The expectation occurs as a result of rumors among customers, customers’ needs, past experience, and information received through direct and indirect channels. Customers’ acknowledgement of service results from given services and communication from
service providers to customers. If provided services are better or meet expectations, it means that the services are satisfactory. Such satisfactory elements include reliability, confidence and concreteness, attentiveness and responsiveness.

According to Santiwong (1998:29), organizational success refers to organizational abilities in their work performance that meets the goals among many changes in the globalized world. The factors affecting the organizational success depend on organizational contexts, administration, structure, and human resources. To assess organizational effectiveness, the Department of Local Administration Promotion has adopted four indicators including financial management, personnel administration and sub-district municipality council affairs, general administration, and public services.

Sub-district Municipalities in Kalasin Province serve to respond to the needs of the community under its jurisdiction. The researcher has studied the variables of quality services towards the success of organization and found five variables on quality services and four variables on organizational success. Then the research will be further conducted to find out the satisfactory level of each variable and create a model for quality service management towards organizational success.

Materials and Methods

This research entitled “A Model for Service Quality Management of Sub-district Municipalities in Kalasin Province, Thailand” is quantitative research. Data were collected by a questionnaire which was divided into 3 parts. Part 1 was concerned with demographic information of the respondents; Part 2, opinions on service quality management and Part 3, opinions on organization success. The sample was 400 people living in sub-district municipalities, Kalasin, calculated by Yamane’s formula (Kaiwan, 2006:105). The instrument used for collecting data was a five-rating scale questionnaire. An average scores were interpreted based on Si-saard (.2010:121): Level 5 Average score 4.51-5.00 referring to highest level, Level 4: Average score 3.51-4.50 referring to high level, Level 3: Average score 2.51-3.50 referring to moderate level, Level 2: Average score 1.51-2.50 referring to low level, level 1: Average score 1.00-1.50 referring to lowest level.

The obtained data were analyzed and presented in the form of the percentage, mean and standard deviation. The statistics used for testing the model equation was Multiple Linear Regression Analysis (Stepwise).

Results

Part 1 : Demographic information of respondents

It was found that out of 400 residents registered in Sub-district Municipalities in Kalasin Province in 2014, most of them were female, aged 25-35, bachelor’s degree holders, farmers/employees.

Part 2: Opinions on service quality management of Sub-district Municipalities in Kalasin

The opinions were found at a high level with an average score of 3.73. Taken each aspect into consideration, the average highest score was on confidence (3.78), followed by responsiveness (3.75), concreteness (3.73), reliability (3.72) and attentiveness (3.66) respectively.

Part 3: Opinions on organization success of Sub-district Municipalities in Kalasin

Overall, the opinions were at a high level with an average score of 3.68. Taken each aspect into consideration, the average highest score was on financial management (3.72), followed by personnel management and sub-district municipality council affairs (3.71), general administration (3.64) and public services (3.62) respectively.

Part 4: A model for service quality management and organizational success administration of Sub-district Municipalities in Kalasin Province

The overall relational equation of variables was $Z = 0.384 Z_1 + 0.226 Z_2 + 0.154 Z_4$ indicating that responsiveness ($X_4$) was most related to the success of organization, followed by concreteness ($X_3$) and attentiveness($X_4$) respectively. Further details of each division of the model were shown below:

1. Regarding general administration, the relational equation of variables was $Z_1 = 0.573 Z_4$ indicating that responsiveness was most influential on the success of organization.
2. Concerning personnel administration and sub-district municipality council affairs($Y_2$), the relational equation of variables was $Z_2 = 0.324 Z_3 + 0.173 Z_4$ indicating that responsiveness was most influential on the success of organization, followed by concreteness aspect.
3. With regards to financial management ($Y_3$), the relational equation of variables was $Z_3 = 0.303 Z_1 + 0.252 Z_3 + 0.220 Z_4 + 0.158 Z_7$ indicating that reliability was most influential on the success of organization, followed by concreteness, attentiveness and confidence aspects respectively.
4. As for public services \((Y_4)\), the relational equation of variables was 
\[
Z_4 = 0.285 Z_1 + 0.265 Z_4 + 0.206 Z_2
\]
indicating that concreteness was most influential on the success of organization, followed by responsiveness and attentiveness aspects respectively.

Conclusions and Discussion

It is concluded that the service quality management of Sub-district Municipalities in Kalasin was at a high level as a whole. In order of average scores, the five aspects included confidence, responsiveness, concreteness, reliability and attentiveness respectively. This is due to people’s confidence and trust in municipal services. For instance the officials can explain clear work procedures; office hours are posted. When problems in services arise, people are confident that they will get help promptly. Besides, the services are given in concrete forms; officers are well-attentive and recognize people. They provide good services and talk to people gently and politely which is in line with Duang-in’s studies (2007: Abstract). According to her assessment of the service quality of Office of Community Development, Sankamphaeng district, Chiang Mai province, the service quality as a whole was at a high level. The sample was satisfied with the service on knowledge sharing procedures, promoting and strengthening community administrative systems for self-reliance, service on developing the potentials of community leaders and community networks, and upgrading community work to standards system. Also, the residents were satisfied with the services on information dissemination, promotion of occupation projects, and service performances of officers who were willing to provide services with a smiling, friendly, humble manner. So, people were impressed with a warm welcome whenever they came to contact the office.

In terms of the organization success of sub-district municipalities in Kalasin, the overall perception on the four divisions was at a high level ranging from financial management, personnel administration and sub-district municipality council affairs, general administration and public services because of efficient work performances. As for financial management aspect, the municipal finance division always disseminated financial situations to public; the performance of personnel administration and council affairs was transparent and the municipal council had a meeting plan in preparing and enacting municipal regulations, documents and constantly putting notifications to public. Regarding general administration, opinions and complaints could be sent through several channels such as websites and telephones. So the residents’ voices could be heard. Concerning public services, education was widely promoted and budget was appropriately allotted for educational purposes which is in agreement with the studies of Ta-In (2007: Abstract) entitled “Factors Supporting the Success of Local Administration Organizations that Received Good Governance Awards: A Case Study of Don Kao Sub-district, Mae-rim District, Chiang Mai Province”. The research result indicated that the success was at a high level due to many supportive factors, for instance, clear, flexible organization structure and easy for organization development to cope with external changes. Besides, the organization had clear, far-sighted strategies that could be adaptable to uncertainties; it also had a clear, flexible working system. In terms of personnel administration, the recruitment method was efficient enough to select knowledgeable persons leading to more efficient work performance. It encouraged officials to be energetic, creative and had leadership so that they could introduce innovations and administrative skills for local development to respond to the needs of local people in larger area. It made employees realize the organization’s shared values, global changes and organizational adaptability in congruence with the changing world so that the organization was always alert and responsive to all problems.

The model for service quality management supporting the success of sub-district municipalities in Kalasin province comprised responsiveness, concreteness and attentiveness because the residents wanted to contact with polite, gentle officers. Equally important, it was suggested that there should be a sample form-filled document; clear, understandable explanations of each kind of service, and fast, active services. Also, people wanted to gain a sense of completeness and neatness in their transaction.

Regarding concreteness aspect, the officers should provide a waiting-room, instruments and equipment, having billboards explaining simple contact procedures and enough amenities. Besides, they should dress appropriately, be polite and informative to all related questions.

Regarding the aspect of attentiveness, the officers should be kind, smiling, helpful, reserved and willing to provide services. They should use simple words in their explanations. According to Worakanyakun’s studies (2012: Abstract) entitled “The Success in Administration of Rangsit Municipality, Pathum Thani Province,” the administrative performance of Rangsit Municipality always followed laws and regulations and sometimes enacted some new rules in congruence with the duties and contexts of the organization. In terms of administrative issues, it was suggested to improve the work structures and personnel. Additionally, it was found that the factors affecting the success in administration with a statistical significance at .05 comprised strategies, organization structure, work systems, leadership, personnel, shared values and work skills. In a predictive
equation, the most influential factor on the administrative success was work skills, shared values, strategies and work systems respectively.

The research findings revealed suggestions to improve quality services and increase the effectiveness and efficiency of the sub-district municipalities in Kalasin. Regarding quality service management, it was suggested that the officers should give clear, easy work procedures and office hours. They should build confidence in people when providing services. In case of problems, they should give help promptly and the services are provided in concrete forms. The officers should have enough staff, materials and equipment and be ready to give services. Also they should be attentive, recognize people and respond to problems and talk to people politely. In terms of organizational success, the sub-district municipalities should inform the residents about financial management, budgets and financial situations. Personnel administration should be transparent. With regards to sub-district municipality council affairs, the meeting reports, new rules and regulations and announcements should be posted in public places. Concerning general administrative aspect, there should be various channels to listen to people’s opinions such as websites and telephones. In terms of public services, the sub-district municipalities should promote education and use the budget appropriately and transparently.

Suggestions for Future Research

For further studies, it was suggested to conduct research on quality services and quality administration of sub-district municipalities in other provinces so that the findings will be used as guidelines for organizational operations.

Acknowledgements

This research has been completed through valuable advice, guidance and attentiveness of Associate Professor Phanita Soonthornchai, my major advisor and through assistance, supports and correction from Assistant Professor Dr.Phoomsak Sirisom and Dr. Nisarat Chotchoei, co-advisors.

My gratitude also goes to the residents living in sub-district municipalities of Kalasin province for answering the questionnaires. Thanks to my research assistants for data collection and documents to enable me to fulfill all thesis procedures and meet the research objectives.

I would like to express my gratitude to my parents; Chatri Khongsomchit, my husband, Chatya and Piyachat Khongsomchit, my son and daughter and also to my relatives, colleagues, M.B.A. classmates, Group 16 for their help and encouragement. My special appreciation goes to my teachers and benefactors for their teachings and morale supports leading to my achievement in life and work progress.

References

[8] Ta-in, Rungnapha. Factors Supporting the Success of Local Administration Organizations that Received Good Governance Awards: A Case Study of Don Kaeo Sub-district, Mae-rim District, Chiang Mai Province. M.A. Thesis (Public Administration), Chiang Mai University Graduate School, 2007.
**Guidelines for Community Development to Sustainability: a Case Study of Ban Tharsee, Kokaeo Sub-District, Selaphum District, Roi Et Province**

Prasarn Sripongplerd

Rajabhat Roi Et University, Thailand
E-mail: prasarn8512@hotmail.com

**Abstract**

The purposes of this participatory action research were: 1) to study the context of Ban Tharsee community, 2) to study the problem and the community potentiality, and 3) to find ways to improve Ban Tharsee community potentiality, Kokaeo sub-district, Selaphum district, in Roi-Et province. The instruments used to collect data were questionnaires, interviews, observation, and small group discussions with community leaders, community committees, community presidents, community consultants, Mayor, Deputy Mayors, networking researchers, networking communities, and 50 people living in Ban Tharsee community. The findings of this research revealed that Ban Tasee community is the small village, 333 people in 98 families covering area approximately 1,500 acres. The villagers are mostly farmers and believe in Buddhism. The problems of the community are: low-income, insufficient water for the agriculture, and insufficiency of the irrigation water supplying to the paddy fields. The community potentialities are: potential leaders, unity, the strong practice of the Buddhist traditions, rich natural resources such as rivers and forests, and Duplicated Phra Thad Phanom in which is the source of learning and tourism. There are five ways to improve the community: economy, society, natural resources, infrastructure, and education. From these five ways of sustainable development for the community, the community can manage by themselves in some ways and the other ways will be done through the help from local agencies and the government.

**Keywords:** Community potentiality, Community development, Participatory action research, Sustainability

**Introduction**

According to the Development of National Economic and Social Development Plan, all organizations in Thai society are aware of the development of human resource as well as happy and healthy society. The development of community is a way of human development and society to meet an objective or goal as needed. (Journal of Education of Social Development, 2008)

The study of any community contexts is one part of the community researches. The community context means the study of physical livings, biology, economy, society, politics, government, culture and tradition, relationship of people within a community etc. Researchers must be aware of the analysis of the identity of a community that is important information for the development of the community so that the community itself will be stronger and potential. The information from the study of community context is like a mirror that indicates the survival of people in the community and every community has ways of life, economies, societies, cultures, and folk wisdoms relating with the uses from the natural resources differently. Therefore, the understanding of ways of life of the people in any community will be the benefits for the development plan for the development of the community efficiently.

From the above mentioned, researchers were interested in studying the contexts of Ban Tharsee Community at Kokaeo sub-district, Selaphum district, in Roi-Et province. This study will explore problems, needs, community potentiality as well as development methods of the Ban Tharsee Community leading to a strong community and sustainability based on the sustainable development according to Sanya Sanyawiwat (1997). That is to say: 1) target development, 2) following ten principles of development which are self-dependent, developing on a strong resource in the community, community participation, applying of local traditions as a focus point for development, reporting concrete outputs by using evaluation, co-operating with other sectors, active developing at the right problems, holding virtues on development, and using technology for the development, and 3) using the participatory action research as the way of development based on Amornwit Nakratan (1998). The findings from this research benefit for the government sector such as Kokaeo Sub-district Administrative Organization to organize a plan for local development based on the community potentiality as well as village leaders and villagers cooperate together to develop their community. According the research findings, there are five ways to improve the community as follows: economy, society, natural resources, infrastructure, and education. From these five ways, the people in the community are aware to manage by themselves in some ways and the other ways they need the help from local agencies and the government.
The Objectives of Research
1. To study the context of Ban Thrasee community, Kokaeo sub-district, Selephum District, Roi-Et province.
2. To study problems and potentiality of Ban Thrasee community.
3. To find ways to improve the potentiality of Ban Thrasee community leading to the unity and sustainability.

Materials and Methods

Research procedures
Step 1  Studying documents and researches included the history of community geography, environment, ways of life, politics, and government, relationships of organizations within the community, outstanding characteristics, and weak characteristics from the past up to the present time.
Step 2 Gathering the data by means of fieldtrip research concerning the community context by means of survey, interviews, observation, and small group discussions. The target groups of this research were community leaders, community committees, community presidents, community consultants, Mayor, Deputy Mayors, networking researchers, networking communities, and 50 people living in Ban Tharsee community.
Step 3 Performing small group discussions with the villagers to gather their problems, needs, community potentiality as well as ways of Ban Tharsee community development. After obtaining the rich data, the researchers conducted public hearing with the community as the way to check the validity of information and hold the seminar as the way to distributing the research results to the community.
Step 4 Conducting SWOT analysis from the data collected, concluded and produced the research report.

Data collection
1. Meeting with co-researchers and the community committees to make clear understanding with the plan.
2. Collecting the data concerning the community context by means of survey, interviews, observation, and small group discussions.
3. Analyzing the community potentiality by research team.
4. Conducting a discussion forum with the community as the way to check the information and distributing the research finding to the community.
5. Organizing a seminar.
6. Data analysis

Data Analysis
The statistics that was used to study the context of Ban Thrasee community, Kokaeo sub-district, Selephum District, Roi-Et province was content analysis. The researcher used SWOT analysis to study problems and potentiality of Ban Thrasee community as well as finding ways to improve the potentiality.

Results
1. From the context study, Ban Tharsee is a small village with 98 houses and 333 people (155 males and 178 female). Its area is 1500 rais, 1,395 rais for farming and 105 rais for living. Most of lands are plain and have natural rivers and brooks. It is located in the north of Selaphum district that is 20 kms from the district. Most of villagers are farmers, traders, livestock, and employers. Their part-time occupations are sewing at home, mushrooms farming, vegetable farms and planting the tapioca. There is one leader governing the village called Phoo Yai Ban. The village is divided into 3 parts. There is one primary school, one pre-primary development center, 1 primary health care, 1 Donglan Sub-district Health Hospital, 1 water supply tank, and 1 public morning new speaker. Ban Tharsee has important natural resources: 1 Tharsee forest, 1 Talaew brook, 2 public brooks. Thrasee villagers conserve the folk wisdoms: sewing bamboo, pan pipe etc. There are good traditions that have been practiced since their ancestors. They believe in Buddhism and follow the principles of the Buddha for their living. Every month of the year, they perform Buddhist ceremonies called Keedsibsong Kongsibsee traditions. Sawang Temple is the learning center and tourism and has the model of Phra That Phanom located for the worship of people.

2. Results of the analysis of problems and community potentiality were found as follows:
   2.1 Problems were found as follows: 1) low income but high living expenses, 2) insufficient water for the agriculture, 3) high investment for the agricultures and floods, 4) inefficient irrigation system, 5) the road damage, 6) teenagers not study, not attending any Buddhist activities, drug addicts and gambling.
   2.2 Community potentiality. The community strengths were found: 1) strengthened leaders, 2) unity within the community, 3) Keedsibsong Kongsibsee traditions are well followed, 4) career groups, 5) important
natural resources for the rice farms, 6) Tharsee forest, and 7) having the model of Phrathat Phanom as the learning center and tourism. The community weaknesses were found: 1) floods in some area in the rainy season, 2) irrigation system lacking its efficiency, 3) using the chemical fertilizers for the agricultures, 4) lacking of the conservation of natural resources, and 5) people do not see the importance of participating in career groups. Opportunities for the community were found that 1) having the natural resources that farmers can do the agricultures throughout years, 2) supporting people to participate in career groups, and 4) making the irrigation system for the agricultures. Lastly, threats of the community were found that 1) natural disasters such as flood, 2) irrigation system lacking of efficient management for the agriculture, 3) limited natural resources for the community, and 5) limited budget support from the municipality.

3. Ways to improve the potentiality of Ban Thrasee community leading to the unity and sustainability were found in five aspects as follows:

3.1 The ways to Economic development are as follows:
1) Supporting careers by training new knowledge continuously for the development of career groups, producing high quality goods for markets, and strengthening career groups by supporting people to participate in the career groups.
2) Supporting the community by planting vegetables within their home area and raises fish in the ponds. This way can make more incomes for the families and then people will not be dependent on others.
3) Providing good rice for planting
4) Producing non-chemical fertilizers for their own farms.

3.2 The ways to social development are as follows:
1) Career supports within the community.
2) Supporting to play sports as the exercise campaign.
3) Campaigning on the dangers of addict drugs by providing knowledge.

3.3 The ways of natural resources and environmental development are as follows:
1) Huitalei brook is the small river for the agriculture that cannot control its flow. So, the community suggested building the dam that can control and keep water by asking for the construction budget from the local administrative organization and the government.
2) Kwangton swamp is another river that cannot keep water throughout the year for the agriculture because the water hyacinths make the swamp shallow. So, the community suggested to dredge and expand the swamps’ bank.
3) The Chi River at some parts of its banks is swallowed; it should be dredged to keep water for the rice farms.
4) The public swamp is located in the north of Tharsee Temple. It is used for raising fish that the community catch it to cook on the special occasions. Now the area has 4 rais. So, the community suggested expanding the swamp from 4 rais to 8 rais as well as improving the environment surrounded to be the place for leisure. Between the temple and the swamp spare land that should be developed it as the community market.
5) Khok Tharsee forest is a rich forest where one source of foods and herbs is. There is the forest fire. So the community suggested building the barriers to protect of the forest from the fire and planting new trees to replace the damaged trees.
6) The duplicated Phra That Phanom is the learning center and tourism of the community. It is the ancient style stupa that is attractive visitors. It is located on the middle of the temple. There is annual festival to worship the stupa. However, there are many new buildings constructed surrounding it that its ground is lower. Therefore, the community suggested making the land equally throughout the temple.

