



**(PROCEEDINGS)** 

**3<sup>rd</sup> National and International Research Conference 2019**  
**(NIRC III 2019)**

**“Challenges of Higher Education in Production  
of Graduate Students in the 21<sup>st</sup> Century”**

**1<sup>st</sup> February 2019**  
**Buriram Rajabhat University**



# PROCEEDINGS

3<sup>rd</sup> National and International Research Conference 2019

(NIRC III 2019)





## Buriram Rajabhat University

### BRU Motto

SUVIJO JANE SUTO HOTI: A person who has good knowledge is the best of all people.

### BRU Philosophy

BRU is the institute for local development.

### BRU Vision

By 2021 BuriramRajabhat University will become a leading higher education institute in the Northeast of Thailand with the goals set for local development and international competition.

### BRU Uniqueness

BuriramRajabhat University places great importance on educational management for local development.

### BRU Identity

BRU graduates are equipped with good sense, knowledge, morals and leadership in community development.

### BRU Mission

- 1.To produce high quality graduates and create educational opportunity implemented under acceptable academic and professional standards
- 2.To conduct research, establish bodies of knowledge and create research networks
- 3.To provide academic services, transfer technology, and upgrade and Strengthen the community
- 4.To preserve arts and cultural heritage and promote and inherit local wisdom
- 5.To produce and develop high quality teachers and educational personnel
- 6.To promote and continue royal projects, support and participate in managing national resources and environment in the local community

## Message from the President of Buriram Rajabhat University

The main important roles of Buriram Rajabhat University (BRU) are to develop local communities and to produce graduates with bachelor's, master's, and doctoral degree. Another BRU role is to produce and publicize research works of lecturers and students. This commitment has been made continuously in order to acquire the academic accomplishment with high efficiency. In the 3<sup>rd</sup> National and International Research Conference 2019 under the theme, "Challenges of Higher Education in Production of Graduate Students in the 21<sup>st</sup> Century," it is considered as a good fulfillment in academic and research works since it will help support the lecturers, researchers and students to publicize their own research works. To accomplish this conference, the Graduate School is assigned to be the main host under the cooperation with Faculty of Humanities and Social Sciences, Faculty of Education, Faculty of Agricultural Technology, Faculty of Science, Faculty of Industrial Technology, Faculty of Management Sciences, Office of International Relations, and Research and Development Institute.

In addition, the conference is also supported by Office of the Higher Education Commission, Knowledge Network Institute of Thailand, Council of the Graduate Studies Administrators of Thailand, educational institutes and universities in overseas which are the academic networks with the BRU. That is a great pleasure.

On behalf of Buriram Rajabhat University, I would like to welcome eminent persons, lecturers, researchers, students and participants both from Thailand and overseas to BRICC and NIRC. My special thanks go to all four keynote speakers from Niagara University, Lewiston, New York, U.S.A. and all featured speakers both from Thailand and overseas, peer reviewers, and commentators. I also sincerely thank the organizing committee for their great effort and contribution to make this conference possible and successful. It is highly hoped that this conference will be beneficial for all participants and those who are interested.



(Associate Professor Malinee Chutopama)  
Acting President  
Buriram Rajabhat University



## Types of the conference

1. Academic Conference
  - 1.1 Keynote address by national and international scholars
  - 1.2 Oral and poster presentation of national and international research in the following aspects:
    1. Education
    2. Humanities and Social Sciences
    3. Science and Technology
    4. Agriculture and Animal Sciences
    5. Health Sciences
    6. Management and Tourism
    7. Arts and Designs
    8. Creative Works and Innovation
2. Conducting proceedings and publishing research works in three journals of Buriram Rajabhat University; Rommayasarn (TCI 1), BRU Academic Journal (TCI 3), BRU Research and Development Journal (TCI 2), and foreign journals.

## Schedule

No.	Activities	Date
1.	Publicize the project	30 Aug. 2018-31 Jan. 2019
2.	Submission of full paper	31 Aug. 2018-30 Dec. 2018
3.	Announcement for full paper acceptance	5 Jan. 2019
4.	Return of full paper correction	12 Jan. 2019
5.	Registration for presenters	31 Aug. 2018-5 Jan. 2019
6.	Registration for participants	31 Aug. 2018- 31 Jan. 2019
7.	Dinner Talk	31 Jan. 2019
8.	Academic conference	1 Feb. 2019
9.	Foreign network meeting	2 Feb. 2019
10.	Publication online proceedings	28 Feb 2019

## Date and Venue

Opening ceremony, keynote address, and poster presentation will be held at Witcha-attasart Auditorium. Oral presentation will be held on floors 6, 7, 8, 9 10 and 11, Building 15 of Buriram Rajabhat University. Poster session will be at 3th floor, Buddharaksa Meeting Room.

## Expected Outcomes

1. Lecturers, researchers, students and those interested can gain knowledge utilized in developing research and academic works and life quality.

2. Research works, creative and innovative works can be brought to the development for all utilizers.
3. Cooperation is conducted amongst Rajabhat Universities and university networks both in Thailand and abroad.
4. The quality research works are publicized and published in proceedings or in national and international journals.

### **Conference Organizers**

Graduate School, Faculty of Humanities and Social Sciences, Faculty of Education, Faculty of Agricultural Technology, Faculty of Science, Faculty of Industrial Technology, Faculty of Management Sciences, Office of International Relation Affairs, and Institute of Research and Development of Buriram Rajabhat University

### **Conference Promoting Organizations**

Office of Higher Education, National Archives Institute and Institute of Higher Education from foreign countries which have done MOU with Buriram Rajabhat University namely;

1. Niagara University, U.S.A.
2. University of Winnipeg, Canada
3. Akdeniz University, Turkey
4. Universiti Putra Malaysia, Malaysia
5. Hue University of Foreign Languages, Vietnam
6. Ton Duc Thang University, Vietnam
7. Philippine State College of Aeronautics, the Philippines
8. Qiannan Normal University for Nationalities, China
9. Shangrao Normal University, China
10. Kathmandu University, Nepal
11. Royal University of Phnom Penh, Cambodia
12. National Pingtung University, Taiwan
13. Institute of Advanced Studies in English, India
14. Tilak Maharashtra Vidyapeet, India
15. Mandalay University of Distance Education, Myanmar
16. Provincial Teacher College, Siam Reap, Cambodia
17. Savannakhet Teacher Training Collage, Laos PDR
18. Middle Tennessee State Univerisy. MTSU., U.S.A.
19. University of Norhern Univeristy, Philippines
20. Chungnam National Univeristy, Daejeon, Republic of Korea

## Application

Participants who want to present their research works can apply at NIRC2019.bru.ac.th from now until 5th January 2019. The individuals who want to join but do not present research works can apply from now until 31st January 2019.