3.4 The ways of development the infrastructure are as follows:
1) Improving, repairing and constructing road.
2) Expanding canals to supply water to the paddy field as well as providing the water pie under the ground to supply water.
3) Lifting water pathway project two kilometers long because of low water pathway that the water flowing is not smooth. If this project success it will be benefit for the community. This project had ever been supported from the government in 2009 that could solve the problem at some level.

5. The development ways of education, folk wisdom, religion and local tradition are as follows:
5.1 Campaigning teenagers to finish education at least grade 9
5.2 Providing new educational technologies for schools.
5.3 Training people to follow the values from their religion and culture.
5.4 Annual conducting Heedsipsong Kongsibsee tradition especially performing big activity in the fourth month tradition.
Conclusions and Discussions

This research can be concluded and discussed as follows:

1. The contexts of Ban Tharsee community: it is a small village in the area of 1,500 rais located in the north of Selephum district. The villagers are farmers and are dependent on the natural resources: forest, river, and brooks. There are two organizations: local health hospital and school. And people are adherent with the Buddhist traditions. From these findings, it can be discussed that Ban Tharsee community has the environmental contexts which support their living and they can stand on their feet. This finding is in line with the research of Thanat Kongsombat (2010) who found the environmental factors such as water, forest etc. have one of the main factors for self-dependent potentiality of any community.

2. The problems and potentialities of community were found that the community problems are to have insufficient water for the paddy farms, damaged road, and teenagers who do not attend the class, gambling, drug addicts, and not participation in the Buddhist activities. These findings can be discussed that there are some farms have no water for their farms except in the rainy season because the water supply does not cover to all areas. This problem is needed help from the local organization as well as the damaged road. For the youth issues, the community has the potentiality to solve. Therefore, people in the community should raise this issue for the discussion and find a way to solve it together. As analyzed by the SWOT technique, it was shown that the community has the traditional capital and vigorous leaders. They may use Sawang Temple in which is the Buddhist learning center of the community by performing attractive activities to induce the teenagers to participate. In addition, the Weaknesses and Threats will not be found any barriers for introducing them to learn Buddhism from attending Buddhist activities.

3. The research findings were found that there are five ways to support the community to become vigorous and sustainable: economy, society, natural resources and environment, infrastructure, and education, wisdom, religion and local traditions. From these findings, it can be discussed that the details of these five ways to develop the community focus on the weak points that they need to be solved. If these weak points can be solved, the community will become vigorous. When analyzing these five ways in-depth, the community can be done by themselves such as becoming career groups, planting vegetables and raising fish for reducing expenses and increasing incomes, conserving forests and rivers that are the natural resources as the source of foods and agriculture etc. For other ways, the community needs the help from outer sectors such as road construction, constructing the dam for keeping water etc. And for some ways the community and local organizations or other agencies can perform together such supporting people to follow 12 good values of Thai citizen, drug addiction campaign, planting trees etc.

Suggestions

Policy Suggestions

For the community potentiality development, there should be supported as follows:

1. The government sector should lay a policy based on the realistic information. The policy is laid in advance, the local development, therefore, is not at the point.

2. Kokaeo Sub-district Municipality is the nearest organization to Ban Tharsee community which is its responsible area. So, it should support the budget to the community continuously under for sustainable development.

3. Ban Tharsee Leaders have the major role in the community. They understand the problems and needs of their community and also follow the policy from the local organization. So, selecting honest leaders will lead to community development successfully.

4. The people in Ban Tharsee community are the stakeholders who will transform a policy into the concrete way of practice. The unity within the community is the way to success.

Further Research Suggestion

From the research findings, there are important natural resources in this community. So, there should be conducted a research on “The Comprehensive Community Strategic Plan Development of Tharsee Village.”
References


[3] Phanas Hueksunan et.al. (2006). Participatory Action Research of Community Member for the lively Community Development: A Case Study of Ratchaburi Province. Primary report for the self-directed community master plan at the 4th Region Health Promotion Center in co-operation with sharing experience of Prof.Dr.Alosara Chuchart. Bangkok: Educational Policy Research Center, Faculty of Education, Chulalongkorn University.


The Development of Teachers’ Instructional Techniques by Using Thinking Tools

Channarong Wisetsat
Roi Et Rajabhat University, 113, Moo 12, Roi Et Ponthong Road, Selaphoom, Roi Et 45120, Thailand
Telephone: 043-544741-3, Fax: 043-544744
E-mail: chanwi7@gmail.com

Abstract

The purposes of this research were to study the lesson plans by the application of Thinking Tools, to study the effectiveness index of the lesson plans, and to study the satisfaction with the lessons. 135 samples were the third year students majoring in Social Studies under the Educational College, Roi-Et Rajabhat University in the academic year 2013. The research instruments consisted of 10 Lesson Plans, Achievement Test with the discriminative power ranging from 0.28-0.96, and Satisfactory Questionnaire containing 12 items of question with the criminative power ranging from 0.47 to 0.76 and with total-deleted reliability at the 0.90. The statistics was percentage, mean, standard deviation, and effective index. The findings of this research were found that there were 10 lesson plans consisting of ten thinking ways: Key Question, Walk and Talk, Thing Pair Share, Round Robin, Mind Mapping, Jigsaw, Hug Thinking, Place Mats, Card and Chart, and Hot Ball. The lesson plans by the application of Thinking Tools had the effectiveness index at 0.80 values. Lastly, the third year students satisfied with the lessons by the application of Thinking Tools at the highest level.

Keywords: Lesson plan, Teaching technique, Thinking tools

Introduction

The most important thing for educational development is the teacher development because teaching is the transmission of body of knowledge to learners (Wichian Chaibang, 2015:2). National Education Act of B.E. 2542 (1999) laid down the principles and sections for the development of teaching professional standards, teachers development, teachers, instructors, and educational personnel in the section 52 as the Ministry shall promote development of a system for teacher and educational personnel, including production and further refinement of this category of personnel, so that teaching will be further enhance and become a highly respected profession. The ministry shall, in this regard, take a supervisory and coordinating role so that the instructions responsible for production and development of new staff and continually developing in-service personnel. It is also in the chapter IV section 20-23 on National Educational Guideline and in the Section 9 state the guidelines in organizing the system, structure, and process of education for teachers, administrations and schools in terms of focusing on individual learning and students entered development, students’ naturally potential development, long life-learning, learning at all places and all times, preparing contents according to students’ needs/ attitude/ individual differences, implanting desired characteristics, and learning with the real situation from experience, learning by doing. The most important thing, the teacher should stress on thinking (Tissana Khaemmanee, 2011: 56-57) because teaching by thinking with the application of Thinking Tools is the efficiently powerful way. This technique is a powerful tool that the teacher can direct learners to do any activities the teacher wants. Without these tools, the learners think on the way they are used to thinking that is nothing new one. The Thinking Tools were discovered and developed by Dr.Edward De Bono and these had been complemented for 20 years because of being the easy tool to use (Karasasnai Wangrangsim, 2011: 34-37).

The researcher had studies these tools from documents and researches concerning thinking tools: Key Question, Walk and Talk, Think Pair Share, Roundtable, Round Robin, Mind Mapping, Jigsaw, Wall Thinking, Place Mats, Card and Chart, Brainstorming, Hot Ball, Six Thinking Hat, Corner and Hug Thinking. These mentioned tools are implemented in Thai Education. Therefore, the researcher is interesting with these tools as the innovation for the development of the third year students’ thinking in Roi Et Rajabhat University. As hoped, this research will benefit for the student teachers and educational personnel who can apply these thinking tools for their teaching. Therefore, the objectives of this research were to study lesson plans by the application of Thinking Tools, to study the effectiveness index of the lesson plans by the application of Thinking Tools, and to study the satisfaction with learning by the application of Thinking Tools. The benefits from this research will get the effective lesson plans for the purpose of thinking development; the students in the Faculty of Education in Roi-Et Rajabhat University understand the process of teaching by the application of Thinking Tools, and Roi-Et Rajabhat University will be an academic center for training teachers on how to teach their students’ thinking.

Keywords: Lesson plan, Teaching technique, Thinking tools
Materials and Methods

1. Steps of research
   1.1 The researcher studied documents and researches concerning the Thinking Tools.
   1.2 The researcher determined the population as the third year regular students in the Education College Roi-Et Rajabhat University by means of the purposing selection.
   1.3 The researcher constructed the research tools that consisted of Lesson Plans, Achievement Test, and Satisfactory Questionnaire. These tools were approved by the specialists on language and subject matters.
   1.4 Checking the quality of the tools with the selected samples and they analyzing the reliability of each tool.
   1.5 The complete instruments were ready in implementation.
   1.6 Analyzing the data.
   1.7 Conclusion, discussion, and suggestion

2. Research Instruments
   2.1 10 lesson plans by the application of Thinking Tools.
   2.2 Achievement Test containing of 30 items of question.
   2.3 Satisfactory Questionnaire containing of 12 items of question.

Results

1. 10 lesson plans by the application of Thinking Tools for the third year students in Roi-Et Rajabhat University were found: Key Question, Walk and Talk, Think Pair Share, Round Robin, Mind Mapping, Jigsaw, Hug Thinking, Place Mats, Card and Chart, and Hot Ball. Students were interesting with the activities by the application of the Thinking Tools. Some students amazed with the activities and questioned many. The teacher asked back some questions to induce them to think about and then connected the questions with its answers. When the students finished all the lessons, they thought to implement these Thinking Tools for their students in the future for the purpose of teaching their young students by individuals, pairs, and groups.

2. The lesson plans had the effectiveness index at the 0.84 values. It indicates that the students’ knowledge increased from 84.12%.

3. The students’ satisfaction with the Thinking Tool lesson plans were at the highest level.

Conclusions and Discussion

1. The results of teaching according to lesson plans by the application of Thinking Tools with the third year students were found that 10 Thinking Tools lesson plans consisted of Key Question, Walk and Talk, Think Pair Share, Round Robin, Mind Mapping, Jigsaw, Hug Thinking, Place Mats, Card and Chart, and Hot Ball. In teaching according to the lesson plans, the teacher questioned the students to think for the purpose of thinking development by practicing thinking alone, pairs, and groups. After finishing all the lessons, the students were aware of thinking. They would implement these techniques for their teaching students in the future. This finding is in line with the research of Thampian Chumpolet at. (2013:69) who had researched on the results of teaching the practical skill by the application of Edward De Bono to develop the creative thinking and arts ability. He conducted with the students Grade 2. The objectives of his research were: (1) to study and compare the creative thinking of the students before and after studying the lesson, (2) to study the arts ability of the students Grade 2 who were learned from the application of Thinking Tools based on Edward De Bono. The research instruments consisted of lesson plans, Thinking Tools based on Edward De Bono, Creative Thinking Type A, Arts Ability Test. The samples from this study were 22 students of Grade 2. The findings were found that the students who learned from the Thinking Tools base on Edward De Bono had the pretest scores 55.88 or 58%, their posttest scores 77.04 or 80.26%, their creative thinking scores being higher than the pretest scores, their arts ability scores 12.33 or 77.05%.

2. The lesson plans on the teaching technique by the application of Thinking Tools had the effectiveness index at 84.12. This indicates that the students’ thinking ability had been developed or progressed in the better way. This is because Thinking Tools, as an innovation, can develop university students’ thinking ability effectively. This finding is in line with the research of Chayut Chumlachart (2009:63) who researched on the thinking development by using the teaching package. He conducted his research with the second year vocational students in the Commerce subject at Wanich Bussiness School. The objectives of his research were to develop the teaching package for the thinking development based on the Course I developed by Edward De Bono, and to compare their pretest and posttest scores concerning the ability of direct thinking at the point and thinking ability according to the Edward De Bono Course I. The Samples were the second year students.
majoring in the Commerce subject at Wanich Business School in semester 2 in the academic year 2004. The 51
volunteer samples obtained from the purposive technique. The students were divided into 2 groups: 12 students
were tried out to test the effectiveness of the instruments and the rest 39 students were experimented with the
Thinking Tools. The research instruments consisted of Thinking Tools Package based on Edward De Bono’s
Course I, and Thinking Test. The findings of this research were found that the thinking tool package can
develop students’ direct thinking at the point at the statistically significant difference at the 0.05 levels as well as
their thinking ability having increased of the scores significantly difference at the 0.05 level. Therefore, it can be
concluded in the basic fact that the lesson plans by the application of Thinking Tools can develop thinking skills
3. The third year students’ satisfaction with the skill developments by the application of Thinking Tools were at the highest level. This is meant that the students love to learn from thinking activities. It can be explained that
3.1 The activities of 10 lesson plans allow them learn by doing, questioning, and sharing. Throughout all of the lessons, they were fun and active with the activities. They were not bored with the learning activities.
3.2 During the process of teaching, the teacher stressed on the positive psychologies by using
admiring words such as saying good, very good, excellent, applauding, smiling, etc.. These manners were
friendly with them. In addition, the teacher played the low volume music during practicing the activities that
could make their relaxation during performing the activities.
3.3 Each plan, the teacher provided new, different, and multiple instruments for the students.
These findings are in line with the research of Jittima Akrathitipong (2009:48-53) who studies on the
fourth year regular students’ satisfaction with learning management for the Human Resource Development. Its
objectives were to study the satisfaction with the subject in terms of teacher, learning activities, and evaluation.
The research finding was found that the students satisfied with the contents, teacher, learning activities, and
evaluation at the highest level in the overall picture, and the aspect of learning supporting factors was at the
highest level.

Acknowledgements

This research was successful by having the support from the Research and Development Institute Roi-
et Rajabhat University, I, therefore, thank you for this opportunity. Thanks to Lamplaimat Pattana School and
thank you to Mr.Wichian Chaiyabang, the headmaster of Lamplaimat Pattanare School, who helped me
recognize the importance of thinking tools. Thanks to the expert in the research including Miss Sangchan
Kalam, Mr.somneang Joonserm, Miss wasanathai singhol and Mr.prasarn Sripongplerd whom checked my
research instruments, Counselled and suggested me some useful point for this research. Thanks to student
teachers at the Faculty of Education in Roi-et Rajabhat University who intended in learning to know the
thinking tools that will benefit fore their teaching in the future. Thank you to my family, my parents to
encourage and support this research, especially my wife who always encourage and help me collect the data.
Finally, I hope the teachers in school will benefit greatly from this research.

Reference

Resources Administration with the Teaching and Instruction of the Human Resources Development
Subject. Phranakhon Sri Ayutthaya RajabhatUniveristy.
[4] Thampian Chumpol et at. (.2013). The Results of Teaching e Practical Skills for the Students Grade 2 by
the Application of Edward De Bono to Develop the Creative Thinking and Arts Ability. KhonKhaen:
Khonkaen University.
Press. 2015.
The Teaching Plans Development for English Instructional Design Through Storytelling Approach on the Bachelor of English Education Students, Roi-Et Rajabhat University

Saengchan Kalam

Roi Et Rajabhat University, 113, Moo 12, Tumbol Khokaew, Amphur Selaphum, Roi Et Province 45120 Thailand
E-mail: chanpanya1917@gmail.com; Fax: 0-4355-6164

Abstract

The objective of this research were to 1) study the teaching plans development for English Instructional design through storytelling approach, 2) study the efficiency of teaching plans development for English instructional design through storytelling approach, 3) study the effectiveness index (E.I) of the teaching plans development for English instructional design through storytelling approach, and 4) study students’ satisfaction from using the teaching plans for English instructional design through story telling approach.

The target group was 65 students who were the 3rd year in English education program at Roi-Et Rajabhat University in academic year 2013. They were taught in the English instructional design through storytelling approach. Research design was the One Group Pretest-Posttest Design by having pre-experimental design treatment prior to the research.

The instruments consisted of: 1) The teaching plans for English instructional design through storytelling approach, 2) The test of designing teaching plans for English instructional design through storytelling approach, to assess learning competency. And 3) The satisfaction questionnaire of students who taught by the teaching plans development for English instructional design through story telling approach.

Findings were reported as the following:

1. The teaching plans development for English instructional design through storytelling approach was efficient at 82.43/92.16 which higher than the prescribed criterion at 80/80 respectively.
2. The effectiveness index (E.I) was found at 0.86 which higher than the prescribed criterion at 0.7
3. The students’ satisfaction was found in the highest level at mean value of 4.56 which higher than the prescribed criterion.

Keywords: Story Telling, Instructional design, Teaching plans Development

Introduction

Thailand is coming to become a part of ASEAN Community in 2015 by joining the same vision of ASEAN Community leaders as “building the ASEAN Community for higher competition, holding the same regulations among the nation, and people centered development”. For the strengthening of people to have an opportunity and facing with politics, economy, stability, and new threats, people can have bargaining power for working competition. They are happy and find a job easily. They are unity. In addition, there are 3 dimensions of cooperation: infrastructures, regulations, and transportation. Becoming the ASEAN Community, ten nations are becoming the “same family” that the people can be better in living, security, and trading. The ASEAN Community consists of the three pillars: ASEAN political security community, ASEAN economic community, and ASEAN cultural community. Because of the three pillars, government and private sectors as well as people must participate in political, economic, and cultural cooperation (Ministry of Foreign Affairs, 2013).

According to the National Education Act of B.E. 2542 (1999), Chapter 4 National Education Guidelines, Section 23-32--- these nine sections guideline for teachers, directors, and schools in organizing the learning process by emphasizing that all learners are capable of learning and self-development, and are regarded as being most important. The teaching-learning process shall aim at enabling the learners to develop themselves at their own pace and to the best of their potentiality, supporting long life learning at all place and in all times. On the subject matters, the approaches shall give emphases to knowledge, morality, learning process, and integration. Under the Section 23, there are five items stating on knowledge about oneself and society, scientific and technological knowledge and skills, knowledge about religion, art, culture, sports, Thai wisdom, knowledge and skills in mathematics and languages, and knowledge and skill in pursuing one’s career and capability of leading a happy life. In organizing the learning process, educational institutions should provide substance and arrange activities in line with the learners’ interests and aptitudes, individual differences, and local curriculum construction. All subjects shall achieve a balanced integration of subject matter, integrity, values, and desirables.
attributes, especially in long life learning, reading habit by learning from authentic situations and from the real practices, training in thinking process, training in doing research and continuous thirst for knowledge, training learners to create the ambiance, environment, instructional media, and facilities for their learning (Tissana Khaemmani et al., 2002: 56-57).

According to the Basic Education Core Curriculum B.E. 2551 (A.D. 2008) stated in the learning area that “in the present global society, learning foreign languages are very important and essential to daily life, as foreign languages served as an important tool for communicative, education, seeking knowledge, livelihood and creating understanding of cultures and visions of the world community. Foreign language enables learners to be aware of diversity of cultures and viewpoints in the world community, conductive to friendship and cooperation with various countries. They contribute to learners’ development by giving learners better understanding of themselves and others. The learners are thus able to learn and understand differences of languages and cultures, customs and traditions, thinking, society, economy, politics and administration. They will be able to use foreign languages for communication as well as for easier and wider access to bodies of knowledge and will have vision in leading their lives. Learners enable to acquire favorable attitude towards foreign languages, the ability to use foreign languages for communicating in various situation, seeking knowledge, engaging in a livelihood and pursuing further education at higher levels. Learners will thus have knowledge and understanding of stories and cultural diversity of the world community, and will be able to creatively convey Thai concepts and culture to the global society. The main contents include: language for communication, language and culture, language and relationship with community and the world” (Ministry of Education, 2008: 210-211). Therefor, the Bachelor of Education Program in English in Roi Et Rajabhat University is aimed related to the Ministry of Education and the National Education Act of B.E. 2542(1999) at teaching bachelor students as a professional teacher with the excellence in English accepted from local areas and in the nation, developing personnel in the local areas and in the country to use English for communication, invoking youth to be aware of English reading habit, observing the good virtues according to the Thai culture (Education College, 2008). The bachelor of English education should know how to apply the English instructional design into the classroom. There are many ways to design in English teaching, such as using integrated approach, cooperative approach, communicative approach, as well as teaching English through storytelling approach.

Storytelling is one kind of literatures that children like listening to such as animals, adventures etc. They like pictures and contents (Paiwun Intanil, 1991). The benefits of storytelling for the children are to learn new vocabularies, building creativity, imagination, and creativity that they can make a storytelling by their own. Paipun Intanil (1991 cited in Saengchan Kalam, 2008:3) suggested the activity to support creativity that there are many activities to train students to have creative thinking; namely, reading, writing, thinking, imagining, from the story they had known before. They should be trained in thinking skills as rapid thinking, fluent thinking, multiple thinking, new thinking, and prudent thinking with learning by doing. In addition, Chiwan Wisasa (Arurat Hemanuk, 2012) stated reading is the basic skill for everyone who should be trained. Learning from reading a storytelling, often reading louder for the children to listen to is an easy and powerful way for the development of their imagination, creativity, meditating. Only 10-15 minutes a day of reading a storytelling to the children, it makes good relationship among family members because the children learn language, sounds, and words that mix with love and arts from a book they see. It also develops the personality and emotion as well as social skill. It can protect the children from game addiction or peer addiction. They can avoid any kinds of bad things when they grow up. They will become happy in reading habit.

From the above mentioned, learning the foreign language from a storytelling, it can practice listening, speaking, reading and writing skills as well as developing the creativity and imagination. Therefore, the application of storytelling in teaching English for the primary school students is suitable for their age. The bachelor students should learn to know how to design attractive storytelling for their students in the future. This way will be suitable technique that university instructors should teach their bachelor students who will become the teacher.

**Objectives of the Study**

1. To study for the teaching plans development for English instructional design through storytelling approach on the bachelor students of English Education;
2. To study the efficiency of teaching plans development for English instructional design through storytelling approach on the bachelor students of English Education;
3. To study the effectiveness index (E.I) of teaching plans for English instructional design through storytelling approach on the bachelor students of English Education;
4. To study the students’ satisfaction from using the teaching plans for English instructional design through storytelling approach.
Materials and Methods

Materials
The materials consisted of:
1. The teaching plans for English instructional design through storytelling approach.
2. The test of designing teaching plans for English instructional design through storytelling approach, to assess learning competency.
3. The satisfaction questionnaire of students who taught by the teaching plans development for English instructional design through storytelling approach.

Hypotheses of the Study
1. The efficiency of teaching plans for English instructional design through storytelling approach for the third year bachelor students of English Education in Roi-Et Rajabhat university is more than 80%;
2. The effectiveness index of teaching plans for English instructional design through storytelling approach for the third year bachelor students of English Education in Roi-Et Rajabhat University is more than 0.7;
3. The students’ satisfaction from using the teaching plans development for English instructional design through storytelling approach is at the satisfaction level or higher.

Methods (Research Procedures)
The research procedures had been done as follows:
1. Research methodology. This research is the pre-experimental research in form of One Group Pretest-Posttest Design (Paisarn Worakham, 2012: 136).
2. Sample. The sample of this research obtained from the purposive sampling technique was the third year bachelor students of English Education amount 65 students, the academic year 2013 in Roi-Et Rajabhat University.
3. Research instruments consisted of three kinds as follows:
   3.1 Five teaching plans for English instructional design through storytelling approach.
   3.2 Three instruments to test the competency learning about the teaching plans for English instructional design through storytelling approach.
   3.3 Satisfaction Questionnaire with the teaching plans for English instructional design through storytelling approach.
4. Research instrument constructions were as follows:
   4.1 The teaching plans were constructed as follows:
   1) Studying theories, concepts, principle from documents and researches concerning the construction of teaching plan for English instructional design through storytelling approach.
   2) Studying the Bachelor of Education Program in English (5 years) improved in 2013 under Education College, Roi Et Rajabhat University concerning goals, missions, and visions.
   3) Drafting five teaching plans for 40 hours by the application of storytelling.
   4) Trying out the teaching plans that were approved by specialists with 41 students who are the fourth year bachelor students of Education Program in English as a way of checking the suitability of teaching plans.
   5) Approving the teaching plans for better conducting activities in the classroom.
   6) The complete teaching plans were ready in use for the experiment.
   4.2 Three instruments to test the competency learning about the teaching plans for English instructional design through storytelling as mentioned in item 3.2 were administered with the third year bachelor students of Education Program in English under the Education College in Roi Et Rajabhat University. These instruments were the rubric scoring to assess the students’ learning competency; namely, the first instrument is the Evaluation Form of Competency Design of the Teaching Plan, the second set is the Evaluation Form of Teaching Plan Suitability that this the analysis of the relationships of contents, standards and indicators, and English instructional design through storytelling, and the last set is Achievement Test that is the essay test about teaching plans for English instructional design through storytelling. The steps of instrument construction were as follows:
   1) Studying theories, concepts, principle from documents and researches concerning the construction of teaching plan for English instructional design through storytelling.
   2) Determining the cognitive domain for the test of teaching plan’s English instructional design through storytelling.
   3) Constructing the test according to the cognitive domain as mentioned in the sub item 2).
4) Trying out the teaching plans with 41 students who are the fourth year bachelor students of Education Program in English and had enrolled in this subject before as a way of checking its suitability of the time for teaching plan.
5) Approving the three instruments.
6) Achievement Test that is the essay test was tried out as mentioned in the sub item 4) and then was calculated for the reliability. The Achievement Test contained 0.6 value of total reliability.
7) Improving the Achievement Test again before using.
8) The test was ready in use for the experiment as performed at the end of teaching of all plans.

4.3 The construction of Satisfaction Questionnaire was as follows:
1) Determining the objectives of the Satisfaction Questionnaire.
2) Studying the theories concerning the satisfaction with learning activities which were found four aspects: instructor, contents, learning processes, benefits. There are 17 items of questions based on Likert-type scale (Vagias, Wad M., 2006)
3) The Satisfaction Questionnaire was tried out with the fourth year bachelor students as mentioned in item 4.2 to check its language accuracy.
4) Improving the Satisfaction Questionnaire after trying out, it was ready in use with 65 samples who were the target group for this pre-experimental research. The criterions for interpreting the scale were given according to Boonliang Thumthong (2012: 198-199)

5. Data Collection was operated as follows:
5.1 Five teaching plans for English instructional design through storytelling approach were administered to collect the data in the classroom.
5.2 Before teaching according to the plans, students were tested their knowledge and after finishing the five plans they were tested again by using the same test.
5.3 After finishing the five teaching plans, students evaluated their satisfaction with teaching plans for English instructional design through storytelling approach.

6. Data analysis was operated as follows:
6.1 Analyzing the efficiency of teaching plans for English instructional design through storytelling approach was use E1/E2 that its efficiency criterion was not less than 80%.
6.2 Analyzing the effectiveness index of teaching plans for English instructional design through storytelling approach was use E.I that its effectiveness index is not less than 0.7
6.3 Analyzing the students’ satisfaction with the teaching plans for English instructional design through storytelling approach was used mean (X) that the criterion is given at not less that level 4 (satisfaction).

Results

The results of this research were finding as follow:
1. The teaching plan for English instructional design through storytelling approach for the third year bachelor students of English Education under the Education College in Roi Et Rajabhat University had five steps based on the communicative approach as follows:
   Step 1  Warm up
   Step 2  Presentation
   Step 3  Practice
   Step 4  Production
   Step 5  Wrap up

   The teaching plans got the efficiency 82.43/92.16 and got the effectiveness index 0.86. The students satisfied with the teaching plan at the Very Satisfactory level (level 5) as shown in the next items.
2. The efficiency of teaching plan for English instructional design through storytelling approach was more than the prescribed criterion 80/80 as shown in the tables 1-3.
Table 1 Means of students’ posttest scores learning from teaching plan for English instructional design through storytelling approach

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Full scores</th>
<th>Test Scores</th>
<th>Mean</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>1,600</td>
<td>24.6</td>
<td>82.0</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>812</td>
<td>12.5</td>
<td>78.2</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>1,459</td>
<td>22.4</td>
<td>74.6</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>867</td>
<td>13.3</td>
<td>83.1</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>805</td>
<td>12.4</td>
<td>77.5</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>1,571</td>
<td>24.2</td>
<td>80.6</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
<td>819</td>
<td>12.6</td>
<td>78.7</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>1,615</td>
<td>24.8</td>
<td>82.6</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
<td>1,213</td>
<td>18.6</td>
<td>93.0</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>606</td>
<td>9.3</td>
<td>93.0</td>
</tr>
<tr>
<td>Total</td>
<td>214</td>
<td>11,367</td>
<td>174.7</td>
<td>82.43</td>
</tr>
</tbody>
</table>

Form the table 1 was found that students’ pretest scores from ten exercises had means 174.70 from the full scores of means 214, estimating 82.43%. That is to say the effectiveness of learning is 82.43%.

Table 2 Pretest-Posttest Scores of the teaching plans from English instructional design through storytelling approach

<table>
<thead>
<tr>
<th>Competency Design of the Teaching Plans</th>
<th>Full scores</th>
<th>Means</th>
<th>Percents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>24</td>
<td>10.06</td>
<td>41.91</td>
</tr>
<tr>
<td>Posttest</td>
<td>24</td>
<td>22.12</td>
<td>92.16</td>
</tr>
</tbody>
</table>

From the table 2 was found that students’ pretest scores were 10.06 of means or 41.91% and their posttest scores was increasing 22.12% of means or 92.16%. This is meant that the students’ efficiency learning outcomes (E2) were 92.16%.

Table 3 Efficiency scores of the teaching plans from English instructional design through storytelling

<table>
<thead>
<tr>
<th>Scores</th>
<th>Full Scores</th>
<th>Mean</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises after learning</td>
<td>214</td>
<td>174.7</td>
<td>82.43</td>
</tr>
<tr>
<td>Achievement Test for design competency of the teaching plan</td>
<td>24</td>
<td>22.12</td>
<td>92.16</td>
</tr>
</tbody>
</table>

From the table 3 was found that students’ mean scores of all exercises (formative assessment) were 174.70 or 82.43% and their means from the Achievement Test (summative assessment) were 22.12 or 92.16%. These results show that the efficiency of the third bachelor students’ teaching plans from English instructional design through storytelling approach was 82.43/92.16 which are higher than the prescribed criterion as given at 80/80.

3. The effectiveness index (E.I) of the teaching plans from English instructional design through storytelling approach

The analysis of effectiveness index (E.I) of the teaching plans from English instructional design through storytelling approach is shown in the table 4.
Table 4 Numbers and means of the effectiveness index scores of the teaching plans from English instructional design through storytelling approach

<table>
<thead>
<tr>
<th>Sum of pretest scores</th>
<th>Sum of posttest scores</th>
<th>Numbers of students</th>
<th>Full scores</th>
<th>Numbers of students x Full scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>654</td>
<td>1,438</td>
<td>65</td>
<td>24</td>
<td>1,560</td>
</tr>
</tbody>
</table>

From the table 4 was found that the effectiveness index was calculated as follows:

\[ E.I = \frac{P_2 - P_1}{Total - P_1} \]

\[ E.I = \frac{1,438 - 654}{1,560 - 654} \]

\[ E.I = 0.86 \]

Therefore, the effectiveness index of teaching plans from English instructional design through storytelling was 0.86 that is higher than the prescribed criterion as given at 0.7. This is shown that the students’ knowledge increased according to learning from the teaching plans from English instructional design through storytelling approach.

3. The satisfaction of students with teaching plans from English instructional design through storytelling approach

Students’ satisfaction with the teaching plans are shown in the table 5.

Table 5 Means of students’ satisfaction with teaching plans from English instructional design through storytelling approach

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Mean</th>
<th>Satisfactory Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>4.54</td>
<td>Very satisfactory</td>
</tr>
<tr>
<td>Contents</td>
<td>4.54</td>
<td>Very satisfactory</td>
</tr>
<tr>
<td>Learning activities</td>
<td>4.56</td>
<td>Very satisfactory</td>
</tr>
<tr>
<td>Benefits</td>
<td>4.61</td>
<td>Very satisfactory</td>
</tr>
</tbody>
</table>

From the table 5 is found that students satisfied with the English teaching plan design through storytelling at the very satisfactory level arranging in order of means as follows: benefits, learning activities, instructor, and contents respectively.

Therefore, the satisfaction of students with the English teaching plan design through storytelling was at the highest level that is higher than the prescribed criterion.

Conclusions and Discussion

1. Conclusions

1.1 The teaching plans from English instructional design through storytelling approach for the bachelor students of English education, Roi-et Rajabhat University had 5 steps based on the communicative approach as follows:

Step 1 Warm up
Step 2 Presentation
Step 3 Practice
Step 4 Production
Step 5 Wrap up

1.2 The efficiency of teaching plans from English instructional design through storytelling approach was 82.43/92.16 that is higher than the prescribed criterion 80/80.

1.3 The effectiveness index (E.I) of teaching plans from English instructional design through storytelling approach was 0.86 that is higher than the prescribed criterion 0.7.

1.4 Students satisfied with learning activities from the teaching plans through storytelling approach were at the very satisfactory level (highest level) that is higher than the prescribed criterion.
2. Discussions

This research is the development of teaching plan from English instructional design through storytelling approach of the third year bachelor students of English education under the Education College, Roi- et Rajabhat University. There are some points for discussion as follows:

2.1 The teaching plans from English instructional design through storytelling approach had five steps: warm up, presentation, practice, production, and wrap up, got the efficiency 82.43/92.16, and got the effectiveness index 0.86. This findings are in line with the research of Saengcham Kalam (2008) who studied the English creative writing by using the communicative approach through the storytelling. The finding was that 24 students had ability in English creative writing, estimating 83% of students in total. This finding was concluded that students can develop their skill more than the prescribed criterion 75%. Therefore, the teaching plans from English instructional design through storytelling based on the communicative approach have the efficiency for the development of English literacy.

2.2 The teaching plans from English instructional design through storytelling had the effectiveness index 82.34/92.16 that is higher than the prescribed criterion as given at 80/80. This finding is in line with the research of Monwipha Seniwong Na Ayutthaya (2002) who studied the development of storytelling for the writing development for Phrathom 5 students in Bangkok Christian College found that the teaching plan had the efficiency 93.10/82.24 being higher than the prescribed criterion as well as their satisfaction was in the better way.

2.3 The effectiveness refers to the results of higher learning achievement as studied from the teaching plan. This research found the effectiveness index 0.86 that is higher than the hypothesis given at 0.3. This finding is in line with the research of Dolawan Phuangwiphak (2011) who studied learning outcomes and retention of English vocabularies as studied form electronic book in English stories. It was found that the posttest scores were higher than the pretest scores statistically significant difference at 0.05 level. It was also in line with the research of Mumontha Wongsawat (2008) who studied the application of story as a way of listening skill development for Pathomsuksa 5 students at Prathomnonsee School, Bangkok, that was found students as target sample had listening skill higher than before the experiment statistically significant difference at 0.01 level.

2.4 Students satisfied with learning from the teaching plans from English instructional design through storytelling at the very satisfaction (\( \bar{x} = 4.53 \)) that is higher than the criterion given at the satisfactory level. This finding is in line with Dolawan Phuangwiphak (2011) who studied learning outcomes and retention of English vocabularies as studied from electronic book in English stories for Pathomsuksa 5 students that were found students satisfied with the learning activities as designed in the teaching plan at the satisfactory level.

Acknowledgements

Thank you to Roi Et Rajabhat University that supports the budget for this research. Thank you to Assist.Prof.Dr. Kochaporn Namnaphol, Vice Director of Research and Foreign Relations, and her colleges to consult me on research. Thank you to the personnel at the Research and Development Institute Roi Et Rajabhat University for providing facilities of doing this research. Thank you Assist.Prof. Theerasak Dakaew, Vice Director of Student Affairs and Culture who gave me knowledge on the knowledge management, classroom management and giving me documents. Thank you to Dr.Saksri Suebsing, Director of Research and Development, who helped me in doing this research. At last but not at least, I thank you to lectures and personnel at the Education College who facilitated me in doing this research as well as thanks to the third year bachelor students of English education who participated in this research.

References


The Development of E-Learning on Microteaching for Practical Teaching Skill in Industrial Education

Wilaiwan Wongjinda

Lecturer of Technical Education, Faculty of Industrial Education, Rajamangala University of Technology Suvarnabhumi Thailand
E-mail: wilaiwan.wongjinda@gmail.com

Abstract

E-learning is an emerging tool that uses advanced technology to provide training and development in industrial education and teacher training. Its rapid growth has been facilitated by the innovational technology and the massive opportunities in global education. The objectives were; (1) to develop an e-learning on Microteaching for practical teaching skill, (2) to compare learners’ learning achievement in both and experimental group and a control group, and (3) to explore students’ attitudes toward learning through e-learning. The sample group was 40 students who were registered in the first semester in the academic year 2014, Faculty of Industrial Education at Rajamangala University of Technology Suvarnabhumi. The results revealed that the efficiency of the e-learning was 83.30/80.20 which was higher than criteria set 80/80. The students’ achievement test of experimental group was higher than the control group. The mean of learners’ attitudes was at good level. Therefore, the e-learning could be used for training industrial teacher.

Keywords: E-learning, Microteaching, Industrial education

Introduction

The World Wide Web has fascinated the academic institutions around the world and provided a potential for a new medium to deliver courses to people, who live far away from the institution, in the form of the text, audio and video without the need of adding new buildings or hiring new instructors (Malalla 2004). The majority of the academic institutions accepted e-Learning as an alternative to the traditional classroom teaching without any stiff resistance. The acceptance rate was very fast, rapid and widespread (Malalla 2004).

As e-learning is emerging as the new paradigm of modern education, used advanced technology to provide training and development in industrial education, its rapid growth has been facilitated by the innovational technology and the massive opportunities in global education. E-learning has become one of the powerful supporting tools which have diversified the traditional context of learning in colleges. Students can engage in self-directed learning and learning resources can be repeatedly used. On the other hand, e-learning provides flexible learning material and consistent information. The learning content is easy to update with the rapid development of technology, the Internet as a delivery platform has motivated colleges to invest their resources on developing online programs (Islas 2004).