## Registration

Participants must pay the registration fee based on the follows rates:

1. International Conference
  - 5,000 Baht for Thai presenters
  - 200 USD for foreign presenters
  - 50 USD for all participants both Thai and foreigners who don't want to present the research works
2. National Conference
  - 3,000 Baht for research works presentation
  - 1,000 Baht for participants who don't want to present the research works.

**N.B.** : The article conducted by more than one person is allowed to register only one person. Co-researchers or followers register as participants. Then keep receipt to refund the meeting documents, food/drinks coupon on 1st February 2019 in front of Witcha-attasart Auditorium. In case of being absent for presenting or not being allowed to present the research works, the applicants will get no refund.

### 3. Methods for Registration Payments

3.1 Pay by cash with the application form to Mrs. Prakai Sirisamran, Office of Graduate School, (8th floor, Building 15) Buriram Rajabhat University 439 Jira Road, Muang District, Buriram Province, 31000

### 3.2 Electronic Bank Transfer

Name of Account : National and International Academic Conference, Buriram Rajabhat University (Saving)

Bank : Bank of Ayudhya (Thailand)

Account Number : 427-1-26004-1

Swift Code : AYUDTHBK

Address : Bank of Ayudhya Branch : Buriram Rajabhat University, 439 Jira Road, Muang District, Buriram Province, 31000

**N.B.** : Send a copy of transferring receipt to Email : nirc2019@bru.ac.th after money has been transferred



## Preparation of Research Article Manuscript

It is recommended to study the preparation of research article manuscript at the website: [NIRC2019.bru.ac.th](http://NIRC2019.bru.ac.th). The presenters must strictly follow the form of writing articles.

## How to Present the Research Works

1. Research works fall into two categories as follows:

1.1 Graduate students' research works approved by the appointed committee

1.2 Research works from general researchers

2. Types of presentation:

2.1 Oral presentation

The oral presentation must be presented using PowerPoint 12 minutes are allotted per one title, and 3 minutes for answering questions. The presenters must submit PowerPoint file as in PDF to [nirc2019@bru.ac.th](mailto:nirc2019@bru.ac.th) before 20th January 2019.

2.2 Poster presentation

The presenters must attach their posters on the board provided and be ready to present according to the schedule at Buddharaksa Meeting Room , 3th floor, Building 15 of Buriram Rajabhat University on 31st January 2019 at 01.00 p.m.- 05.00 p.m. The language used to present is Thai or English for national presentation, but only English will be allowed for international presentation.

## Announcement of Selected Presenters

The selected presenters will be acknowledged on 5th January 2019.

**N.B.** : The correct full paper will be collected as online proceedings and can be accessed from Google Scholar. The papers will be published in six academic journals of Buriram Rajabhat University or foreign journals if it is approved as an excellent one. Publication in academic journals must follow each journal's regulations, and also the researcher must present the paper by him/herself following the schedule. The published research works would be partial fulfillment of education according to the announcement of Office of Higher Education Committee.

## Selection of Research Works

The appointed committee of Buriram Rajabhat University reserve the right and follow the university announcement relevant to the, Criteria for selecting research and academic articles to publicize and publish in the 3rd National and International Research Conference 2019 and the university order on the Appointment of Proceedings Editorial Staff in the 3rd National and International Research Conference 2019. The following are the committee's consideration:

1. Selection of groups and type of presentation
2. Selection and publications research works in academic journal, or proceedings
3. Disqualification paper presentation as in the following cases:
  - 3.1 Abstract, research article and posters which do not comply with the required form and the peer reviews' suggestions;
  - 3.2 The delaying registration and payment and/or incomplete registration and payment; and
4. The committee's consideration is considered final.





**February 2, 2019**

08.30 a.m.- 09.00 a.m.	Registration
09.00 a.m.- 09.15 a.m.	Opening ceremony by Assoc.Prof. Malinee Chutopama, Acting President of Buriram Rajabhat University
09.15 a.m.- 12.00 a.m.	Foreign research network meeting
12.00 a.m.-13.30 p.m.	Lunch

**N.B.** : The schedule is subjected to change as appropriate.

**Oral Presentation Session Room No. 150901 (ED 1)**  
**Floor 9, Building 15, Buriram Rajabhat University**

No	Code	Name	Organization	Topic	Type	Time
	Featured Speech	Prof. Dr. Ted Yu-Chung Liu	National Pingtung University	Towards a research methodology with learning: the implications of narrative approach in education		1:00-1:40 p.m.
1	ED-O-15	Zin Me Soe	Mandalay University of Distance Education	EFL Teachers' and Learners' Perceptions towards Culture and Culture Learning in Myanmar Context	Education	1:40-1:55 p.m.
2	ED-O-16	Ni Ni Hlaing	Mandalay University of Distance Education	Students' Perceptions on 21st Century Learning Skills: Myanmar Context	Education	1:55-2:10 p.m.
3	ED-O-17	Khin Mar Mar	Mandalay University	Perceptions on Parental Involvement and Autonomy Support by Basic High School Teachers and Parents in Myanmar	Education	2:10-2:25 p.m.
4	ED-O-18	Ni Ni Hlaing	Mandalay University of Distance Education	Pre-Service Training for Teacher Quality Improvement of Educational Context in Myanmar	Education	2:25-2:40 p.m.
5	ED-O-19	Soe Soe Oo	Mandalay University of Distance Education	The Use of Lecture-related ICTs and Technology-related Pedagogical Practices of University Teachers in Myanmar	Education	2:40-2:55 p.m.
6	ED-O-20	Honorato R. Patubo	University of Northern Philippines	OPTIMIZING STUDENTS WRITING PROFICIENCY USING METALINGUISTIC CORRECTIVE FEEDBACK	Education	2:55-3:10 p.m.
7	ED-O-21	Ma. Jesusa D. Ridor-Unciano	University of Northern Philippines	K to 12 Deliverance: Basis for the Generation of 21st Century Instruction	Education	3:10-3:25 p.m.
<b>Certificate Presentation</b>						3:30-4:00 p.m.