Microteaching was originally created in the early 1960s at Sanford University as a type of scaled-down simulation activity to help teacher candidates learn to teach (Allen, 1967). It was designed as a brief but structured practical experience in which prospective teachers would begin to bridge the theory-practice gap by planning and presenting a 5 to 10 minute lesson, in which they were to apply specific instructional skills or tasks previously studied in class (Allen & Eve, 1968). Teacher candidates conducted the microteaching episode before a small group of their peers, which was typically recorded for subsequent viewing, refection, and evaluation by the teacher candidate, her/his peers, and the course mentor/instructor (Edvin, 2014: Trott, 1976)

The literature related to this topic demonstrates that all the academic institutions as well as industry is implementing e-learning in every field at a very fast pace. Researcher from various fields have been trying to find out the effectiveness of e-learning and focused on technology-based components of e-learning system (Liaw S 2007). The individual assessment frameworks comply with the needs only partially. Students’ e-learning system consists of many subsystems, such as personal factors, technical environment, and social environment. Without a multi-level analysis, it is not possible to grasp a comprehensive view of applications of e-learning in college from the system perspective. After reviewing literature associated with e-learning (Ozkan and Koseler 2009) proposed that systematic and multi-level consideration of evaluation of e-learning system is necessary and considering the social issues, the socio-technical system approach adopted in (Kontoghiorghes 2004) should be employed.

For microteaching, Ambill (2012) describes microteaching as an efficient learning technique for effective teaching. Learning is a change in behavior, which is brought about by activity, training, or
experiencing at any age. When the learner is more experienced, learning becomes more effective; the most important quality of the participants of microteaching sessions is the ability to give and receive constructive feedback with an open mind and achieves appropriate teaching and learning goals.

Therefore, the researcher realizes the advantages of using the computer program and internet for learning and teaching on microteaching for practical teaching skill in industrial education at Rajamangala University of Technology Suvarnabhumi.

**Objectives of the Study**

1. To develop the e-learning on microteaching for practical teaching skill
2. To compare learning achievement of learners in both and experimental group and a control group, and
3. To explore students’ attitudes toward learning through e-learning on microteaching for practical teaching skill

**Methodology**

As quasi experimental design, with both quantitative and qualitative data analysis which include two groups: the control and the experimental group. The populations were 40 learners who were registered microteaching in the first semester in the academic year 2014 Department of Industrial Education at Rajamangala University of Technology Suvarnabhumi. Instruments of the study were (1) E-learning on Microteaching, (2) Students’ learning achievement test, and (3) Attitude Questionnaire.

The data collection procedures; after both groups were established, the learners assigned to the control group were invited on a pre-set day to attend a traditional lecture about topic. The lecture was held in the same classroom. The author, who had adequate teaching experience, delivered the lecture, which employed a PowerPoint presentation format. Before the lecture, all subjects were requested to perform a pre-test on unit. After the lecture, learner requested to perform a post-test on unit.

Those in the experimental group were studied via the e-learning program. The program provides information about to present on microteaching by video about teaching skill, along with clear definitions, and high quality images on the topic. The learners in this group were requested to complete the pre-test and post-test on the topic. All the answers from the pre and post training exercises were emailed to the researcher. Both types of training contained the same material, including texts, photographs and exercises, and took about one hour to complete. The pre-test, the learning sessions and the post-test were performed one after another in each group.

The data obtained from different methods was analyzed and interpreted in quantitative data analysis. The data obtained from the pre-test and post-test and attitude questionnaire. The statistical analysis of data included mean, Standard Deviation (SD), t-test independent

**Result and Discussion**

1. The results of develop an e-learning on microteaching for practical teaching skill

<table>
<thead>
<tr>
<th>Trial</th>
<th>Efficiency of process ($E_1$)</th>
<th>Efficiency of results ($E_2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>70.55</td>
<td>65.00</td>
</tr>
<tr>
<td>Small Group</td>
<td>80.25</td>
<td>78.50</td>
</tr>
<tr>
<td>Field</td>
<td>83.30</td>
<td>80.20</td>
</tr>
</tbody>
</table>

The e-learning on microteaching had efficiency at the level 83.30/80.20 which met the specified criteria 80/80. This was because the e-learning was completely developed in three: an individual, a small group, and a field trial. For each step, the researcher could see both good and bad points. Thus, every step of trying out helped to develop the e-learning. It might be that students were interested in doing exercises on the lesson and checked their answers with immediate feedback. Besides, the post-test had more difficulty than exercises; therefore, the efficiency of the outcomes was lower than the efficiency of the process.

2. The results of comparing learning achievement for both groups

<table>
<thead>
<tr>
<th>Method</th>
<th>N</th>
<th>Mean</th>
<th>Std.Dviation</th>
<th>Std.Error mean</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>20</td>
<td>19.05</td>
<td>4.097</td>
<td>0.916</td>
<td>6.818</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>17.10</td>
<td>3.892</td>
<td>0.870</td>
<td></td>
</tr>
</tbody>
</table>

Comparing learning achievement for both groups showed that the experimental group had a higher average post-test score than the control group with a statistically significant difference at the 0.01. The might be
due to the fact that learners had more of a chance to learn collaboratively and help and support their friends. However, when comparing the learning achievement of learners in the experiment, it was found that the average post-test score was not very high. One explanation for this was that each learner had different learning ability. Since there were detailed unit and lots of practices and exercises on the e-learning, learners may have needed more time understanding and training.

3. Results of learners’ attitudes toward learning through e-learning for practical teaching skill demonstrated that had good attitudes toward learning though e-learning (X = 3.80). Considering for each item, it was revealed that learners through the topic was interesting (=4.30). The learners enjoyed learning, agreed that learning the topic through e-learning, and helped them understand the lesson (=4.10). Beside the learners also agreed that learning through e-learning for practical teaching skill was not difficult, and learner did not get worried (=3.50). The attitudes toward learning using the e-learning were generally positive. It was interesting to note that this mode of learning and teaching might affect learners’ attitudes because it promoted interaction between both learners to learners, and learners to teacher.

Conclusion

This study can be summarized as follows.

1. The efficiency of the e-learning on microteaching was 83.30/80.20, which met the prescribed criterion 80/80 level.
2. The learning achievement of learners in the experimental group was higher than those of learners in the control group with statistically significant differences at 0.01.
3. The students had good attitude toward learning through the e-learning for practical teaching skill Industrial Educator at Rajmangala University of Technology Suvannabhumi have inadequate B.Sc.Ed.(Tech) classification skill. Although both traditional method and experimental method that using e-learning programs as type of teaching skill shows potential as an organized, flexible, and dynamic technique.

Acknowledgement

This study was funded by Faculty of Industrial Education. The author, Therefore acknowledge with Head of Faculty for promoting.

References

Development of the Science Process Skills Development (SPSD) Kit for Science Teachers in the Primary Schools in Roi-Et Province

Saksri Suebsing
Director of Research and Development Institute, Roi Et Rajabhat University, Thailand

Abstract

The objectives of this research were aimed to 1) develop the science process skills development (SPSD) kit for teachers in the primary schools in Roi-Et Province, 2) assess the efficiency of the SPSD by using the standard criteria 75/75, 3) compare the efficiency among subjects in Roi Et province by using Purposive Sampling Method. 150 subjects were drawn to the study. Findings had shown that the kit yield higher efficiency level at 83.62/95.38 comparing to intended criteria 75/75. Effectiveness between pre-test and post-test was significantly higher with statistics confidence level at .01

Keywords: Science, Skills, Primary schools, Roi-Et, Teacher

Introduction

Education in the current era has emphasized on the basis of “Learn How to Learn”. Learners are encouraged to construct self-knowledge independently. Therefore, learning management has to develop learners to communicate what they know to the world effectively. They are expected to know on the scientific approach by using science and technology to explore knowledge. Learners are also need to know how to adapt themselves with community and society. The above idea has congruent with Thailand National Educational Act B.E, 2542 (1999) which stated that learning should be centered on learners needs and science should be part of learning process. Moreover, the learning process had to develop Thai citizens to be the completed people in all aspects: body, mind, intelligence, moral, ethics, and culture. The main aim of learning management is emphasized on encouraging every learner to obtain knowledge and to develop their competency. Development of learners is the process of natural learning by allowing them to explore all aspects. Science education is one ways to encourage learning competency. Science teachers are the people who important to support cognitive competency and imagination of the students to use for scientific knowledge enquiry. The learners also learn how to create value from learning process they conducting. The effective science education is truly relied on development of learning skills.

The scientific mindset is necessary for science teachers. They have to ponder in their mind to reach the blind area of knowledge where they recognize their unknown knowledge. Eventually, they will try to think for answer to create wisdom. Teachers can adopt many quality lesson plans but it is more important to decide to adopt the available options. Quality science education depends on teachers’ endeavor to emphasize on science knowledge, scientific process, and scientist mindset. After each lesson, teachers are encouraged to review their instruction in order to reflect the effectiveness of science education. Importantly, science education is the crucial contribution to national development from scientific mind citizens.

Materials and Methods

1. Population and Sampling
   1.1 Population was 9,876 teachers who taught in the primary school in Ro Et province during the 2013 academic year.
   1.2 Samples were 150 teachers selected by the Purposive Sampling Method.

2. Research Tools
   2.1 Science process skills development (SPSD) kit for 13 sets.
   2.2 Test booklet pre-training and post-training consisted of 65 multiple-choice questions.

3. Data collection
   3.1 Duration of using the SPSD kit was one semester in the 2013 academic year, between July 3rd-31st, 2013. There were 13 sessions of SPSD kit usage excluding pre-test and post-test session.
   3.2 Pre-test was conducted for 1.30 hour by 65 multiple-choice questions on 65 subjects.
   Score was recorded for data analysis.
   3.3 Training on SPSD kit for 13 sessions by all 150 samples. Before and after every training session, there was a test for SPSD kit using.
3.4 After 13 training sessions, the pre-test was re-taken for data collection.

4. Data analysis
   4.1 Using the statistical software package to analyze pre-test scores, post-test scores. Statistics obtained were mean (x), standard deviation (S.D.) and t-test at .01 statistics significance.
   4.2 Analyzing efficiency of the SPSD kit by 75/75 standard criteria, using mean (x), standard deviation (S.D.), and percentage (%).
   5. Statistics for data analysis were: mean (x), standard deviation (S.D.), percentage (%), and t-test.

Results

1. The efficiency of the SPSD kit was higher than the criteria of 75/75 which yielded 83.62/95.38 at shown in Table 1.

Table 1: The efficiency of SPSD kit according to 75/75 criteria

<table>
<thead>
<tr>
<th>Item</th>
<th>Student (n)</th>
<th>Total score</th>
<th>x</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score taken from each SPSD session</td>
<td>100</td>
<td>10</td>
<td>8.36</td>
<td>83.62</td>
</tr>
<tr>
<td>Score of proficiency test after training session</td>
<td>100</td>
<td>65</td>
<td>61.24</td>
<td>95.38</td>
</tr>
</tbody>
</table>

2. Comparison of pre-test and post-test proficiency from using the SPSD kit was a difference at .01 significance level.

Table 2: Comparison of the pre-test and post-test score of scientific process skill development

<table>
<thead>
<tr>
<th>Test</th>
<th>Student (n)</th>
<th>x</th>
<th>S.D.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>100</td>
<td>33.88</td>
<td>3.12</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>100</td>
<td>61.24</td>
<td>1.36</td>
<td>86.55**</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

1. Efficiency of the SPSD kit had an efficiency level at 83.62/95.38 which was higher than the 75/75 criteria. This result was congruent with Somprom’& study (2007) study that his SPSD kit (unit on daily substance) for the 6th grade students yielded efficiency at 89.53/94.96 higher than the 80/80 criteria. Also Kambangpai’& study (2007) study from the SPSD kit on chemical substance for the 5th grade students, it yielded efficiency result at 75/75.

2. Amparity comparison the efficiency test between pre-test and post-test scores were significantly difference with statistics confidence level of .01. The result was congruent with Somprom’& study (2007) study which compared the teaching by SPSD and by traditional method of the 6th graders. It found that the result yielded higher efficiency at .01 confidence level. Kambangpai’& study (2007) study reported that her 5th graders had shown the same result at .01 confidence level. Lastly, Saengchompoo’& study (2006) study had shown the same result from his 7th graders for a higher level.

Acknowledgements

1. Teachers who wish to use the SPSD kit for their science classes need to study procedures completely for their efficient instruction and meet the full capacity of the kit.

2. The SPSD kit should have been used on other class of students beside the primary school. The benefit can enhance the science skills and learning management.

References


The Practicum Outcome of Pre-Service Teacher Students Majoring Biology in Education Program of Rajabhat Maha Sarakham University

Watchara Senajuk

Faculty of Education, Rajabhat Maha Sarakham University,
Thailand
E-mail: mylove_2547@hotmail.com

Abstract

The purpose of this research was to examine opinion of university’s schools network toward pre-service teacher students in Biology major. To examine six aspects of comments and suggestions from schools that accepted pre-service teacher students such as 1) Developing Morality and Ethics 2) Knowledge 3) Cognitive Ability 4) Interpersonal Relationship and Responsibility 5) Numerical Analysis, Communication, and Information Technology and 6) Learning Management. The samples group consisted of 98 mentor teachers in 98 network schools that had 130 teacher students in the second semester of the academic year 2014 majoring in Biology at Faculty of Education, Rajabhat Maha Sarakham University. The research instrument was 5-rating scale questionnaires for mentor teachers. The statistics used in analyzing data for this research were mean and standard deviation.

The results of this research were as follows:
1. Positive opinion regarding attributes of pre-service teacher students, in overall, was rated at the high level (4.38). For the individual aspects, the aspect holding the highest level of positive opinion were Developing Morality and Ethics, Interpersonal Relationship and Responsibility, while the other aspects were rated at the high level.
2. Suggestions toward attributes of pre-service teacher students were there should be a research investigating obstacles and problems in pre-service teacher students in a more comprehensive aspects to get in-depth understanding on this issue and brought about the knowledge for improving the practicum system and eventually revising the curriculum.

Keywords: Practicum outcome, Teachers, Student, Biology, Education

Introduction

Teacher plays a crucial role in education because they are the driving mechanism in providing education for students nationwide. In addition, they are considered the compass holder that navigates the people’s future. So, if any nation has competent, brilliant, determined, and devoted teachers who adhere to the students’ benefits, the students in that nation are certainly smart, potential, and ready to compete with other nations globally.

So, anyone becoming teachers must be a person who is ready to devote high level of energy and spirit dedication because teacher is the highly respected and credential career in Thai society. However, teachers in the 21st century must enable their students to attain maximum competence and grounding attitudes such as creativity, tolerance to situational changes, ability to understand and make decision, analytical thinking, investigating problems and finding solutions. The 21st century teacher must be professional, holding expertise in academic ability, advancing in pedagogical and interdisciplinary approaches, updating instructional methods through mass media, promoting interaction with students, equipping students with media literacy skills, understanding the foundation of adult learning in order to comprehend global issues for readiness in working collaboratively with parents and community members, and being able to control their own study process continuously.

Practicum management is considered the heart of producing teachers and this process is about providing authentic teaching experience for pre-service teacher student in order that they would fully perform teaching career at their best ability. Practicum management of Education Curriculum at Faculty of Education, Rajabhat Maha Sarakham University is offered in various types so that the students could have knowledge and experience based on theory and practice. All pre-service teacher students must follow every steps prescribed by the institution and they must receive the pass in all stages to meet graduation criteria and thus be eligible to perform the teaching career.

The practicum is the part of the instructional management of Education Curriculum at Faculty of Education, Rajabhat Maha Sarakham University with an aim for students to have real teaching experience at
school, acquire knowledge and skills in teaching, apply knowledge in real situation, and solve immediate problems. A feedback toward the university includes opinion from schools under the university network in practicum project so that the university could compile the opinion received for improvement of the instructional management and activities under this project which must be in compliance with standard criteria prescribed by The Teacher Council of Thailand. The criteria comprise curriculum standards, production standards, and graduates standards in accordance with advance teacher professional curriculum.

To undertake practicum, responsibility, duties, and guidelines for practicum is designed to inform the students that cover 6 dimensions including teaching, students’ activities and consultation, classroom administrative tasks, general administrative tasks, school and community development, and personal development. The researcher as supervisor of pre-service teacher students majoring biology is in charge of supervising these students while they are doing practicum at the assigned school. The researcher thus holds an interest in the practicum outcome of these pre-service teacher students in their 2014 academic year. The results are expected to serve as guidelines for supervising teachers in helping the pre-service student teachers to attain effectiveness in the practicum which definitely reflects the quality of teacher production.

Objective

To examine opinion of university’s schools network toward pre-service teacher students in Biology Major.

Scope of the Study

The researcher aimed at examining six aspects of comments and suggestions from schools that accepted pre-service teacher students such as

1. Developing Morality and Ethics has 2 indicators
2. Knowledge has 4 indicators
3. Cognitive Ability has 3 indicators
4. Interpersonal Relationship and Responsibility has 3 indicators
5. Numerical Analysis, Communication, and Information Technology has 3 indicators
6. Learning Management has 3 indicators

The population were 98 mentor teachers in 98 network schools that had 130 teacher students in the second semester of the academic year 2014 majoring in Biology at Faculty of Education, Rajabhat Maha Sarakham University.

The research instrument was 5-rating scale questionnaire.

The researcher examined completeness of the returned questionnaire and statistically analyzed the data using a computer software.