## Oral Presentation Session Graduate School Meeting Room 9<sup>th</sup> Floor (ED 2)

### Floor 9, Building 15, Buriram Rajabhat University

No	Code	Name	Organization	Topic	Type	Time
	Featured Speech	Prof. Dr. Leslie Barratt	University of Malaya, Malaysia	What English Skills Do Graduate Students Need?		1:00-1:40 p.m.
1	ED-O-01	พลพิศิษฐ์ ตาละซอน Polpisit Talason	โรงเรียนมัธยมยางสีสุราช	The Development of Problem-solving Ability and Learning Achievement in Chemistry Subject of Mathayomsuksa 6 Students	Education	1:40-1:55 p.m.
2	ED-O-02	ชญานี โนนคู่เตโขง Chayanee Nonkhukhetkhong	มหาวิทยาลัยราชภัฏอุดรธานี	The Development of English Reading Comprehension Ability Using Collaborative Strategic Reading of Matthayomsuksa 5 Students	Education	1:55-2:10 p.m.
3	ED-O-03	ระพีพรรณ บุญราศรี Rapeepan Boonrasri	มหาวิทยาลัยราชภัฏอุดรธานี	The Development of English Reading Comprehension Using 4MAT Learning System Of Matthayomsuksa 1 Students	Education	2:10-2:25 p.m.
4	ED-O-04	KORRAKOD PANPOOM	Udon Thani Rajabhat University	The Development of English Vocabulary Learning Ability Using Total Physical Response Storytelling for Prathomsuksa 5 Students	Education	2:25-2:40 p.m.
5	ED-O-05	PONGSAKORN BOONSORN	UDON THANI RAJABHAT UNIVERSITY	THE DEVELOPMENT OF ENGLISH SPEAKING ABILITY USING ACTIVE LEARNING ACTIVITIES OF MATTHAYOMSUKSA 3 STUDENTS	Education	2:40-2:55 p.m.
6	ED-O-06	WAROONSIRI SURAKITBOWON	Udon Thani Rajabhat University	The Development of English Speaking Ability using Four Communicative Activities for Matthayomsuksa 3 students	Education	2:55-3:10 p.m.
7	ED-O-07	Emalyn Bofil Chairathpong	Udon Thani Rajabhat University	The Development of English Vocabulary Learning Ability Using Visual Aids of Prathomsuksa 1 Students	Education	3:10-3:25 p.m.
Certificate Presentation						3:30-4:00 p.m.

**Oral Presentation Session Room No. 150902 (ED 3)**  
**Floor 9, Building 15, Buriram Rajabhat University**



No	Code	Name	Organization	Topic	Type	Time
	Featured Speech	Prof. Dr. Ni Ni Hliang	Mandalay University of Distance Education	University Students' Engagement in International Experiences and the Development of Intercultural Competencies: Myanmar Context		1:00-1:40 p.m.
1	ED-O-08	Podjaman Inudom	Khon kaen University	Problem-posing approach in English language teaching: A critical study of Thai undergraduate students	Education	1:40-1:55 p.m.
2	ED-O-09	MORSHED SALIM ABDULLAH AL-JARO	University of Malaya	Guide me please! EFL Student Teachers' Perceptions of their Teaching Practice from a Yemeni University	Education	1:55-2:10 p.m.
3	ED-O-10	Milinda NORLASEN	Savannakhet Teacher Training College	Teachers' Perceptions towards Teaching English Vocabulary Techniques at Foreign Language Department, Savannakhet Teacher Training College	Education	2:10-2:25 p.m.
4	ED-O-11	Verasak Boonyapitak	Sukhothai Thammathirath Open University	Development of Multi – Cultural Curriculum for Primary School in Yala Province	Education	2:25-2:40 p.m.
5	ED-O-12	Souk Vongviman	Savannakhet Teacher Training College	A Comparison of Scripted and Unscripted Role Play Techniques on Lao EFL College Students' Speaking Ability	Education	2:40-2:55 p.m.
6	ED-O-13	Katika Rajboutra	Buriram Rajabhat University	The Current States of Teachers' Doing Classroom Action Research at Savannakhet Teacher Training College, Lao People Democratic Republic	Education	2:55-3:10 p.m.
<b>Certificate Presentation</b>						3:20-3:45 p.m.







## Oral Presentation Session Room No. 150905 (SC 1)

### Floor 9, Building 15, Buriram Rajabhat University

No	Code	Name	Organization	Topic	Type	Time
	Featured Speech	Prof Dr. Myint Myint Sein	Mandalay University			1:00-1:40 p.m.
1	SC-O-01	Sa-nga Patjami	Buriram Rajabhat University	CHARACTERIZATIONS OF ORDERED $\Gamma$ -SEMIGROUPS BY THE PROPERTIES OF THEIR ORDERED $\Gamma$ -IDEALS	Science and Technology	1:40-1:55 p.m.
2	SC-O-02	Jakkaphan Riantaisong	Buriram Rajabhat University	On $(m, n)$ - $\Gamma$ -ideals of an ordered $\Gamma$ -semigroup	Science and Technology	1:55-2:10 p.m.
3	SC-O-03	Watcharin Sainumsai	Songkhla Rajabhat University	Influence of Crosslink Density on Strain-induced Crystallization and Strength of Sulphur-vulcanized Natural Rubber	Science and Technology	2:10-2:25 p.m.
4	SC-O-04	Kongkiat Tidjaidee	Buriram Rajabhat University	CHARACTERIZATIONS OF ORDERED SEMIRINGS BY THE PROPERTIES OF THEIR ORDERED $(m,n)$ -QUASI-IDEALS	Science and Technology	2:25-2:40 p.m.
5	SC-O-05	Wasana Kaewla	Surindra Rajabhat University	Rice, fish and salt's field, way of life in Tung Kula Dimensions	Science and Technology	2:40-2:55 p.m.
6	SC-O-06	Myint Myint Khine	East Yangon University	Study on Some Bioactivities of Leaves of Calotropis Procera R.Br.	Science and Technology	2:55-3:10 p.m.
<b>Certificate Presentation</b>						3:20-3:45 p.m.

## Oral Presentation Session Room No. 150906 (SC 2)

### Floor 9, Building 15, Buriram Rajabhat University



No	Code	Name	Organization	Topic	Type	Time
	Featured Speech	Prof Dr. Ilhan Cagirgan	Akdeniz University, Turkey	A Fragile Capsule Mutant for Combine Harvestable Sesame		1:00-1:40 p.m.
1	SC-O-07	Nwe Nwe Hninn	Yadanabon University	Asparagus: A Small-Scale Agriculture Alternative in Myanmar	Science and Technology	1:40-1:55 p.m.
2	SC-O-08	Nwe Nwe Hninn	Yadanabon University	Bamboo Diversity and Traditional Uses in Myanmar	Science and Technology	1:55-2:10 p.m.
3	SC-O-09	Khin Myint Aye	Monywa University	Socio-economic Survey of Commodity Flow in Monywa District of Myanmar	Science and Technology	2:10-2:25 p.m.
4	SC-O-10	Khin Myint Aye	Monywa University	Flow of Agricultural Produces in Monywa District of Myanmar	Science and Technology	2:25-2:40 p.m.
5	SC-O-11	Thin Myat Nwe	Mandalay University of Distance Education	Acute Toxicity, Hypoglycemic Activity and Isolation of Spiro Compound from the root of Myanmar Indigenous Medicinal Plant, <i>Tribulus terrestris</i> L. (Tsu-te)	Science and Technology	2:40-2:55 p.m.
6	SC-O-12	Thin Myat Nwe	Mandalay University of Distance Education	Acute Toxicity, Antimicrobial Activities and Structure Elucidation of an Isoflavonoid Compound Isolated from the Bark of <i>Mucuna macrocarpa</i> Walt.(Pauk net)	Science and Technology	2:55-3:10 p.m.
Certificate Presentation						
3:20-3:45 p.m.						

## Oral Presentation Session Room No. 150601 (HS 1)

### Floor 6, Building 15, Buriram Rajabhat University

No	Code	Name	Organization	Topic	Type	Time
	Featured Speech	Asst. Prof Dr. Barbara Turnage	Middle Tennessee State University	What you Learn from Attending Graduate School		1:00-1:40 p.m.
1	HS-O-01	Le Ngoc Huy	Vietnam National Lung Hospital	Evaluating laboratory features and prognosis factors of tuberculosis meningitis: a vietnamese retrospective study	Health Science	1:40-1:55 p.m.
2	HS-O-02	Ei Ei Phyo Myint1	Maharakham University	Fish-borne Parasitic Infections in Northeast, Thailand	Health Science	1:55-2:10 p.m.
3	HS-O-03	Ei Ei Phyo Myint1	Maharakham University	Fish borne trematode metacercariae infection and cholangiocarcinoma in myanmar	Health Science	2:10-2:25 p.m.
4	HS-O-04	Korakot Chaimongkhon	Maharakham University	Alternative Medicine for Osteoarthritis in elderly patients, Phrapokklao Hospital Chanthaburi Province ; Trend and Health Promotion	Health Science	2:25-2:40 p.m.
5	HS-O-05	Pacharamon Soncharoen	Maharakham University	Helminthiasis in Remote Area in Northern Thailand	Health Science	2:40-2:55 p.m.
6	HS-O-06	Suratsawadee Sinwat	Maharakham University	Herbal Medicine for Chronic Liver Failure Treatment in Prapokklao Hospital Chanthaburi	Health Science	2:55-3:10 p.m.
7	HS-O-07	Myint Myint Khine	East Yangon University	Traditional Medicine in Myanmar	Health Science	3:10-3:25 p.m.
<b>Certificate Presentation</b>						
3:30-4:00 p.m.						



## CONTENTS

	Page
<b>Education (Oral Presentation)</b>	
The Development of Problem-solving Ability and Learning Achievement in Chemistry Subject of Mathayomsuksa 6 Students Polpisit Talason Kanyarat Cojorn	2
The Development of English Reading Comprehension Ability Using Collaborative Strategic Reading of Matthayomsuksa 5 Students Chayanee Nonkukhetkhong Rapeeporn Sroinam Worawoot Tutwisoot	16
The Development of English Reading Comprehension Ability Using 4MAT Learning System of Matthayomsuksa 1 Students Rapeepan Boonrasri Rapeeporn Sroinam Worawoot Tutwisoot	27
The Development of English Vocabulary Learning Ability Using Total Physical Response Storytelling for Prathomsuksa 5 Students Korrakod Panpoom Napasup Lerdpreedakorn Rapeeporn Sroinam	37
The Development of English Speaking Ability Using Active Learning Activities of Matthayomsuksa 3 Students Pongsakorn Boonsorn	50
The Development of English Speaking Ability Using Four Communicative Activities for Matthayomsuksa 3 Students Wareonsiri Surakitbowon Prayong Klanrit Rapeeporn Sroinam	63
The Development of English Vocabulary Learning Ability Using Visual Aids of Prathomsuksa Students 1 EFL Thai Students Emalyn Bofill Chaivirathpong Worawoot Tutwisoot Rapeeporn Sroinam	76
Problem-posing Approach in English Language Teaching: A Critical Study of Thai Undergraduate Students Podjaman Inudom Suban Keowkanya	99

## CONTENTS (Continued)

	Page
Teachers' Perceptions towards Teaching English Vocabulary Techniques at Foreign Language Department, Savannakhet Teacher Training College	113
Milinda NORLASEN    Viengkhone THIKHAMMY	
Development of Multi – Cultural Curriculum for Primary School in Yala Province	124
Verasak Boonyapitak    Suwannee Yahakorn    Darunee Jumpatong	
A Comparison of Scripted and Unscripted Role Play Techniques on Lao EFL College Students' Speaking Ability	133
Souk Vongviman    Lattana Chanthalasy    Nawamin Prachanant	
The Current States of Teachers' Doing Classroom Action Research at Savannakhet Teacher Training College, Lao People Democratic Republic	134
Katika Rajboutra    Kovit Vajarantaragoon    Nawamin Prachanant	
Pre-Service Training to Improve Teacher Quality in Myanmar Educational System	146
Ni Ni Hlaing    Aye Myat Phyu    Zin Me Soe	
EFL Teachers' and Learners' Perceptions towards Culture and Culture Learning in Myanmar Context	155
Aye Myat Thu    Zin Me Soe	
Perceptions on Parental Involvement and Autonomy Support by Basic Education High School Teachers and Parents in Myanmar	167
Khin Mar Mar    Aye Myat Thu    May Thae Su	
The Use of Lecture-related ICTs and Technology-related Pedagogical Practices of University Teachers in Myanmar	176
Soe Soe Oo    Thuzar Lin	
Optimizing Students Writing Proficiency using Metalinguistic Corrective Feedback	186
Honorato R. Patubo	