Result

Table 1 Responsibility on learning outcome toward individual learning aspects.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>S.D.</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Developing Morality and Ethics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Showing behaviors following morality and ethics of teaching profession in empowering the sustainable development, showing ethical courage, understanding others and the world, showing public minded and sacrifice, and being role model.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Able to handle and solve moral and ethical problems regarding ethics in teaching profession using judgment on values, feeling of other people, and public benefits.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Item</strong></td>
<td>Mean</td>
<td>S.D.</td>
<td>Level</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>S.D.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2.1</td>
<td>Hold general knowledge, in-depth systematic disciplinary knowledge on biology at macro and micro levels and able to integrate biological knowledge with other related disciplines.</td>
<td>4.27</td>
<td>0.50</td>
</tr>
<tr>
<td>2.2</td>
<td>Hold comprehensive awareness in principles and theories that allow integration at the cross-disciplinary level and practical implementation in the real world.</td>
<td>4.24</td>
<td>0.59</td>
</tr>
<tr>
<td>2.3</td>
<td>Hold in-depth understanding in advancement of disciplinary specific knowledge, understand the nature of research work, and update academic and research knowledge for consistent skills development.</td>
<td>4.25</td>
<td>0.61</td>
</tr>
<tr>
<td>2.4</td>
<td>Hold the ability to analyze, synthesize, and evaluate the body of knowledge, and apply that knowledge to maximize the competence in teaching profession. Application also includes using appropriate tools for solving biological problems.</td>
<td>4.35</td>
<td>0.58</td>
</tr>
<tr>
<td>3. Cognitive Ability</td>
<td>4.35</td>
<td>0.54</td>
<td>High</td>
</tr>
<tr>
<td>3.1</td>
<td>Think critically and systematically, comprehend and evaluate information system for solving the problems constructively, and undertake the research project for personal development and organization development.</td>
<td>4.40</td>
<td>0.58</td>
</tr>
<tr>
<td>3.2</td>
<td>Able to solve complex issues, propose solution toward constructive resolution based on theoretical knowledge, practicality, and impact.</td>
<td>4.26</td>
<td>0.63</td>
</tr>
<tr>
<td>3.3</td>
<td>Be an intellectual leader in constructive development, having vision in developing the education program to meet the trend of changes and public needs, and develop professionalism innovatively.</td>
<td>4.38</td>
<td>0.65</td>
</tr>
<tr>
<td>4. Interpersonal Relationship and Responsibility</td>
<td>4.68</td>
<td>0.39</td>
<td>Highest</td>
</tr>
<tr>
<td>4.1</td>
<td>Perform quick perception of other people’s feeling, understand the others, hold positive thinking, have high EQ, and be friendly sociable.</td>
<td>4.62</td>
<td>0.52</td>
</tr>
<tr>
<td>4.2</td>
<td>Responsible for assigned tasks at individual and team levels, pay attention and help the others, sympathetic and constructive in solving problem in a group and among groups.</td>
<td>4.75</td>
<td>0.45</td>
</tr>
<tr>
<td>4.3</td>
<td>Understand role and duties of leader and follower, hold good relationship with students, and concentrate on public benefits in regard to socio-economic and environment aspects.</td>
<td>4.68</td>
<td>0.47</td>
</tr>
<tr>
<td>5. Numerical Analysis, Communication, and Information Technology</td>
<td>4.36</td>
<td>0.48</td>
<td>High</td>
</tr>
<tr>
<td>5.1</td>
<td>Acquire technological skills and sensitive in analyzing information covering statistical, numerical data, oral and written language which affects comprehension of knowledge or issue for constructive problem solving in a quick and effective manner.</td>
<td>4.29</td>
<td>0.58</td>
</tr>
<tr>
<td>5.2</td>
<td>Able to employ good judgment in processing, translating, selecting information system data, using and presenting media by taking advantage of information technology appropriately and consistently.</td>
<td>4.38</td>
<td>0.56</td>
</tr>
<tr>
<td>5.3</td>
<td>Hold effective communicate both oral and written modes and able to deliver the presentation formats suitable for individuals and groups with different backgrounds.</td>
<td>4.42</td>
<td>0.60</td>
</tr>
<tr>
<td>6. Learning Management</td>
<td>4.16</td>
<td>0.57</td>
<td>High</td>
</tr>
<tr>
<td>6.1</td>
<td>Hold expertise in learning management of different forms covering formal, non-formal, and informal.</td>
<td>4.12</td>
<td>0.58</td>
</tr>
<tr>
<td>6.2</td>
<td>Hold expertise in delivering learning management for learners of different backgrounds covering gifted learners, average learners, and learners with special needs of innovation.</td>
<td>4.11</td>
<td>0.63</td>
</tr>
<tr>
<td>6.3</td>
<td>Hold expertise in integrated learning management for major students.</td>
<td>4.25</td>
<td>0.67</td>
</tr>
<tr>
<td>Total</td>
<td>4.38</td>
<td>0.41</td>
<td>High</td>
</tr>
</tbody>
</table>
Conclusion

The conclusions showed that

1. Positive opinion regarding attributes of pre-service teacher students were rated at the high level as 4.38 in overall. For the individual aspects, Developing Morality and Ethics, and Interpersonal Relationship and Responsibility were in the highest level as 4.55 and 4.68 respectively. While the other aspects were at high level, Knowledge was 4.27, Cognitive Ability was 4.35, Numerical Analysis, Communication, and Information Technology was 4.36 and Learning Management was 4.16.

2. Pre-service teacher students’ satisfactions of planning and proceeding field experience course, and the perception on their practice quantity and their own teacher’s characteristics were found at high level of satisfaction. However, during their one-year student teaching experience, pre-service teacher students faced problems in trying to set clear learning outcomes in lesson plans, rarely probing students’ prior knowledge or asking questions, classroom management, misconceptions in biology concepts, and conducting classroom action research. Despite the struggles they experienced, pre-service did learn lesson planning techniques, teaching strategies, students’ learning, classroom management, and how to incorporate instructional materials. This study has direct implications for the ways in which we introduce and engage pre-service teacher students into constructivist-based teaching practice in their chosen profession.

References


Development of the Science Activity Packages on Concept Mapping: The Structures and Functions of Flower Plants for Grade 11th Students

Nongnuch Srinucool¹*, Yuwadee Insumran² and Natchanok Jansawang³

¹Graduate Biology Student, Rajabhat Maha Sarakham University
²Ph. D. (Biology), Biology Department Staff, Rajabhat Maha Sarakham University
³Ed. D. (Sports Science), Vice-Rector for Academics, Rajabhat Maha Sarakham University

(*) author for correspondence, E-mail: nutdee2514@gmail.com

Abstract

The purposes of this research were: 1) to develop and identify the learning efficiency of science activity packages on concept mapping: the structures and functions of flower plants for grade 11th students, 2) to study and to compare the biology’s post-test and pre-test learning achievement of grade 11th students in general and specified by the results of the students’ biology’s learning achievement through science activity packages, 3) to compare the post-test learning achievement of the students with different biology’s learning achievement through the science activity packages on concept mapping: the structures and functions of flower plants, and 4) to study the grade 11th students’ ability of drawing concept maps of learning via science activity packages on concept mapping: the structures and functions of flower plants. The sample was the 11th grade students of Phochaichanupatham School in the second semester of 2014 academic year and was from cluster random sampling. The research instruments were: 1) the science activity packages on concept mapping: the structures and functions of flower plants, 2) 5 E’s learning plan, 3) achievement test, and 4) the concept mapping ability evaluation form. The statistical tools for data analysis were percentage, mean and standard deviation. A t-test (dependent sample) was employed to test the hypothesis. An F-test was employed to perform one-way ANCOVA.

The results of the study were as follows:

1. The science activity packages on concept mapping: the structures and functions of flower plants for grade 11th students attained efficiency value of 85.62/88.75.
2. The post-test students’ learning achievement for whole class and in accordance with the students’ biology’s learning achievement was higher than it of the pre-test with statistical significance of .05.
3. The students with higher biology’s learning achievement showed statistical significance of .05, comparing to the students with lower biology’s learning achievement.
4. After learning how to create the concept mapping, the students in general and specified by the results of the students’ biology’s learning achievement showed the abilities to create concept mapping at the very high level while the lower one showed abilities to do so at the high level.

Keywords: Concept mapping, Structures, Packages, Flower plants

Introduction

Sciences nowadays play an even more important role in both present and future world society because it always relates with human’s daily life and profession. Inventing tools and equipments to facilitate the human’s daily life and work are all resulted from such knowledge, creativity and connectivity of human together with the relationship with other disciplines. Sciences inspires human to develop thought process, logical thinking, creative and critical thinking, data searching ability, systematic problem-solving ability, judgment-making-through- various-information-and-detectable-witness ability. In addition, sciences represent the new world cultures in which concentrate on knowledge-based society. As such, everybody should be developed to be scientific literacy in order to understand the nature of the world and the invented technology altogether with the reasonable and worthy application of knowledge gained (Ministry of Education, 2008: 1), resulting in changes in the human’s behaviors and ideas such as how to live with nature, how to use natural resources wisely and how to keep up with and to apply new technology. Education, thereby, is an extremely important factor to develop people to be able to think more and do more and eventually leads to the socio-economical development together with knowhow of natural resources management and conservation. The education management by the National Education Act of 2542 B.C., as amended (revision no.2) 2545 B.C. and (revision no. 3) 2553 B.C. in section 22 prescribed that the education management must hold to the principle that the every students are able to learn and develop themselves and must treat the students as the most important factor in doing so. The process
of such management should reinforce the students’ maximum natural ability in self-development. As part of the learning process, Section 23 Education Management for Non-Formal Education System and Informal Education System gives a special attention to knowledge, ethnics, learning process and the integration of the learning improvement upon the learners’ educational degree. It also intensifies the scientific and technology-related knowledge and skill as well as the comprehension and experiences towards management, conservation and balanced and sustainable utilization of natural resources and environment. Section 24 identifies tasks for any related educational institutes and sectors to process as follows: Further the teaching whenever and wherever that the students’ parents and locals are willing to in order to cooperatively develop the students in accordance with their capacity (The Institute for the Promotion of Teaching Science and Technology, 2002:5).

The reason behind that is to cooperatively develop the students in accordance with their capacity (The Institute for the Promotion of Teaching Science and Technology, 2002: 144). For the science’s education management regarding the basic education, it anticipates the students to be able to study sciences that spotlight the process and then lead to the creation of knowledge in which the students involve in there. Moreover, the students have a variety of activities through a series of activities which are widely available (The Institute for the Promotion of Teaching Science and Technology, 2002: 5).

Adopting the activity packages to effectively change the students’ learning behavior results in more self-learning for the students and also teaching benefits for the teachers. Teaching science through activities packages is an innovative educational media which are now playing a big role to science instruction as to what Pop Laohapaiboon (1999: 194) said that “teaching science must employ teaching materials to be used as a medium for the exchange of ideas between the students and the instructor to get knowledge transferred, to initiate the process of science and scientific attitude at the same time."ChaiyongPromwong (2008: 123) said that “teaching media or activity packages helped the instructors demonstrate how tangible the conducted lesson or experiences are to the students and in return, it helped arouse the students’ interest towards what the teachers were conveying. Could help solve the problems including individual differences and insufficient number of science teachers also could motivate the students to practice their scientific skills as well as encourage students to have a good attitude towards science.

Several scholars focus on the concept mapping in teaching science. Concept mapping is to create learning activities that allow students to use thought process, knowledge creation, summarizing and manually presenting the key concepts (The Institute for the Promotion of Teaching Science and Technology, 2003: 40). Creating concept mapping is a way to present the information and the structure of one particular matter in order to draw the overall picture of it (SamanLoypha, 1999: 5) which is not only helps develop the comprehension of the overall picture but also help develop the post-test learning achievement to be higher than the pre-test learning achievement (Phuangphitsiriprom (2008: 106; AreewanKattiyawong, 2012: 82). Therefore, if science activity packages and concept mapping are employed together in order to let the students use their thought process, information searching, summarizing and manually presenting the All of which can stimulate more understanding of what the students are studying.

Thus, the selection of material fell into Unit 1: Living Creatures and Their Life and Unit 8: Nature of Science and Technology on Structures and Functions of Flower Plants in order to create science activity packages and concept mapping for grade 11th students, focusing on practical self-learning activities, inquiry for knowledge and knowledge creation by learning to create concept mapping caused by learning exercises of activity packages. The students should also be able to learn systematically and to connect all their gained knowledge to be their concept, to improve their learning achievement either in high or low learning achievement group, to apply their gain knowledge in their real life as well as to realize how important the flower plants which are considered the most important natural resources for human’s and other creatures’ life on earth.

**Material and Methods**

1.Population and Samples. The population of the study was 84 grade 11th students of Phochaichanupatham School in the second semester of academic year 2014. They were from 2 classrooms. The sample of the study was 42 grade 11th students of Phochaichanupatham School in the second semester of academic year 2014, chosen through “Cluster Random Sampling”.

2.Research Tools. Procedure of research instrument development

2.1. Development of science activity packages

2.1.1 Study document or research paper related to science activity packages

2.1.2 Study document or research paper related to concept mapping teaching strategy

2.1.3 Analyze the method of creating concept mapping according to the concept of Novak and Gowan (1984) and then develop the concept mapping which will be used in the activity packages
2.1.4 Study the teaching content in accordance with the science lesson plan of standardized teaching principles W.1 and W.8
2.1.5 Analyze the information given and then develop the science activity packages for the students to promote their self-learning being
2.1.6 Arrange the science activity packages on concept mapping and evaluation and assessment tools to facilitate the students’ learning achievement
2.1.7 Present the advisors and the specialists the science activity packages for inspecting the validity of their content, language used and appropriateness
2.1.8 Fix the flaws found in the science activity packages in accordance with the suggestion from the advisors and from the specialists to facilitate the students’ learning achievement

2.2. Lesson plan creation procedure
2.2.1 Study the problems of the activity of biology teaching of Phochaicha nupatham School
2.2.2 Study the Basic Education Core Curriculum 2551 B.C.
2.2.3 Study the concept and theory related to inquiry teaching approach
2.2.4 Create the lesson plan in accordance with the inquiry teaching approach together with the science activity packages

2.2.5 Analyze the content and the objects of the study then set the lesson plan in order to arrange what needs to be put in the overall lesson plan
2.2.6 Draft the lesson plan in the 5 papers in accordance with the inquiry teaching approach together with the science activity packages
2.2.7 Present the set lesson plan to the advisors and the specialists for inspection and correction

2.3. Examination of learning achievement
Research tools creation procedure
2.3.1 Study how to create criterion referenced examination and how to create objective examination
2.3.2 Study biology teacher’s manual, biology student’s coursebook and biology handout for science learning area 4

2.3.3 Analyze content and the purpose of the study
2.3.4 Create 60 four-choice questions of learning achievement which actually requires only 40 questions, covering content and the behavioral objective of the study as well as 4 behavioral aspects, namely memorizing, understanding, applying and analyzing of knowledge
2.3.5 Present the created examination to 3 experts and let them inspect the coverage of the questions to the objectives of the study and the concordance of the questions to the objectives of the study and also let one of them inspect whether or not each question is consistent with the objectives of the study that needs to be tested
2.3.6 Note the findings of each expert’s criterion on each aspect and then find index of correspondence values (IOC) between the test and the purpose
2.3.7 Select the examination with index of correspondence values from .71 and above and adjust the examination with index of correspondence values below .67
2.3.8 Distribute the examination to the students who were not targeted and already studied the content of what to be tested. Then get the test score of each question analyzed individually to determine the discriminating (r) and the difficulty index or easiness (P). The qualified 40 questions found the difficulty index or easiness value (P) of .56 to .79 and the discriminating value (r) of .23 to .78 and the reliability value in accordance with the Kuder–Richardson Formula 20 (KR - 20) of .75.
2.3.9 Utilize the examination with the sample
2.4. Assessment of concept mapping
2.4.1 Study how to create a concept mapping evaluation form from documents related to the measurement and evaluation, adapted from the concept mapping evaluation form of Areewan Kattiwong (2012: 117-118) to suit the students
2.4.2 Get original assessment test presented to 3 experts to check its consistency between the evaluation criteria and the assessed behaviors. The selection of criteria relies on content validity, representing index of correspondence values (IOC) of .67 or above .67
2.4.3 Adjust assessment items, evaluation criteria and measured behavior as well as the use of language as experts recommend in order to elicit the assessment as shown in the Appendix B.
2.4.4 Launch the assessment of concept mapping to the sampling group
3. Data collection. This study was conducted with 42 grade 11th students, room no. 5/1 of Phochaichanupatham School, located in Pho Chai District, Roi Et Province.
3.1. The sample group was divided into 2 groups; high biology’s learning achievement group and low biology’s learning achievement group. Such categorization was made upon the students’ biology’s learning achievement in the second semester of 2014 academic year, adjusted to be consistent with the standard T-score
that also divided the sample group into two groups; high biology’s learning achievement group, scored 50 or more points and low biology’s learning achievement group, scored below 50 points.

3.2. Conduct the pre-test examination with the help of the learning achievement test.

3.3. Teach the lesson through the science activity packages on concept mapping: the structures and functions of flower plants.

3.4. Evaluate and score the produced concept mapping in accordance with the measurement standard.

3.5. Let the students do the post-test examination with the help of the pre-test learning achievement test.

4. Data analysis and statistical methodology

4.1 Basic statistical methodologies include Mean (x̄), Percentage (%) and standard deviation (SD).

4.2 The dependent t-test for paired samples is used to compare the pre-test and post-test learning achievement.

4.3 The F-test is used to conduct the one-way analysis of covariance (One-way ANCOVA) to elicit the comparison of the learning achievement of students in general and specified by the results of the biology’s learning achievement.

Results

The results of the research are as following.

1. For the analysis of efficiency acquisition of the science activity packages on concept mapping: the structures and functions of flower plants for grade 11th students, it found that the efficiency of the science activity packages on concept mapping: the structures and functions of flower plants for grade 11th attained its E/E, efficiency value of 85.62/88.75, representing that the science activity packages on concept mapping: the structures and functions of flower plants for grade 11th attained efficiency value higher than it of set standard.

Table 1 Efficiency of the science activity packages on concept mapping: the structures and functions of flower plants according to the standard 80/80

<table>
<thead>
<tr>
<th>Test</th>
<th>Full Score</th>
<th>X</th>
<th>S.D.</th>
<th>E</th>
<th>E1/ E2</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Class</td>
<td>50</td>
<td>42.81</td>
<td>2.43</td>
<td>85.62</td>
<td>85.62/88.75</td>
</tr>
<tr>
<td>Post-Test</td>
<td>40</td>
<td>35.50</td>
<td>1.66</td>
<td>88.75</td>
<td></td>
</tr>
</tbody>
</table>

2. The comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants of grade 11th student

2.1 The comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants of the students in general found that the students in general attained their pre-test average score (X̄) of 12.02, representing 30.35% and their average post-test score (X̄) of 35.50, representing 88.75% after being conducted with science activity packages on concept mapping: the structures and functions of flower plants.

Table 2 Comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants of the students in general

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Full Score</th>
<th>X</th>
<th>S.D.</th>
<th>T</th>
<th>df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>42</td>
<td>40</td>
<td>12.02</td>
<td>9.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>42</td>
<td>40</td>
<td>35.50</td>
<td>1.66</td>
<td>-16.81</td>
<td>41</td>
<td>.000</td>
</tr>
</tbody>
</table>

* Statistical significance of .05

2.2 The comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants of the student with high biology’s learning achievement found that the students with high learning achievement attained their average pre-test score of 21.90+ S.D., representing 54.76% and their average post-test score of 36.38+ S.D., representing 90.95% after being conducted with science activity packages on concept mapping: the structures and functions of flower plants.
Table 3 Comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants found in the student with high biology’s learning achievement

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>T</th>
<th>df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>21</td>
<td>21.90</td>
<td>1.45</td>
<td>-28.385</td>
<td>20</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(54.76)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Test</td>
<td>21</td>
<td>36.38</td>
<td>1.36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(90.95)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Statistical significance of .05

2.3 The comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants of the student with low biology’s learning achievement found that the students with low learning achievement attained their average pre-test score of 3.33+ S.D., representing 8.33% and their average post-test score of 29.57+ S.D., representing 73.93% after being conducted with science activity packages on concept mapping: the structures and functions of flower plants.