## CONTENTS (Continued)

	Page
K to 12 Deliverance: Basis for the Generation of 21st Century Instruction Ma. Jesusa D. Ridor-Unciano	187
 <b>Humanities and Social Sciences (Oral Presentation)</b>	
Ethos, Logos and Pathos in Patient-Doctor Communication at a Nepali Hospital Eak Prasad Duwadi	190
The Impact of Short Academic Programs in Entrepreneurship Education on Self-confidence and Entrepreneurial Intentions in Students Hans Michael Guelich     Ulrike Guelich	200
Pottery Business Development Guidelines to Promote Community Economy: Case Study of Andong Reusy Village, Kampong Chhnang Province, Kingdom of Cambodia Vorn Searivoth     Sureechai Sukantarat Akkharadet Supannafai     Supimpa Wattanasangkhasophon	213
Modernization and Modernity as Represented in Uthis Haemamool's The Brotherhood of Kaeng Khoi in the Characters: Dreams and Aspirations Damrongsak Tadwong     Sasinee Khuankaew	225
The Development of English for Selling Product Pocket Book for OTOP Entrepreneurs in Phetchabun Province Wanwisa Meunchong     Kanokwan Navawat	238
Comparison of Chinese Learning Motivation between Thai University Students and Overseas Students in China Min Xiao	247
The Causal Model of Factors Affecting Continuance Intention to the Taxi Application of The Generation-C in Bangkok Surasit Udomthanavong     Jeerawan Sangkhaong	258



## CONTENTS (Continued)

	Page
Thai Secondary Students' Perceptions on Using Note- Taking Strategy to Enhance Vocabulary Learning Jidapa Chanjomlong Chongrak Liangpanit	271
Thai Graduate Students' Perceptions on Using Collocation in Thesis Writing Lihua Fu Chongrak Liangpanit	286
Harmonious Living in Multi-religious Society according to Buddhadasa Bhikkhu Prayong Jandaeng	293
Gender and Handling Environmental Challenges: Myanmar Education Context Zin Me Soe Ni Ni Hlaing	303
Implementing Democracy in the Classroom: Myanmar Higher Education Context May Thae Su Thin Thin Win	312
Communication Skills in Day to Day Practice of the Doctors: : Myanmar Context Yu Yu Htwe Saw Thidar Khin	322
The Importance of Language Support in Medical Tourism Saw Thidar Khin Yu Yu Htwe	338

### Science and Technology (Oral Presentation)

Characterizations of Ordered $\Gamma$ -Semigroups by the Properties of Their Ordered $(m, n)$ -Quasi- $\Gamma$ -Ideals Wichayaporn Jantanan Sa-nga Patjami Wuttichai Somrit	351
On $(m, n)$ - $\Gamma$ -Ideals of an ordered $\Gamma$ -semigroup Wichayaporn Jantanan Jakkaphan Riantaisong	367





## CONTENTS (Continued)

	Page
<b>Science and Technology (Poster Presentation)</b>	
Production of wine from lotus ( <i>Nelumbo nucifera</i> ) root extracts by <i>Saccharomyces Cerevisiae</i> TISTR 5019 Tiyaporn Luangpipat	535
The study of characteristics of karanda fruit ( <i>Carissa carandas</i> ) on difference stage of ripeness and its used in spicy candy products Mathuros Rattanawongsanit Sasamol Phasuk Poonyanuch Nilsang	542
Effect of Magnetic and Electric Field on the Chemical Properties of Riceberry 1 Rungnapa Suntitumma Porjai Rattanapanadda	555
Efficiency of <i>Feronia limonia</i> (L.) Swing crude extract as Tyrosinase Activity Inhibition Wantana Tidchai Poonyanuch Nilsang Sasamol Phasuk	564
Effects of using dried distillers cassava pulp with solubles (DDCS) on growth performance of growing Thai Native x Anglo-Nubian female goats Kanin Bunnakit Surachai Artkla	572
Effect of dietary supplementation of moringa ( <i>Moringa oleifera</i> ) leaf meal and turmeric ( <i>Curcuma longa</i> L.) on Productive Performance of Native Chickens. Naruemon Somkuna	585
Effects of Cadmium and Arsenic to a Microalga <i>Desmodesmus maximus</i> -A Potential Strain for Toxicity Test in Thailand Surumpa Jareonsin Jeeraporn Pekkoh Chayakorn Pumas	594

## CONTENTS (Continued)

	Page
<b>Health Science (Poster Presentation)</b>	
The Effects of a Fall Prevention Program Among Elderly People Sirikanya Ridthplake    Kajornsuk Piekienng	608
Antimicrobial Activity Of Hiptage Candicans (Hook.F.) Sirirugsa Crude Extracts Against Human Pathogens Thtima La-ongthitirat    Sasamol Phasuk    Poonyanuch Nilsang	620



## Education (Oral Presentation)

## The Development of Problem-solving Ability and Learning Achievement in Chemistry Subject of Mathayomsuksa 6 Students

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### Abstract

This action research aimed to develop problem-solving ability in chemistry subject by using the Problem-based Learning (PBL), Problem-based Learning (PBL) cooperated with social media, and Problem-based Learning (PBL) cooperated with KWL technique. The participants of this study were 19 students who have the problems in problem-solving ability and they were selected by purposive sampling. They were studying in Mattayomsuksa 6 at Mattayomyangsisurat School. The research procedure was divided into 3 main phases consisting of 4 steps which were (1) Plan, (2) Act, (3) Observe, and (4) Reflect. The instruments used in the research consisted of 1) The problem-solving ability tests, 2) the learning achievement tests in chemistry subject, 3) the behavior observation form in problem-solving ability, 4) learning activity record form, 5) students' diaries, 6) interview form, 7) lesson plans integrated with Problem-based Learning (PBL), Problem-based Learning (PBL) cooperated with social media, Problem-based Learning (PBL) cooperated with KWL technique. As a result, after having conducted throughout the phases, the results indicated that:

1. The participants whose problem-solving ability was higher than the criteria of 70% were accounted for 18 students and the mean score after learning by Problem-based Learning (PBL), Problem-based Learning (PBL) cooperated with social media, and Problem-based Learning (PBL) cooperated with KWL technique in 3 phases were 78.84, which was higher than the expectation.

2. The participants' learning achievement was accounted for 80.53% in phase 1, 74.74% in phase 2 and 83.86% in phase 3. It was concluded that students' learning achievement were considered at high level.

**Keywords :** Problem-solving ability, problem-based Learning (PBL), Social study, KWL







students' opportunity to learn by planning and doing by themselves which teachers' role is a facilitator. The progress of project-based learning is a discovering of science and technology focusing on problem-solving. The activities of project-based learning promotes about self-planning to solve the problems (Poonnachot, 1988, p.1). In KWL technique, learning is promoted by activating students to analyze their prior knowledge, be self-planning on what they want, and synthesize prior knowledge and new knowledge with their own pace. It is assumed that KWL technique is consistent to students' problem as if the technique promotes them to solve the problem (Kammoon & Kammoon, 2002, p.92). In cooperative learning, students are encouraged in learning environment as a group which the members of each group are potentially different, and all students are participated in the activities (Kammanee, 2008, p.40). The cooperative learning persuades students to share, synthesize, and develop their knowledge in order to solve the problems in steps by steps. Lastly, social media effectively activates students in learning because it is one of communication channel to discuss what they learn. In short, several of teaching methods and techniques that researcher are interested develops student's problem-solving ability.

From the aforementioned problem, the researcher systematically thinks about how to develop students' problem-solving ability and gain more understanding of the lessons, so the researchers conducts action research focusing on problem-based learning to develop Mattayomsuksa 6 students at Mattatyomyangsisurat school, Maha Sarakham Province in order to boost students to have a higher problem-solving ability as to be consistent to the principle of National Education Act B.E. 2542 (1999) and The Basic Education Core Curriculum B.E 2551 (2008) (Revised Edition B.E 2560 (2017)).

## **2. Objectives of the Study**

This research consisted of two objectives including:

2.1 To develop Mattayomsuksa 6 students' problem-solving ability who were studying at Mattatyomyangsisurat school in order to pass in the criteria of 70%

2.2 To study learning achievement in chemistry subject topic "Petroleum and Polymer"



was 0.42 0.54 0.50 0.54 0.50 0.46 0.42 and 0.38 accounting that all items were appropriate. In phase 2, the value of item difficulty was 50 0.50 0.54 0.54 0.58 0.50 0.46 and 0.46 accounting that all items was appropriate. And for phase 3, the value of item difficulty was 0.25 0.54 0.63 0.46 0.67 0.71 0.54 and 0.63 accounting that all items were appropriate. The reliability calculated by using Cronbach Alpha's coefficient (Aunarromlert, 2006, p. 86-87) applied to measure problem-solving ability in 3 phases. In phase 1, the reliability value was 0.88 which is acceptable. To measure problem-solving ability in phase 2, the reliability value was 0.85 which is acceptable. Besides, to measure problem-solving ability in phase 3, the reliability was 0.79 which is acceptable.

2) The achievement test in chemistry subject which evaluated by the experts found that the IOC value was 0.67 – 1.99 which is acceptable. The test contains 12 items in phase 1, 16 items in phase 2, and 24 items in phase 3 respectively. After that, the test was piloted to non-participants which their qualification was similar to the participants, which are 25 students who were studying in Mattayomsuksa 6/2. 3) Behavior observation form in problem-solving using to indicate behavioral appropriateness had the mean score of 4.33, which was considered as “good”. Moreover, the mean scores of behavior observation form in problem-solving using to indicate the criterial appropriateness was 4.67, which was considered as “very good”. Finally, the mean scores of behavior observation form in problem-solving using to indicate the appropriateness of language and form was 4.67, which was considered as “very good” of. 4) learning activity record form, 5) students' diaries, 6) interview form, and 7) lesson plans integrated with problem-based learning, problem-based learning cooperated with social media, and problem-based learning cooperated with KWL technique for 7 lessons. The mean scores of lesson plan, which was evaluated by the experts, were from 4.53 to 4.83. That was interpreted as “very appropriate” Furthermore, the experts suggested to have the more media and techniques used in learning. After being learnt, the researcher quantitatively analyzed the data in each phase including problem-solving ability and learning achievement in chemistry subject. Finally, the data was analyzed by each phase.

#### 4. Research Results

The content of the lessons conducted in this study can be divided into 3 phases as following:

In phase 1, the content of the lesson was “Crude Oil Refining and Defining Natural Gas” using problem-based learning for 2 lessons plan

In phase 2, the content of the lesson was “Determining the Quality of Gasoline Diesel” using problem-based learning cooperated with social media such as Facebook and Google Drive for 2 lessons plan.

In phase 3, the content of the lesson was “Plastic, Fiber, and Rubber” using problem-based learning cooperated with KWL technique for 3 lessons plan.

#### 4.1 Problem-solving Ability

The participants in this study were 19 students who took problem-solving test for 3 phases. The test consisted of 8 items so the score was out of 8 in each phase. The results are shown as following:

**Table 1** Student’s Problem-solving Ability

Participant No.	Problem-solving Ability								
	Phase 1			Phase 2			Phase 3		
	Score (Out of 8)	Percentage	Interpretation	Score (Out of 8)	Percentage	Interpretation	Score (Out of 8)	Percentage	Interpretation
1	5.00	62.50	Not Passed	5.67	70.83	Passed	5.67	70.83	Passed
2	5.67	70.83	Passed	6.00	75.00	Passed	5.67	70.83	Passed
3	7.00	87.50	Passed	6.33	79.17	Passed	6.33	79.17	Passed
4	5.33	66.67	Not Passed	7.67	95.83	Passed	6.00	75.00	Passed
5	5.67	70.83	Passed	6.00	75.00	Passed	7.00	87.50	Passed
6	5.67	70.83	Passed	5.67	70.83	Passed	6.33	79.17	Passed
7	5.50	68.75	Not Passed	2.67	33.33	Not Passed	5.00	62.50	Not Passed
8	5.00	62.50	Not Passed	3.67	45.83	Not Passed	7.17	89.58	Passed
9	6.33	79.17	Passed	6.00	75.00	Passed	5.67	70.83	Passed
10	6.00	75.00	Passed	6.00	75.00	Passed	7.00	87.50	Passed
11	6.00	75.00	Passed	5.17	64.58	Not Passed	5.67	70.83	Passed
12	6.83	85.42	Passed	5.67	70.83	Passed	6.00	75.00	Passed
13	5.67	70.83	Passed	6.00	75.00	Passed	6.33	79.17	Passed
14	4.50	56.25	Not Passed	3.17	39.58	Not Passed	6.50	81.25	Passed
15	4.33	54.17	Not Passed	3.83	47.92	Not Passed	7.67	95.83	Passed
16	4.00	50.00	Not Passed	5.83	72.92	Passed	6.33	79.17	Passed
17	5.00	62.50	Not Passed	5.67	70.83	Passed	5.67	70.83	Passed
18	5.67	70.83	Passed	7.67	95.83	Passed	7.00	87.50	Passed