Table 4 Comparison of pre-test and post-test learning achievement through science activity packages on concept mapping: the structures and functions of flower plants found in the student with low biology’s learning achievement

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>T</th>
<th>df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>21</td>
<td>3.33</td>
<td>1.53</td>
<td>-59.976</td>
<td>20</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.33)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>21</td>
<td>29.57</td>
<td>5.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(73.93)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Statistical significance of .05

3. Comparison of the different students’ post-test biology’s learning achievement through science activity packages on concept mapping: the structures and functions of flower plants found that the grade 11th students with different biology’s learning achievement had different post-test achievement, elaborating that the students with high biology’s learning achievement had higher learning achievement than it of the students with low biology’s learning achievement with statistical significance of .05.

Table 5 Analysis of Covariance: ANCOVA to compare the different students’ post-test biology’s learning achievement through science activity packages on concept mapping: the structures and functions of flower plants

<table>
<thead>
<tr>
<th>Source of Covariance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>8.592</td>
<td>1</td>
<td>8.592</td>
<td>4.699</td>
<td>.036</td>
</tr>
<tr>
<td>Inter-group</td>
<td>14.271</td>
<td>1</td>
<td>14.271</td>
<td>7.805</td>
<td>.008</td>
</tr>
<tr>
<td>Intra-group</td>
<td>71.313</td>
<td>39</td>
<td>1.829</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>94.176</td>
<td>41</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Statistical significance of .05

4. Assessment of the capacity of the grade 11th students in general and specified by the results of the biology’s learning achievement in creating concept mapping on structures and functions of flower plants found that the science activity packages on concept mapping: the structures and functions of flower plants promoted the students in general and with high biology’s learning achievement to be able to create post-test concept mapping in very good level and those with low biology’s learning achievement to be able to create post-test concept mapping in good level.
The 5th International Conference on Sciences and Social Sciences 2015 (ICSSS 2015): Research and Innovation for Community and Regional Development
September 17-18, 2015 at Rajabhat Maha Sarakham University

Table 6 Mean score of the capacity of the students in general and specified by the results of the biology’s learning achievement in creating concept mapping on structures and functions of flower plants

<table>
<thead>
<tr>
<th>No.</th>
<th>Subject</th>
<th>Students in general</th>
<th>Students with high achievement</th>
<th>Students with low achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Score</td>
<td>Level</td>
<td>Score</td>
</tr>
<tr>
<td>1</td>
<td>Tissue</td>
<td>3.42</td>
<td>Good</td>
<td>3.47</td>
</tr>
<tr>
<td>2</td>
<td>Structures and Functions of Root</td>
<td>3.48</td>
<td>Good</td>
<td>3.55</td>
</tr>
<tr>
<td>3</td>
<td>Structures and Functions of Stem</td>
<td>3.55</td>
<td>Very Good</td>
<td>3.63</td>
</tr>
<tr>
<td>4</td>
<td>Structures and Functions of Leaf</td>
<td>3.57</td>
<td>Very Good</td>
<td>3.67</td>
</tr>
<tr>
<td>5</td>
<td>Nutrient Uptake in Plants</td>
<td>3.66</td>
<td>Very Good</td>
<td>3.77</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>3.54</td>
<td>Very Good</td>
<td>3.62</td>
</tr>
</tbody>
</table>

Conclusions and Discussion

The results of the study can be summarized as follows:

1. The efficiency value of the science activity packages on concept mapping: the structures and functions of flower plants was 85.62/88.75, meaning that the students had average score of 85.62% on minor tests, and had average score of 88.75% on post-test learning achievement test. The learning achievement through science activity packages on concept mapping: the structures and functions of flower plants for grade 11th students showed its efficiency value of 80/80 above standard measurement since the activity packages which were initiated by the researcher were originally from various types of teaching materials packed together and were multimedia in order to enhance the students’ learning capacity and to instruct the students how to create the concept mapping which was counted as a foundation of thought and interpretation to the audiences of the individuals. Such result of the study was compromised with the notion of PhuangphitSiriprom (2008: 32), illustrating the components of the teaching medium in which the teachers created with explanation, study purpose, content, time, media, equipment, various teaching activities and evaluation and assessment which was logically collected and arranged in groups. In order to initiate the students to be a self-starter, trying to learn or to recap what they must do by themselves according to their ability and interest with some guidance and help from their teachers to get the students to reach their set goals, corresponding to the study of Suwaporn Pavinich (2012: 130) which conducted the study on the development of the sciences packages on Unit 3: substances and their characteristics through inquiry teaching approach (5E) and concept mapping teaching method for grade 7th students and found that it had an efficiency value of 81.60/76.81.

2. The pre-test and post-test learning achievement of the students through science activity packages on concept mapping: the structures and functions of flower plants for grade 11th students in general and specified by the results of the students’ biology’s learning achievement found that the post-test learning achievement was higher than the pre-test learning achievement with statistical significance of .05 since the students could comprehend how to be the self-learners in accordance with their capacity and the students could synthesize the knowledge gained and were able to logically interpret to the audiences through science activity packages on concept mapping, corresponding to the study of Saowanee Matra (2011: 49) claimed the concept mapping as the tool to manage the students’ knowledge system, corresponding to the statement of Saowanee Matra (2011: 49) that concept mapping was a tool to manage the students’ knowledge system, thought process, and comprehension regarding any specific matter. The students were able to connect their schema and newly gained knowledge which were identical through giving definition and signing to substitute the main ideas then able to accumulate all idea to initiate the secondary ideas and also some tiny ideas. It was corresponded to the study of Sawanee Chuethong (2008: 64) which researched the science’s learning achievement and critical thinking ability of grade 9th students of Preng Wisutha Thibodi School under Samutprakan Primary Educational Service Area Office 2 through the science packages on cognitive ability development and found that the post-test learning achievement was higher than the pre-test learning achievement with statistical significance of .01. Also, Phuangphit Siriprom developed the science activity package through inquiry teaching approach (5E) together with concept mapping in order to improve critical thinking ability of the grade 7th students through the science activity package through inquiry teaching approach (5E) together with concept mapping. The results of the development appeared as follows: 1) the efficiency value of science activity packages through inquiry
teaching approach (5E) together with concept mapping was higher than it of set standard, 2) the pre-test and post-test science’s learning achievement through the science activity package through inquiry teaching approach (5E) together with concept mapping appeared the statistically significant difference of those two groups of the students of .01, 3) the pre-test and post-test critical thinking ability of the students through the science activity package through inquiry teaching approach (5E) together with concept mapping appeared the statistically significant difference of those two groups of the students of .01.

3. The learning achievement of grade 11th students concerning the differences in biology’s learning achievement conveyed the differences in post-test learning achievement because of the differences in the cognitive ability of individual, resulting in the different learning achievement and data synthesis. It was corresponded to the study of Pankgratatús (1988: 49), illustrating the result of applying the concept mapping towards the physics’ learning achievement for high school students. The sampling was the students from 6 classes; 2 classes for controlled group being taught with normal teaching modules and 4 classes being taught through concept mapping, in which, again were divided into 2 groups, one for the students being taught through normal concept mapping and the other one through high-level concept mapping. The research found that the pre-test and post-test scores of those 3 teaching methods were statistically significant difference of .05.

4. Post-test learning achievement of creating concept mapping: the structures and functions of flower plants was higher than it of pre-test learning achievements since concept mapping was counted as the preparation method to get the students ready for the upcoming lesson. And concept mapping was the analysis method of the learnt lesson so that the post-test students were more able to create concept mapping than the pre-test students were. The students were more able to create the concept mapping through latter activity packages because the teachers conducted the class in accordance with the principles of concept mapping of De Cecco. (De Cecco, 1974: 123) and Pannee Chutaijenjit (Pannee Chutaijenjit, 2002: 66). Concept mapping focused on how the students could create it which is considered the important factor in teaching sciences, especially biology teaching since concept mapping was a foundation of thought and interpretation of the information to the audiences and was the main idea of the knowledge differently obtained by different students. Teaching methods of how to create concept mapping were various according to the teachers’ perspectives and should be chosen to match the characteristics of area under discussion, maturity and readiness of the students. All of which was in line with the study of Aree Khattiyawong (2012: 82) that researched learning achievement through concept mapping on chemical bond for grade 10th students and researched comprehension in creating concept mapping of grade 10th chemistry students Borabu Wittayakhan school with the subject of chemical bond. The study showed that the chemistry students with the subject of chemical bond through concept mapping attained their post-test learning achievement higher than their pre-test learning achievement with statistical significance of .05. And the chemistry students with the subject of chemical bond through concept mapping were supremely able to create the concept mapping in terms of content management and creativity representing 88.25%. The students developed their comprehension in creating the concept mapping in terms of content management and creativity. The results from science activity packages on concept mapping: the structures and functions of flower plants for grade 11th students are summarized as below.

1. The efficiency value of the science activity packages on concept mapping: the structures and functions of flower plants was 85.62/88.75.

2. The students’ pre-test and post-test learning achievement classified by whole class and in accordance with biology’s learning achievement through the science activity packages on concept mapping: the structures and functions of flower plants found that the post-test learning achievement was higher than the pre-test learning achievement with statistical significance of .05.

3. The students’ learning achievement of the students with high biology’s learning achievement was higher than it of the students with low biology’s learning achievement with statistical significance of .05.

4. The students with high biology’s learning achievement and general group of students showed very high ability to create the concept mapping while the students with low biology’s learning achievement showed lower ability to create one after being taught the science activity packages on concept mapping: the structures and functions of flower plants.

Acknowledgements

I would like to express my deepest gratitude to all those who have given me a hand in carrying out this research. First, I would like to thank Asst. Prof. Dr. Somsanguan Passago, Dr. Natchanok Chansawang, Dr. Yuwadee Insamran and Dr. Panada Tansupo, the members of my thesis defense committees, for their valuable advice, guidance and comment for my study. The study would never have been successful if I had never received the kindness from Asst. Prof. Dr. Saman Akpim, Ast. Prof. Tawn Saentrong and Mr. Patpong Chansawang for their profession to inspect and to improve the research instruments of the study. Last
but not least, I wish to offer a word of personal gratitude to the school administrators and teachers of Phochaichanupatham School for their guidance and encouragement as well as the students of Phochaichanupatham School for their devotion for my study.

Reference


Enhancing Learning Achievement and Analytical Thinking in Biology Course by Science Instructional Package

Prapawan Sittisena¹*, Pornnarong Siripiying², Somsanguan Passago³

¹Graduate Student, Department of Biology, Rajabhat Maha Sarakham University
²Ph. D. (Biology), Lecturer, Biology Department, Rajabhat Maha Sarakham University
³Ph. D. (Biology), Lecturer, Science and Environment Department, Rajabhat Maha Sarakham University
Thailand

(* author for correspondence, E-mail: Prapawan.2515@gmail.com)

Abstract

This research aims to: 1) develop the instructional package on scientific activities, for 10th grade students, 2) compare students’ learning achievement and analytical thinking with their scores at pre- and post-sessions by using instructional package, 3) compare learning achievement and instructional package and conventional classrooms, 4) find out learning durability by using instructional package and conventional classrooms, and 5) study learning satisfaction. The sampling groups were 10th grade students of 2nd semester in academic year B.E. 2557 at Phochaichanupatham School, numbering 79 participants; they were sampled by cluster random sampling in to two. Two classes were chosen to undergo the study, using the fresh set and the normal groups. Research instruments were learning management plan, learning achievement test, analytical thinking test, and questionnaire on learning satisfaction. Data were analyzed with statistics of percentage, mean and standard deviation, testing hypotheses by t-tests (Dependent Sample and Independent Sample).

The findings can be concluded that instructional package had effective criterion at 0.7368. The learning achievement analytical thinking had pre-tests cores higher those post-test scores at .05 level of statistical significance. The classroom had instructional package can fain learning achievement analytical thinking, satisfaction than those conventional classrooms.

Keywords: Instructional package, Learning achievement, Analytical thinking, Satisfaction, Science learning

Introduction

In article 22 of the National Education Act of B.E. 2542 (1999) and Amendments (Second National Education Act B.E. 2545 (2002)) and Third National Education Act B.E. 2553 (2010) indicates that educational management must support the learners to develop themselves naturally and with their highest potential. In article 23 (2) there is a highlight on Formal Education System, Informal Education System to focus on both knowledge and moral. The education and integration system must be consistent with education levels especially knowledge and scientific skill including knowledge and understanding in sustainable and well-balanced in natural resources and environment maintenance and usage. These principles are consistency with the Ministry of Education’s policy in youth development in the 21st century by aiming to support learners to have skills in analytical and thinking.

Nowadays, according to the Basic Education Curriculum B.E. 2551 (2001), learning and teaching aim to emphasize on knowledge, idea, ability, moral, learning system and social responsibility by persisting on learner-centered principles. All learners should be and are supported to be persons who can learn and develop naturally by themselves. So, there must be activities that encourage learners to learn from real experience and practice in order to be able to think and do properly. In science subject, there are categories of basic subjects which are core subjects for institutions to use for learning and teaching approach to generate, according to the Eleventh National Economic and Social Development Plan (B.E.2555-2559), basic thinking and strategies for learners to deal with problems and national crisis. The Eleventh National Economic and Social Development Plan (B.E. 2555-2559) is a national development plan emphasizing in all-level participation and aim to make a “people-centered development” for sustainable development and well-being of Thai people. The Development plan also focuses on supporting development in all aspects; science staffs, science teachers, modern instructional media, and generate people’s awareness to learn, think and do scientifically (Office of the National Economics and Social Development Board. (2014:78). Science and technology are adopted for development and the outcome of people development will internationalize Thailand in global arena.

Besides all above, science also plays important role in the current and future world society since science involves with all human’s life both in daily life and professional life. There are many subjects that are
related to science, for example, Physics, Chemistry, Physical Science and also Biology. Biology is a basic subject of many important professions such as doctor, nurse, pharmacist, agriculturist, and engineer. So, studying science will help modernizing surrounding things in social, economic and global aspects. Moreover, science is also help improving learner’s idea to have a systematic thinking, rational decision, prompt thinking and taking action, methodical solution which are tools for quality life. Studying science supports students to know how to think reasonably and analytically, link relations between data, conclude principles and solve problems in daily life, these will make learners to learn and memorize perfectly.

Teachers play major roles in making students and young generations to know science because all science’s consequence affects working experience. Biology is one of science fields that not only study on life and environment but also human, natural resources, and environment. Biology is also included in high school program curriculum in Stand 1 Living and Family and Stand 2 Life and Environment. Moreover Biology is one of subjects in university entrance examination and in National Test (ONET).

From the study on students’ Biology learning achievement in Phochaichanupatham school, the study found that the students got low score in Biology test using content that student already studies in the beginning of the semester. This shows that the students lack of retention of learning. In the university entrance examination, there were only 20 students out of 80 students in the school passed Biology exam. In academic year 2013, the average score in Biology subject in the National test (ONET) of Grade 12th students were 26.21 scores (from 100 scores) (National Institute of Educational Testing Service.2014). So, it is necessary to develop Biology learning potential of the students urgently.

According to the related studies of scholars on learning achievement, analytical thinking and learning retention, there are many principles to raise learning achievement, analytical thinking and learning retention higher. The Instructional Package on Scientific Activities is one of the ways that interests researcher to utilize in science class, it is an activity that learners can participate by doing, be able to analyze, memorize effectively and apply in ONET and university entrance examination.

**Methodology**

1. Sample in this study were 79 Grade 10th students in class 4/1 and 4/2 in academic year 2014, 2nd semester, Phochaichanupathamschool, Secondary Educational Service Area Office 27. The target groups were chosen by dividing groups of students who will be instructed by the science activity package and normal principles. There were 39 students in Class 4/1 who were instructed by using the science activity package and 40 students in Class 4/2 who were instructed by conventional principles.
2. The content used in the study is Life and Environment topic, Biology subject for Grade 10th students according to the Basic Education Curriculum 2008, Learning Area of Science, Ministry of Education.
3. Research duration was during January to March 2014 for 18 hours in 2nd semester academic year 2014 using the science activity package and conventional classrooms Human Being and Environments topic.
4. Research Tools
   4.1 6 instructional packages on scientific activities for 18 teaching hours in Human Being and Environment topic, Biology subject of Grade 10th classes.
   4.2 6 learning management plans for 18 teaching hours in Life and Environment topic, Biology subject of Grade 10th classes.
   4.3 Learning achievement test in Life and Environment topic, Biology subject of Grade 10th classes, the test contained 40 questions with 4-multiple choices for setting post-test to evaluate learner’s Biology knowledge and understanding and repeating experiment again after class had ended for 14 days to evaluate learning retention.
   4.4 Analytical thinking ability test in Life and Environment topic, Biology subject of Grade 10th classes, the test contains 40 questions with 4-multiple choices aiming to analyze 3 aspects; importance, relevance and approach; for testing students after finishing class through the science activity package.
   4.5 Learning satisfaction of Grade 10th students towards teaching activities through the science activity package, contained 21 questions and covered 2 aspects; teacher’s teaching aspect and student’s learning aspect.
5. Data collection
5.1 Pre-test to evaluate basic knowledge of the students, the test would be conducted to the research sample on the first day of class by using learning achievement test and learning analytical thinking ability test.

5.2 The teaching activity was conducted by researcher using the science activity package for students class 4/1 and normal principles for 4/2 students in Life and Environment topic, Biology subject. Each class took 6 teaching plans and 18 hours.

5.3 Reusing the learning achievement test and learning analytical thinking ability test as in Pre-test again after the class ended to evaluate whether the students gained knowledge according to the learning objectives. The Post-test would be conducted after the teaching activity process finished.

5.4 Using the learning achievement test after class had ended for 14 days to evaluate learning retention whether the students gained knowledge according to subject objectives and which kind of teaching activity students have more learning retention.

5.5 Using satisfaction survey to explore the student’s preference towards the teaching activity. Analyzing all results by statistical methodology.

6. Data analysis

Data were analyzed by various used of methods Effectiveness index was calculated, pre-test and post-test design was employed. Data were described by mean, standard deviation and t-test.

Results

Effectiveness index

<table>
<thead>
<tr>
<th>Test</th>
<th>Full score</th>
<th>X</th>
<th>Total score</th>
<th>E.I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>40</td>
<td>21.49</td>
<td>838</td>
<td>0.7368</td>
</tr>
<tr>
<td>Post-test</td>
<td>40</td>
<td>35.13</td>
<td>1370</td>
<td></td>
</tr>
</tbody>
</table>

Table 1, the Effectiveness index of the science activity package in Life and Environment topic, Biology subject of Grade 10th students was 0.7368.

Comparison of learning achievement in pre and post-test

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>39</td>
<td>21.49</td>
<td>2.59</td>
<td>-27.87</td>
<td>38</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>39</td>
<td>35.13</td>
<td>1.24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical significance at .05.

Table 2, the post-test average score of Grade 10th student in Life and Environment topic, Biology subject in class conducted by the science activity package is higher than pre-test at .05 level statistical significant.

Table 3 Learning achievement test before and after class conducted in conventional classroom.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>40</td>
<td>21.44</td>
<td>1.77</td>
<td>-30.92</td>
<td>39</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>40</td>
<td>31.13</td>
<td>1.52</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical significance at .05.

Table 3, the post-test average score of Grade 10th student in Life and Environment topic, Biology subject in class conducted by conventional classroom higher than pre-test at level of .05 level statistical significant.
Table 4 Learning achievement of between conducted by the science activity package and conventional classroom.

<table>
<thead>
<tr>
<th>Learning management</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>science activity package</td>
<td>39</td>
<td>35.13</td>
<td>1.24</td>
<td>12.83</td>
<td>77</td>
<td>.000</td>
</tr>
<tr>
<td>conventional</td>
<td>40</td>
<td>31.13</td>
<td>1.52</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4, science activity package classroom had higher than the class that was conducted by conventional classroom .05 level statistical significance.

Table 5 Analytical thinking ability in pre and post-test between two classrooms.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>39</td>
<td>10.59</td>
<td>1.52</td>
<td>-46.87</td>
<td>38</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>39</td>
<td>24.33</td>
<td>1.13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistical significance at .05

Table 5, the average score of the analytical thinking ability of Grade10th student in Life and Environment topic, Biology subject in class conducted by the science activity package is higher than the class that was conducted by conventional classroom at .05 level statistical significance.

Table 6 Analytical thinking ability in pre and post-test between two classrooms.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>40</td>
<td>11.00</td>
<td>1.64</td>
<td>-30.69</td>
<td>39</td>
<td>.000</td>
</tr>
<tr>
<td>Post-test</td>
<td>40</td>
<td>20.70</td>
<td>1.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistical significance at .05

Table 6, the post-test average score of Grade10th student in Life and Human Being and Environments topic, Biology subject in class conducted by conventional classroom higher than pre-test at .05 level statistical significance.

Table 7 Analytical thinking ability between two classrooms.

<table>
<thead>
<tr>
<th>Learning management</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>science activity package</td>
<td>39</td>
<td>24.33</td>
<td>1.13</td>
<td>14.23</td>
<td>77</td>
<td>.000</td>
</tr>
<tr>
<td>conventional</td>
<td>40</td>
<td>20.70</td>
<td>1.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistical significance at .05

Table 7, the result found that the average score of analytical thinking ability of Grade10th student in Human Being and Environments topic, Biology subject in class conducted by the science activity package is higher than the class that was conducted by conventional classroom at .05 level statistical significant.

The comparison of learning retention of the Grade10th student in Life and Environment topic, Biology subject in class conducted by the science activity package and normal principles

Table 8 The difference analysis on of average score tested by the learning achievement test and learning retention test of the class conducted by the science activity package.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test learning achievement score</td>
<td>39</td>
<td>35.13</td>
<td>1.24</td>
<td>-0.76</td>
<td>38</td>
<td>.453</td>
</tr>
<tr>
<td>Learning retention score</td>
<td>39</td>
<td>35.33</td>
<td>2.02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistical significance at .05

Table 8, student’s learning retention had difference of average score of learning achievement test of Grade10th student in Life and Environment topic, Biology subject in class conducted by the science activity package 14 days after the class had ended.
Table 9 The difference analysis on average score tested by the learning achievement test and learning retention test of the class conducted conventional classroom.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>achievement score</td>
<td>40</td>
<td>31.13</td>
<td>1.52</td>
<td>3.89</td>
<td>39</td>
<td>.000</td>
</tr>
<tr>
<td>Learning retention score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>30.08</td>
<td>1.99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistical significance at .05

Table 9, there was no student retention because the post-test’s average score of learning achievement of Grade 10th student in Life and Environment topic, Biology subject in class conducted by the normal principles is higher than the test conducted in 14 days after the class had ended at .05 level statistical significance.

Table 10 The difference analysis on average score tested by the learning retention test of the class conducted by conventional classroom.

<table>
<thead>
<tr>
<th>Learning management</th>
<th>N</th>
<th>X</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>science activity package</td>
<td>39</td>
<td>35.33</td>
<td>2.02</td>
<td>11.65</td>
<td>77</td>
<td>.000</td>
</tr>
<tr>
<td>conventional</td>
<td>40</td>
<td>30.08</td>
<td>1.99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistical significance at .05

Table 10, the result found that the student’s retention of Grade 10th student in Life and Environment topic, Biology subject in class conducted by the science activity package was higher than the class that was conducted conventional classroom at .05 level statistical significance.

The student’s satisfaction towards teaching activity in Human Being and Environments topic conducted by the science activity package and conventional classroom.

Table 11 The average score of student satisfaction of the Grade 10th student in Life and Environment topic, Biology subject in class conducted two classrooms.

<table>
<thead>
<tr>
<th>Learning management</th>
<th></th>
<th>S.D.</th>
<th>Level of Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>science activity package</td>
<td>4.56</td>
<td>0.49</td>
<td>highest</td>
</tr>
<tr>
<td>conventional</td>
<td>4.45</td>
<td>0.48</td>
<td>high</td>
</tr>
</tbody>
</table>

Table 11, student’s satisfaction of the Grade 10th student in Life and Environment topic, Biology subject in class conducted by the science activity package was higher than those conventional classroom.

Discussion

The study on the Development of Instructional Package on Scientific Activities for Enhancing Grade 10th Students’ Learning Achievements and Competence for Their Analytical Thinking in Learning Biology, and Durability in Pursuing it under the Heading: ‘Human Being and Environments topic’ could be discussed as follows:

1. The effectiveness index of the science activity package of Grade 10th student in Human Being and Environments topic, Biology subject is 0.7368 or 73.68%, this finding shows that there is an increase of learner’s learning advance at 73.63%, this is because the researcher’s science activity package is a media that well-suited for attracting learner’s interest and support to change their learning behavior individually by their own ability. This will help learners to have knowledge seeking skill and learning participation. In the study of Suwapon Pawinich (2012:78) mentioned that the activity package is a media that is collected and systematized in a group for students to learn and do activities by themselves, generate learning by their ability and interest under teacher’s suggestions. Isariya Nuyoy (2006 : 82) studied the result of environment learning activity package development on the topic of ecosystem in paddy field for Third Level Secondary Grades 1-3 Students found that the evaluation of this environment learning activity package by specialists is in good-standard level and its effectiveness is .827 which means after using the activity package, the score increased for 82.70%, the student’s scientific skill is higher than the skill they had before using the science activity package.

2. The Post-test learning achievement of Grade 10th students in Human Being and Environments topic, Biology subject conducted by the science activity package and conventional classrooms is higher than the pre-test and the average score of the students in class conducted by the science activity package is higher than those who were instructed by conventional classroom at .05 level statistical significant. This is because the researcher’s
science activity package helps creating learning management by content and objective, help developing students to have fast learning, increasing teaching effectiveness. (ChomPoomipark, 2000 : 100) This kind of teaching principle is a principle that students can participate in activities by themselves, the students are informed learning score right after class, they are also supported by teachers, are instructed systematically by a proper media, using a working group and analysis to produce teaching media. This principle matches with the studies of Kulruedeet Ratsameesawat and Prayoon Thepnuan (2013 : 88) on the comparison of learning achievement of Grade 7 students by using the science activity package and with conventional classroom, the result found that the pre-class’s learning achievement of the students in class that was conducted by the science activity package was higher than post-class’s achievement at the at .05 level statistical significant.

3. The Post-test of the analytical thinking of Grade 10th students in Human Being and Environments topic, Biology subject conducted by the science activity package and conventional classroomis higher than the class that was conducted by conventional classroomat .05 level statistical significant. This is because the students in class conducted by using the science activity package has chance to practice analyzing, discussion in class which enhanced students’ analytical thinking. This findings consistent with the study of Chatree Samran (2005 : 40-41) mentioned that the analytical thinking ability can be taught because this is about understanding and knowledge, this skill will be generated by a brain-based activities. Chatree’s study also matches with Bloom’s study on describing process, knowledge beginning, understanding, usage, analysis, synthesis, and evaluation and Vivas and Davis’s study on development and evaluation design of thinking recognition of Grade 1st students in Venezuela, the study found that the students who were taught by using teaching package have higher ability in thinking, class readiness, creativity, intelligence and social adaptation than those who were taught in a normal teaching process.

4. The Post-test of the learning retention of Grade 10th students in Human Being and Environments topic, Biology subject conducted by the science activity package and conventional classroom is higher than the pre-test because in the class with the science activity package, the students have chances to do, research, exchange knowledge with classmates regarding the instruction in the science activity package. These activities will make students understand by doing and those knowledge will be committed to students’ memory, this findings consistent with Supaporn Homkum’s Two – Process Theory of Memory (2013 : 14) that a short-term memory is a temporary memory, it must be revised to make that short-term memory to be a long-term one or so called learning retention.

5. The Post-test of the student’s satisfaction of Grade 10th students in Human Being and Environments topic, Biology subject conducted by the science activity package and conventional classroomis higher than the pre-test because the students who were taught by using the science activity package since there were activities for students to do and research by their own interesting, preference and willingness. This will help students to have good attitude towards lesson and working in a team. This findings match with Saranoon Wapakeaw’s theory (2004 : 52) that there is a hierarchy of needs with a hypothesis that “human always want needs and it is endless”, human’s needs hierarchy are; 1) Physiological needs, 2) Safety needs, 3) Social needs, 4) Status needs, and 5) Fulfillment needs, this study also matches with Watsarin Gawicha’s study (2005 : 86) on activity package development to promote Environmental studies for Second Level Primary Education students, the study found that overall Post-class’s Student’s satisfaction toward the activity package promoting Environmental Studies for the Second Level Primary Education students was in the highest level.

Suggestions

1. Instructional Package on Scientific Activities Usage suggestions
   1.1 The teachers should describe a clear instruction to the students in using the science activity package in order to manage the class continuously and effectively and open chance to students to ask when they have questions.
   1.2 In class using the science activity package which focuses on analytical thinking, teachers should pay attention, take care, advise and encourage students to concentrate to the activities for an effective class.

2. Suggestions for further research
   2.1 There should be a study on comparison between the learning management with the science activity package and other learning units.
   2.2 There should be a study on learning management by the science activity package with a practice on analysis writing.
2.3 The activity package should include more analytical and integrated thinking skills in the activity’s content.

2.4 There should be a study on a comparison between analytical thinking retention from the teaching activity by the science activity package and other teaching approaches.

Acknowledgements

The study on the Development of Instructional Package on Scientific Activities for Enhancing 10th Grade Students’ Learning Achievements and Competence for Their Analytical Thinking in Learning Biology, and Durability in Pursuing it under the Heading: ‘Human Being and Environments topic’ would not be completed without the dedication of my thesis advisor, Assist. Prof. Dr. PornarongSiripiyasing and my co-advisor, Assist. Prof. Dr. SomsanguanPassago. I would like to express my sincere thanks to their kindness, assistant and advises on those of any of my mistakes in the study, they also enlighten and be a role model for me on my working.

I am also deeply grateful to my chairman of the thesis committee, Assist. Prof. Dr. ManitAnyabho, my thesis committee, Dr. Yuwadeelnsumran for their suggestions on my thesis and I also would like to extend my sincere thanks to Dr. NetchanokJansawang, Dr. NukoolKudthalang, Dr. Yuwadeelnsumran, Ms. NiramoTipchai, and Ms. NanapatKhampa for their assistant on proofreading, statistic evaluation, for their kindness on research tools suggestion, and for wasting their time to evaluate the research tools until they were perfect.

I would like to express sincerely appreciation to the School Principle of Phochaichanupathom school, and also head of academic department, head of science subject learning for their facilitating and support to my study and the last I would like to thank to the students in class 4/1 and 4/2, Phochaichanupathom school for their well-cooperation in the study.

References


The Development of Parents' Growth Evaluation for Disability Children, Special Education Center, Kalasin Province

Saranya Khanyoo¹, Paisan Worakham², and Prapatsorn Pree-Iam³

¹ Graduate Student, Educational Research and Evaluation, Faculty of Education, Rajabhat Maha Sarakham University
²,³ Lecturer, Faculty of Education, Rajabhat Maha Sarakham University

Abstract

The purposes of this study were to 1) develop the Parents' Growth Evaluation for Disability Children, Special Education Center, Kalasin Province, 2) audit the quality of Parents' Growth Evaluation for Disability Children, Special Education Center. The research methodology of this study were research and development. The scope of the research were; 1) data source scope, the 21 data providers are members of the Multidisciplinary team selected by Purposive Sampling. These 21 data providers included; 1.1) two pediatricians, 1.2) two activity therapists, 1.3) 2 physical therapists, 1.4) special education teacher, 1.5) five parents with 10-year experience of supporting disability children development and assistant. 2) content scope including 6 skills of disability children's growth; Gross Motor development, Fine Motor development, self-assistance in daily life, receptive and expressive language, social skill and intelligence skill or academic readiness. 3) Variable scope included quality of growth evaluation for disability children and characteristics of the disability children's development in Special Education Center, Kalasin Province. Research tools were semi-structured and non-directive interview and questionnaire with 5 rating scales. The statistics used in this research were mean, percentage, median, interquartile range and Rater Agreement Index: RAI determination. The research results were presented in terms of descriptive analysis and tables.

The result found that;
1. All three times of the analysis parents' growth evaluation for disability children by using Delphi Technique, the result could be concluded that the parents' growth evaluation for disability children in the special education center in Kalasin Province contained the highest fitness value and high consistent value (Mdn. = 4.00 – 5.00, IR = 0.00 - 1.00) which was in an acceptable level. There was also the evaluation on 6-skills development; Gross Motor development, Fine Motor development, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or academic readiness. The evaluation criteria were the skills that met standard or “normal growth” must be in middle and good level, but if the skills did not meet the standard when compare with normal children’s criteria, the disability children would be in a should-support level (good level=3, follow the instructions fluently, middle level=2, can follow some instructions, should-support level=1, cannot follow the instructions).
2. According to the quality audit of parents’ growth evaluation for disability children in the special education center in Kalasin Province, there were 2 assessor evaluated 6 development skills; Gross Motor development, Fine Motor development, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or academic readiness. The result found that the Index of Consistency of the assessors was 0.92 and the analysis result on disability children’s development found that the disability children’s development level increased more than before receiving the service at level of 0.05 level statistically significant.

Keywords: Growth Evaluation for Disability Children, Special Education Center of Kalasin Province

Introduction

The Education Management for Persons with Disabilities Act of B.E. 2551 entitles that the disabilities have right to (1) access the rights and equal opportunities to obtain basic education, and the rights to access facilities, media, service, (2) access to other forms of educational support including choices of education service, setting, system and type, and (3) access to education standard and assurance and management of appropriate curricular, learning process, examination, relevant to the need for each type of disabilities and individual.

From all mentioned above, we can see that the education management for disabilities needs to be managed from birth or first found abnormality by using Early Intervention or EI. EI is a process to rehabilitate efficiency and preparereadiness to those disability children in order to help them to restore
theirefficiency as fast as possible. The processes of EI are to estimate basic latency, potentialdisability, collect basic data for analysis and plan with the parents. The practice on rehabilitationefficiency by the plan witheducated parents and the before and afterservice’sevaluation must meet the individual’s expectation. (SompornWanset. 2000:10)

Education management for disabilities must beupon the requirement of individuals. The effectiveness on rehabilitatingthoseefficiencies must consistent withchild’sgrowth and itwill have a continuousresult and match with the development. This process changes on child’s body and alsooverallbody’s pattern and these changes are graduallydevelopedfrom one period to anotherwhichmake a childhaving new physical, emotional, social, and intelligent characteristics and abilities. The continuous changes in body take place since the fertilization in mother’s wombuntil a childis 3-6 yearsold. Attheseperiods of a child'sgrowth are more specialbecausethere are integrated changes in their body at the same time and these changes and behaviors are obviouslynoticed. The development’s speed rate for eachpersonisdifferent but most of the developments are under the same plan and direction. (Sucha Chan-ame, 1999:40)

The developmentevaluation must use an effective and standardizedtools to distinguish a slow and fastdevelopmentproblems, the healthofficials who know how to use those tools are needed but thiscanpursueonly passive evaluation and the servicedcenters are limitedatonlyhealth service centers because parents, babysitters and personswhotake care of thosechildren are lacked of knowledge on estimatingchild’sdevelopment. According to the survey on children’sdevelopment in General Inspector Area 10 and 12, the surveyfound that parents, babysitters and personswhotake care of thosechildren and public healthofficials (especially in health station) are lack of knowledge on child’sdevelopment, child’sdevelopmentevaluation, child’sdevelopment stimulation and lack of tools to evaluatethosedevelopments. In some cases, there are toomanytools to evaluatethosedevelopments which make the estimation’sresultdifferently (Health Station No.6, 2005) Moreover, the cooperationbetween parents and surrounding people alsohelps children to develop and preparereadinessproperly because the children in thisperiod, the braincanbe developedat itshighestpotential and leaningability, sothey must beunder the parents’ care. Also, parents must prepare, understand and set environment to support theirchild’swellgrowth. (RungruttananBoonyaruk. 2011)

From all abovereasons, researcher was attracted to study on approaches and theories on development on the development of parents’ growthevaluation for disabilitychildren, specialeducation center, Kalasin Province, in order to find a prompt way for parents to understand in a service on helpingtheseabilitychildren and conductprimary assistance to themupontheirdisability condition by a family-basedprinciple.

Objectives

1. To develop the parents’ growthevaluation for disabilitychildren, specialeducation center, Kalasin Province
2. To audit the quality of the parents’ growthevaluation for disabilitychildren, specialeducation center, Kalasin Province

Research Tools And Procedure

1. The researchtoolswere divided into 2 types; semi-structure with non-directive interview and questionnaire to audit suitability of the evaluation and explore quality of the parents’ growthevaluation for disabilitychildren, specialeducation center, Kalasin Province. The questionnaire contained 5 rating scale.
2. Procedure ResearchMethodology and Delphi Technique were used for the researchprocedure.

Scope Of The Study

In this research, the researcherspecified scope of study as follows;
1. Data source scope : data providers were 21 experts in the multidisciplinary team selected by purposivesampling in order to get real experts and cover all needed data. These 21 data providers included; 1) twopediatricians, 2) twoactivitytherapists, 3) 2 physicaltherapists, 4) specialeducationteacher, 5) five parents with 10-year-experience of supportingdisabilitychildrendevelopment and assistant
2. Content scope : content scope included 6 skills of disabilitychildren’sgrowth; Gross Motor development, Fine Motordevelopment, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or academicreadiness.
3. Variable scope : variable scope included quality of growthevaluation for disabilitychildren and
characteristics of the disability children’s development in Special Education Center, Kalasin Province.

Data Collection

Data collection processes were as follows: The researcher sought for specialists on disability children in health care center in Kalasin Province included; Kalasin Hospital, Public health office, Special Education Centers, in order to get quality data providers. After that, the researcher would coordinate them to be data providers and conduct interview and questionnaire.

Data Analysis

Data was analyzed by specified 21 specialists who were units of analysis by using the following research statistic:

1. Data from interviewing would be analyzed by content analysis.
2. Data from questionnaire would be analyzed by:
   Part 1: Analyze general condition and data of the answerers by using frequency distribution table and percentage
   Part 2: Analyze data on suitability on the evaluation and explore for its quality of growth evaluation for disability children using median and interquartile range and compare with the criteria
3. Rater Agreement Index or RAI of Burry-Stock and others would be analyzed by using case study of one example and two evaluators in order to find index of consistency from the two evaluators who observed or estimated behaviors of one sample group using scoring rubric.