**Table 2** Learning Achievement in Chemistry's Subject

Participant	Learning Achievement in Chemistry's Subject					
	Phase 1		Phase 2		Phase 3	
	Score (Out of 10)	Percentage	Score (Out of 10)	Percentage	Score (Out of 15)	Percentage
1	7	70.00	6	60.00	11	73.33
2	7	70.00	6	60.00	13	86.67
3	9	90.00	7	70.00	12	80.00
4	8	80.00	7	70.00	14	93.33
5	7	70.00	7	70.00	14	93.33
6	8	80.00	7	70.00	13	86.67
7	9	90.00	7	70.00	12	80.00
8	8	80.00	9	90.00	13	86.67
9	8	80.00	8	80.00	14	93.33
10	9	90.00	8	80.00	12	80.00
11	9	90.00	9	90.00	12	80.00
12	8	80.00	8	80.00	10	66.67
13	8	80.00	8	80.00	13	86.67
14	8	80.00	7	70.00	14	93.33
15	9	90.00	8	80.00	12	80.00
16	8	80.00	8	80.00	13	86.67
17	8	80.00	7	70.00	13	86.67
18	7	70.00	8	80.00	12	80.00
19	8	80.00	7	70.00	12	80.00
$\bar{X}$	<b>8.05</b>	<b>80.53</b>	<b>7.47</b>	<b>74.74</b>	<b>12.58</b>	<b>83.86</b>

## 5. Conclusion

The students who were taught by problem-based learning cooperated with social media and KWL technique in order to develop their problem-solving ability found that there were 18 students or 94.74% considered as “passed” of all students. However, only 1 student or 5.65% didn't pass the test from the whole participants. If considering in each phase, it is found that:

In phase 1, the students were taught by problem-based learning. The results revealed that there were 10 students or 52.63% passing the test in the criteria of 70%.

In phase 2, the students were taught by problem-based learning cooperated with social media such as Facebook and Google Drive. The results revealed that there were 9 students or 52.63% passing the test in the criteria of 70%.

In phase 3, the students were taught by problem-based learning cooperated with KWL technique. The results revealed that there were 3 students or 75.00% passing the test in the criteria of 70%

In learning achievement, 19 students were required to take a learning achievement posttest after being learnt by problem-based learning cooperated with social media and KWL technique. The results showed that learning achievement score was 8.05 or 80.53% in phrase 1. Moreover, in phrase 2, the learning achievement score was 7.47 or 74.74%. Finally, the learning achievement score in phrase 3 was 8.05 or 80.53%.

## 6. Discussion

Apart from researching on developing 19 students' problem-solving ability who were studying in Mattayomsuksa 6 by using problem-based learning cooperated with social media and KWL technique, the results indicated that 18 students or 94.74% out of 19 students were passed in the criteria of 70% after completing phase 3. From conducting this action research, the teacher applied systematic and reliable process to discover the situation or context in the classroom, and directly solve the students' problem (Nuengchalerm, 2013, p.57). In addition, two researchers used problem-based learning cooperated with social media and KWL technique to authentically assess. It is assumed that assessment in problem-based learning was realistic and systematic because there were various ways in learning assessments (Eggen & Kauchak, 2001, p. 256-259). For more details, it can be discussed that:

In phase 1, after students learnt by problem-based learning, the results revealed that students has developed their problem-solving ability and passed for the criteria of 70% accounted for 10 students or 52.63% of the whole students. It is because students were taught to think, practically do, and discuss, which leads students to share knowledge in the group together. After finishing lesson 1, the researcher integrated what is incomplete in lesson 1 to lesson 2 and 3 in terms of time, activity organization, and more interesting and real-life situation in order to be consistent with Thitsana Kammanee (2012, p.137). She stated that problem-based learning is considered as a learning tool that students are activated to reach their goal, which teachers might lead the students to face in real-life situation or practical problems. Moreover, students are



taught to analyze and the problems so that they clearly understand the problems. Students are able to identify problems from the challenging situation but they are not able to solve by themselves because they have to be guided by adults or friends who have more experience. Students are able to solve problem because of learning (Berk & Winsler, 1995, 232; cited in Vygotsky, 1978). In some situation, the researcher as a teacher provided some real-life situations into the problems in order to guide the students to think and analyze the problem by themselves of in group. As a result, the students will clearly understand those problems and point out the choices and method in many ways to solve problem. Students will be acquired of self-ambition, thinking process, and problem-solving process (Kammanee, 2005, p.137). For the 19 students who didn't pass the criteria, there might be some factors to impede the students' opportunity to express their opinion. For example, the students already knew the answer but they didn't have a chance to express what they know because the other students answer those before. Besides, when the teacher provided activity to work in various group, there only "high-achieving" students worked on it. Then, the "low-achieving" students as the participants had no chance to work. In summary, the teacher brought those problems to adjust in phase 2.

In phase 2, after students learnt by problem-based learning cooperated with social media, the results revealed that students has developed their problem-solving ability and passed for the criteria of 70% accounted for 5 students or 78.95% of the whole students. It is because students analyzed the problem one day before going to the class in order that students had more time to think more thoroughly. Students also had a chance to identify problems through social media. Resulting from students analyzing and discussing about the problems in classroom and social media, students gained more problem-solving ability which is consistent to Taale (2011, p. 8-21), which he stated that problem-based learning cooperated with social media can develop problem-solving ability. Therefore, students were able to identify problems, share knowledge, and present their own information in the freedom way (Laothiang, 2014, p. 61-64). Moreover, students had more time in learning cooperated with social media especially in identifying, replacing a formula to find the answer and giving the reasons. For the students who didn't passed the criteria, it is assumed that the students still had obstacles on analyzing problem level. The researcher brought the limitations in phase 2 to adjust in phase 3.

In phase 3, after students learnt by problem-based learning cooperated with KWL technique, the results revealed that students has developed their problem-solving

ability and passed for the criteria of 70% accounted for 3 students or 94.74% of the whole students. It is because the teacher integrated what the students know, what the students want to know, and what the students learned. KWL technique motivates students' attention and interesting (Moonkam & Moonkam, 2002, p. 88), which also develop student's problem-solving ability in planning stage. After finishing learning activity in check stage, students were able to apply knowledge to new or real-life situation. Students can be also brought what their learnt to plan in solving problems in other situation. Apart from the learning, students had knowledge in the situation and be able to determine the topic to study further together with discussing and sharing knowledge so that students gained enough knowledge to solve the problem of the situation in classroom. Moreover, students thoroughly check their knowledge, which is consistent to Suwit Moonkam and Orathai Moonkham (2002, p.88). They claimed that the objectives of KWL are to facilitate students to aware of the process of self-learning by planning, setting goal, checking understand, and effectively organizing knowledge, which is also consistent to Rungrawee Siriboonnarn (2008, p. 48-84). She studied about comparing analytical ability and learning achievement in department of science topic "acid and base" and investigated the attitudes towards chemistry subject of Mattayomsuksa 6 students who was taught by using 7E learning cycle model, KWL technique, and traditional method. The results indicated that students learning by KWL technique is improved their analytical ability better than learning by traditional method.