Research Statistic

The statistics used in this research were mean, percentage, median, interquartile range and Rater Agreement Index: RAI determination.

Results

1. According to all three times of the analysis parents’ growth evaluation for disability children by using Delphi Technique, the result could be concluded that the parents’ growth evaluation for disability children in the special education center in Kalasin Province contained the highest fitness value and high consistent value (Mdn. = 4.00 – 5.00, IR = 0.00 - 1.00) which was in an acceptable level. There was also the evaluation on 6-skill development; Gross Motor development, Fine Motor development, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or academic readiness and the evaluation criteria were the skills that met standard or “normal growth” must be in middle and good level, but if the skills did not meet the standard when compare with normal children’s criteria, these disability children would be in a should-support level (good level=3, follow the instructions fluently, middle level=2, can follow some instructions, should-support level=1, cannot follow the instructions).

2. According to the quality audit of parents’ growth evaluation for disability children in the special education center in Kalasin Province, there were 2 assessors evaluated 6 development skills; Gross Motor development, Fine Motor development, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or academic readiness. The result found that the Index of Consistency of the assessors was 0.92 and the analysis result on disability children development found that the disability children’s development level increased more than before receiving the service at level of 0.05 level statistical significant. This result helps to know the level of disability children level and able to make Individualized Education Program or IEP consisted with type and requirement of disability children which affect them to have the highest potential and continuous development.

Conclusions and Discussion

1. According the parents’ growth evaluation for disability children in the special education center in Kalasin Province, the result found that all three times of the analysis parents’ growth evaluation for disability children by using Delphi Technique, the highest fitness value and high consistent value which was in an acceptable level. here was also the evaluation on 6-skill development; Gross Motor development, Fine Motor development, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or
academic readiness and the evaluation criteria were the skills that met standard or “normal growth” must be in middle and good level, but if the skills did not meet the standard when compare with normal children’s criteria, these disability children would be in a should-support level. The important factors in evaluation disability children were; their parents needed to have knowledge and understanding in childhood’s development. All involved people also must participate in stimulating children’s growth which consisted with SompornWanset (2000 : B) which mentioned about parents participation in the primary health care service for disabilities. This principle was about to categorize disabilities into individual group and in family group by their own requirement, aim to develop them with full potential. All level of persons in charge must participate in service providing, cover all service, stretch, modernize, legalize the services and also follow up and evaluate the services continuously. Somporn’s study also harmonized with O’Toole’s study (1995), the parents of disability children needed to be trained in order to know and concern about the following content: 1) the growth of most normal children would be developed by the growth hierarchy, 2) the children’s effectiveness would be taken place with the rehabilitative children whom their parents believed that their children would be developed faster if they participated in the development practice and rehabilitation, 3) disability children must access chance for their rehabilitation, the parents must admit that environmental changes or daily life context and rehabilitation influenced their children to learn more.

2. According to the quality audit of parents’ growth evaluation for disability children in the special education center in Kalasin Province, there were 2 assessors evaluated 6 development skills; Gross Motor development, Fine Motor development, self-assistant in daily life, receptive and expressive language, social skill and intelligence skill or academic readiness. The result found that the Index of Consistency of the assessors was 0.92 and the analysis result on disability children development found that the disability children’s development level increased more than before receiving the service at level of 0.05 level statistical significant. This result helped to know the level of disability children level and able to make Individualized Education Program or IEP with type and requirement of disability children which helped them to have the highest potential and continuous development. This result matched with SompornWanset’s study (2004 : 157-159) that the result of early intervention model for disability children’s development by the special education center’s participation management in school district number 9 found that; the parents and health officials requested to participate in the primary assistance to disability children by identifying problems, planning for assistance, providing facilities, media, service, and any other education support, cooperating in developing potential by the individual’s requirement and also evaluating work’s process and solving problems. The study of Roffey S. (2001) on result of effective primary assistance, the service providers needed to concern about the importance of working with parents, they had to be sensitive and interested in the process and content of conversations. Beside of the work on social relationship, they also needed to know about organization structure in order to work together between parents at home and teachers at school.

Acknowledgements

1. Suggestion on utilizing the research result
In order to use the parents’ growth evaluation for disability children in the special education center in Kalasin Province, parents need to have knowledge and understanding in evaluating disability children’s growth and the children individual’s needs.

2. Suggestion for further study
There should be a study and development on disability children’s development for teacher in multidisciplinary team and other relevant organizations in all type of education management for disability children by area context.

References

Executive Research Report, Copied version.


Development Herbal Production for Serving Community Attractions Case Study of Nathong Village Vangvieng District Vientiane Province Laos

Bounxom Sriharath

Abstract

The objectives of this research were: 1) to study contexts of communities and herbs in Nathong village Vangvieng District Vientiane Province Lao People’s Democratic Republic 2) to study the herbal product processing at in Nathong village Vangvieng District Vientiane Province Lao People’s Democratic Republic. The target site of this research and development in Lao People’s Democratic Republic was at Ban Nathong village Vangvieng District Vientiane Province. This research and development integrated both qualitative and action research methodologies including: in-depth interviews, brainstorming, focus group discussions, workshops and practices in processing the herbal products with community participation. The results of the studies were as follows.

1. The study of community and herb contexts found 648 villagers, 323 females, 110 families, and 123 households at Nathong village Vangvieng District Vientiane Province of Lao People’s Democratic Republic. They were farmers, traders, employees and civil servants. Most of them were Buddhists. The sick people usually used the local herbs for common sickness treatment, and went to see the doctor at the hospital just for the serious cases. Those herbs were for the treatment of: 1) respiratory diseases, 2) gastrointestinal tract, 3) urinate diseases, 4) neurotic disease, 5) rheumatoid, 6) sexual transmitted diseases, 7) blood circulation diseases, 8) venomous animals, 9) flu, and 10) skin diseases.

2. A study of herbal product processing at the model community in Nathong village Vangvieng District Vientiane Province of Lao People’s Democratic Republic found at least 4 key processes: herb acquiring, herb washing, attending workshops for relevant knowledge, and herbal product processing practices. Their community herbal products included: mixed herbal balls, liquid balms, herbal balms, multipurpose herbal liquids, herbal shampoo, fabric softener, dish washing liquid and mosquito repellence.

3. The development of herbal product processing at the selected site in Nathong village Vangvieng District Vientiane Province of Lao People’s Democratic Republic resulted outputs of the knowledge essential for the process included: 1) focus group discussions, 2) workshops with the experts 3) processing practices. Their herbal products from such practices included: liquid balms, herbal shampoo, and dish washing liquid.

Introduction

Lao People’s Democratic Republic believes in important strategy on protection and construction the country since the changing of the governing in 1975. Many years later, our country has stability in politics, protecting the country, and protecting for peace. Then, our party intends to develop our country. Besides, we have relationship with several countries in the world, response to two-party relationship and several party relationship for education, public health, agriculture, forestry, transportation, industry, investment, commercial and so on. Each party takes advantages.

Lao People’s Democratic Republic attends to be the member of many international organizations; for example, United Nations, Franco phonny (for the countries which use French language, a member of Association of South East Asian Nations, World Trade Organization and soon. It shows that Lao People’s Democratic Republic is stronger in many ways. There is a greater way of Lao Revolution People Party in the IX reference of the party. It is to push the country away from under development country in 2020. The party plans to develop the rural. The important problem is poverty in the rural. The policy is to solve the poverty of the people in the rural areas. The authorities who look after the rural have to take care of the rural specially because development in the rural in low, especially, agriculture which is the basic economics for the country more than 50% GDP. 80% of rural people are farmers. Over 83% of them are not insured for food, with low quality of life. Many families lack of chances to attend the authority services or attend the last services from the government. The party and the government worry about them so they try hard to help them, especially the people who live far away in the arid areas. In the developing plan of 2001-2010, there is economics structure which villages have to practice practically, the policy must be done effectively and get rid of the poverty.

Nathong village is the goal for this study. Nathong village Vangvieng District Vientiane Province practiced the policy and the quality life of the people is better gradually. The attractions service is developed but not satisfaction. Many things are still the problems which have to be improved better. There are not any
products in the attractions so the author is interested in development herbal production for serving community attractions, case study of Nathong village Vangvieng district Vientiane province.

Methods
To study and develop herbal production for serving community attractions in Nathong village Vangvieng district Vientiane province 1. Study community context and herbal context in Nathong village Vangvieng district Vientiane province 2. To develop herbal production in Nathong village Vangvieng district Vientiane province

This study is Research and Development: R&D, by combining Action Research. The tools are interviewing, group discussion, workshop and fieldwork with community for herbal production of the community. The population who provide important information in Nathong village and the authorities are the officers of Basic Construction and Rural Development Department (for towns) and the committee who respond village economics; for example, Nathong village headman, and the members of Nathong village attractions service Nathong village Vang vieng district Vientiane province. Content analysis was used for quality data analysis. The analysis was interpreting data from field study by interviewing, group discussion and workshop. The results can be concluded as follows:

The Results
1. Community Context Study and Herbal Context
A Nathong Village Context Nathong village is an old village that has been told for a very long time. The former name of this village was Namkla village because there was NamKla stream running pass Pha Song cliff. The water was very cold and stiff while the people were swimming so it was called Namkla. The village was called Namkla after the stream, then. (Interviewing Mr.Inta-30/1/2011)

In 1708, there were only 6-7 families which moved from Huaphanh Province. Later, the village got bigger. The village’s name was changed by new villagers who moved from other villages. It was call Namkla village because they could not pronounce correctly. During 1709-1975, the village was called both Nam ka and Namkla (Interviewing Kamson 19/2/2011). Than Luang Hode family was the first one who established the village. When the country was free and changed the governing into Lao People’s Democratic Republic in 1975 Namkla or Namka village was changed into Nathong village since then. (Interviewing Kamgow Sriboribarn 30/2/2011).

Nathong village is a rural village, 6 kilometers far from Vang vieng district municipal in the west. In the past passengers travelled by boats of rafts along the Namsong river to Nathong village. Nowadays, they can cross a bridge for comfortable transportation. It rains much in the rainy season. Nathong village is 2 kilometer long closed to Nasom village in the north, 0.5 kilometer closed to Phathong village in the south, 0.5 kilometer closed to Phaka village in the east, and 1 kilometer close to Say Phu Ya Thao in the west. (Report of Nathong Village Office 2011).

Populations Condition
Nowadays, Nathong village depends on Nalongkwang village’s group. There are about 648 people in Nathong village, 323 women with 110 houses and 123 families. About 539 people are Buddhism. There are many tribes of people live together in the village, 80% are Lao-Tai, and 20% are Mon-kmaire, 269 workers-with 116 women, 87 reserved workers-with 39 women.

Social and Economics Condition
Most of people are diligent and patriots. Rice farm is a main career, orchard and cattle farm are secondary careers. Some people earn their living on employee, general officer, and commerce. There are Buddhist temples and schools in the village. It is developed for public health and there are not any crimes in the village, it is peaceful. There are 125,647 ha for the rice farm area, the production capability is 3.8 ton/ha. A person achieves 417 kilograms of un milled rice a year which is enough for consuming and there is the rest to bug for his income.

Village Development Condition
The villagers develop their village by the government’s projects and their village’s ability. Our village does not have good projects to practice. Most of the projects were done in the past by the government’s plan and the party’s, for example, basic construction about house building and the group of developed village. They practice by the center’s commands. The headman and the villagers always have a meeting about construction in the village. There are concrete houses, wooden houses in the village. The roads in the village are developed, many lanes to the village and other villages are built completely. Visitors can travel to Pukam cave more comfortably. Travelling to the town can be done for 2 seasons so visitors can travel there the whole year. There is a parents association to cheek their children’s ages to attend school as age standard. There is room for doing homework (at the headman’s office), a public health hall to serve people and instruct them about public health. The serious sick people are transferred to the hospital in the province or other provinces or the neighborhood
countries. Dead person’s relationship wills achieve 500,000 kip from the village’s welfare. Every family has at least 1 mobile phone for communication.

Nathong village has basic factors, for example, social creative factor, and natural footor. There are governing organization, youth organization, elderly organization and protective organization in the village. They are union ship for their happy village and their advance. The natural environment of the village is Nam ka stream. There is a stream running through the rice field the whole year. For this condition, the villagers can work on agriculture every season. An interesting attractions in the village is Pukam cave. Visitors in the country and foreigners always visit there and a lot of incomes support the village.

Herbal Context

The results of herbal context study in Nathong village Vang vieng district Vien Tiane province. Most of herbs found in the village have the same name as E-sarn’s but some are different names by different locals. Two reasons to name the herbs are calling by ancient E-sarn and calling by universal langage. E-sarn’s names are similar to Laotian recipes. Herbs are divided by curing, for example, herbs for breathing system, digestive system, urinary system, neurotic system, muscle and bone system, reproductive system, poisonous animals, other diseases and skin diseases.

The results of the study for herbal context in Nathong village Vang vieng district Vientiane province were to aim to improve the herbal indications to produce the herbal production for Pukam cave attractions. Visitors can use the herbal production during their trip or after the traveling, for example, taking a bath, swimming, sunbathing, volleyball by the stream, football and soon. Visitors have to take a bath to clean their bodies. This is the reason for choosing herbal transformation to be the production to serve community’s need and visitors’

2. Process for Developing Herbal Production Nathong village Vangvieng district

Vientiane province

2.1 Group Discussion

These following aims are 1) to determine herbal transformation for kinds of production. 2) To determine activities for practicing. 3) To determine each member’s duty. To have a group discussion and brainstorming about herbal transformation for kinds of production, Nathong production group agreed to product 7 productions, that is : 1) compress 2) water balm 3) balm 4) shower cream 5) shampoo 6) dish washer 7) fabric softener. They choose some productions to be the real productions, that is : 1) herbal water balm 2) Yanang leaf herbal shampoo 3) dish washer

2.2 Workshop for Herbal Transformation for Herbal Productions

The discussion group determined the main activity which is interesting, workshop for herbal transformation for herbal productions. The participants are officials of Vangvieng district, the headman, representatives of the committee for village development, 15 members of village group. There are 3 experts from National University; Social Welfare and Development field, Faculty of Social Science. The results of workshop on April 3, 2011 were that; there were two parts of workshop, theory and practice. The researcher was the tutor for theory part with 3 parts, first was informing about herbs for productive transformation, for example; herbal tea, dried herbs, powder herbs, fresh vegetables and fruits for herbal drinks by boiling or pickling; second, informing about some productions for example, soap, conditioner, dish washer, shampoo, pharmaceutical for topical application such as, balm (as herbal balm) water borneol (as herbal water borneol, dish washer (as herbal dish washer), all purposed solution (as herbal all purposed solution, shampoo (as herbal shampoo) and so on. For practicing, the experts for National University informed how to transform herbs by demonstration for interested participants. The herbal transformation which were the results of the workshop; 1) herbal compress 2) herbal water balm 3) herbal balm 4) herbal all purposes solution 5) Yanang leaf herbal shampoo 6) herbal dish washer 7) herbal fabric softener. The followings are some theories which informed by the experts;

After workshop, sightseeing, demonstration for transformation, they practiced for the community herbal productions that is: 1) herbal water balm 2) Yanang leaf herbal shampoo 3) herbal dish washer

1) Method of herbal water balm transformation

(1) Ingredients : camphor 100 grams boneol 100 grams mental 250 grams herbal oil
2 spoons plastic jar bottle for cotton containing

(2) Methods: Put the ingredients into a plastic bag and shake until it turns to be water. Boil the herbal oil and wait until it is cooloan has sediment and clear. It takes about 4-5 hours. Extract clear solution from the sediment, add coloring for beauty and bottle with or without cotton. Knowledge body for making herbal water balm is various. Some recipes use carnation oil, Rakam oil and peppermint to add the quality for relief painful symptom. Some recipes use Ecualyptus oil to is made by adding lemon grass, carnation oil and Kakam oil. Lemon grass prevent us from mosque to biting

2) Method of Yanang leaf herbal shampoo transformation
(1) Materials: Yanag leaves 3 kilograms N.70 2 kilograms salt 2 kilograms clean water 10 kilograms

(2) Methods and procedures: Squeeze Yanang leaves with water, boil and strain it for Yanang leaf solution. Stir N.70 until it dissolves, add salt into the mixture. Put Yanang leaf solution into the mixture, stir it. Add perfume and stir it again

3) Method of herbal dish washer transformation

(1) Materials: N 70 1 kilogram Removal of fat 1 kilogram, thicken powder 100 grams preservatives, 5 cc lemon flavor 25 cc cool boiled herbal water 5 liters yellow coloring

(2) Method and procedures: Mix coloring with a glass of water Mix N.70, removal of fat, and thicken power together and stir the mixture while adding cool boiled herbal water. Adjust the thickness of the solution with thicken powder. Add coloring water and preservatives. Leave the mixture for 30 minutes and then bottle it

Development the process of herbal production in Lao People’s Democratic Republic through the process of exchanging knowledge by group discussion to choose herbs for transformation and productions, workshop and practicing were done participatory so the herbal productions can be produced for the market of Nathong village’s attractions. The community has its herbal productions which caused by the learning process of the community. It makes the community understand the way to develop and participate the activities. Therefore, groups of herbal transformation are founded to produce herbs for the herbal productions which are the unique of Nathong village’s community concretely for the followings: herbal water balm, Yanang leaf herbal shampoo, and herbal dish washer. The first three productions are good practices for Nathong villagers and there will be other productions to practice again. We hope that National University will improve the production’s quality in the next time.

Even though, the quality of the Nathong village’s herbal products have not constantly achieved the standard as of the neighboring countries, however, it is admirably a good start. Since the standards may vary in each country, the quality of Nathong village’s herbal products may be proved to be better than some others. One of the factors is that most agriculture products of Laos are not widely exposed to chemical substances. Additionally, the expert also advised an alternative method to reduce the strength of chemical by using ash solution instead or min with N.70 which is better for the health. Since the herbal products are made in order to support the tourism business as well as to supply the needs of the villagers, an evaluation should be conducted along with the survey on both the tourists and the villagers.

Lastly, I, as a researcher, would like to raise and support the expert’s statement that “the community’s university is the university which is responsible for serving the community with academic services in order to strengthen the community’s power”.
**Proceeding Assembling Staff**

- Dr. Nitaya Klangchanee
- Asst. Prof. Dr. Somsanguan Passago
- Asst. Prof. Dr. Pornarong Siripiyasing
- Asst. Prof. Dr. Prasopsuk Rittidet
- Dr. Wanida Pharanat
- Dr. Mali Hachaisin
- Mrs. Piyanart Panprasit
- Miss Angsuma Kanchak
- Mr. Patamapong Punpibool
- Mr. Krisda Sanbuakham
- Miss Nartida Pansena
- Miss Ubonrat Wanarom
- Mrs. Tantip Khuana
- Miss Pornanong Rawadchoo
- Mr. Puthai Rattaban
- Mr. Thodsapon Wichaiwong
- Mr. Bodin Mongkhonsin
- Mr. Weerawat Samanen