The current research results indicated that learning through problem-based learning was such learning activities to support student's to solve problem, which is consistent to Pramote Rangsi (2017, p.77-79). He conducted a research about developing Mattayomsuksa 5 students' problem-solving ability using problem-based learning. His results found that the score of students' problem-based ability was improved from 62.22% to 84.56%. Moreover, problem-based learning cooperated with social media enhances students' in problem-solving ability and the right to express opinion, which is consistent to Pichittong Krongponkwa (2016, p.89-91). He conducted a study about developing learning activity in physics subject using problem-based learning cooperated with social media to enhance learning achievement problem-solving ability, and student's putting effort persistently. His findings indicated that students' problem-based ability during taught by lesson 1-5 was in a high level ( $X = 2.7$ ,  $S.D = 0.34$ ). Besides, cooperating KWL technique enriches learning in the planning level so that students had a chance to plan better. That caused students to have higher problem-solving ability, which is consistent to Sujitraporn Paisri (2014, 77-84). She studied about learning

achievement, thinking for problem-solving and learning satisfaction for Mattayomsuksa 4 students using 7E learning cycle model, 7E learning cycle model cooperated with KWL technique. Her research results revealed that there were 13 students or 86.67% out of 15 students passed the criteria of 75%.

## 7. Recommendations

The recommendation for the future research will be described as follow:

1. Students' problem-solving ability was individually different, so there should be flexible criteria based on students' individual difference.
2. Other kind of social media is suggested to cooperate in the learning in suitable and various ways.

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## The Development of English Reading Comprehension Ability Using Collaborative Strategic Reading of Matthayomsuksa 5 Students

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### Abstract

This article provides an overview of collaborative strategic reading (CSR) as an approach to enhancing the reading comprehension skills. The purposes of this research were to study and compare the English reading comprehension ability before and after the instruction using collaborative strategic reading of Matthayomsuksa 5 students and to study the students' attitude towards teaching English reading comprehension ability using collaborative strategic reading. The sample consisted of 35 Matthayomsuksa 5 students at Pathumthep Wittayakarn School, under the Secondary Educational Service Area Office 21, in the first semester of the academic year 2018. The design of this research was a one group pretest-posttest design. The research instruments were 12 lesson plans, an English reading comprehension ability test and an attitude questionnaire. The experiment lasted twelve weeks, 2 hours a week, or 24 hours for all. The mean, percentage, standard deviation and t-test for Dependent Samples were used for data analysis. The results revealed that the students' posttest score was not less than 70 percent. The students' reading comprehension ability after the experiment was significantly higher than that of the pretest.

**Keywords :** English reading comprehension, collaborative strategic reading, Matthayomsuksa 5 Students

## 1. Introduction

Reading is an essential skill in people's daily lives. Reading is a very significant factor for students to be successful with their learning because they can get more information from what they have read and develop themselves to a better life. Even reading is important, many English learners still have problems in reading. It can be stated that teaching English reading in Thailand is not successful. Many researchers have mentioned a number of evidence indicating that Thai students in academic levels still have obstacles in reading (Adunyarittigun, 2002, p. 245). This is related with Munsetthawit (2009, p. 9) who points out that there are three main areas of difficulty in reading English for understanding: teachers use inappropriate methods, lack of teaching techniques, and lack of teaching equipment. In addition, this is consistent with Chayapurakul (2006, p. 95) who states that the boring teaching methods and classroom atmosphere cannot help learners develop their reading ability. The learning process will be successful depending on teacher's techniques. Therefore, teachers need to develop their teaching techniques and provide good atmosphere to learners.

There were some research studies revealing that English reading ability of Thai students is at the low level. Chawwang (2008, p. 4) states that students encounter problems with grammar and vocabulary when reading the texts. Therefore, they cannot understand what they have read. In addition, Soonthornmanee (2002, pp. 125-141) points out that the methods of teaching English reading comprehension in Thai classroom focus on translation from English to Thai instead of a reading process which could help the readers comprehend or interpret the meaning of the texts. Moreover, Yimwilai (2008, p. 137) shows that reasons for students' failure in reading English classified into six major categories: individual factors, physical factors, psychological factors, socioeconomic factors, language factors and educational factors. Therefore, in order to help students comprehend reading texts, it is necessary for the teachers to teach reading strategies in the English classrooms.

In the context of Pathumthep Wittayakarn School, students' English reading ability was quite low in the area of English reading subject (E30204) of matthayomsuksa 5 students. In the academic year 2017, the school final examination scores in the area of English reading subject (E 30204) of Matthayomsuksa 5 students was under 50 % while the criteria for English reading subject (E 30204) is 70 %. The problems might be from large size classes and methods of teaching reading in Thai classrooms. One reason of the students in Pathumthep Wittayakarn School gained a low level of their English reading ability might be from lack of English reading comprehension strategies.

To solve reading problems in teaching English reading comprehension, many researchers and educators have proposed many techniques in teaching English reading comprehension. Collaborative strategic reading is one of the useful techniques that might help improve students' English reading comprehension ability.

Collaborative strategic reading was developed by Klingner and Vaughn (Klingner & Vaughn, 1999, pp. 738-747). There are 4 steps to read: 1) Preview, 2) Clink & Clunk, 3) Get the Gist, and 4) Wrap up. This collaborative reading strategy will help to teach reading, encourage students to work together allow students to exchange ideas, and promote good relationships between people. Collaborative strategic reading is considered to be a way to help students with difficulties on reading comprehension and improve their reading ability. With the benefits of collaborative strategic reading, some researchers studied the use of collaborative strategic reading in order to improve learners, English reading comprehension ability. For example, Thongphao (2016) conducted a study on the development of English reading comprehension ability using collaborative strategic reading of Matthayomsuksa 3 students at Nonghuakhupuang prachanukhror School in the second semester of the academic year 2016. The results indicated that the students' posttest score was not less than 70 percent. The students' reading comprehension ability after the experiment was significantly higher than that of the pretest. Furthermore, students' attitude towards teaching English reading comprehension ability using collaborative strategic reading was at a good level. Furthermore, Sroinam (2017) conducted a study on the development of English reading comprehension ability using collaborative strategic reading of graduate students. The finding showed that the students' pretest and posttest mean scores on English reading comprehension ability were 23.03 or 57.57 percent and 33.28 or 83.19 percent respectively. The students' English reading comprehension ability after the experiment was significantly higher than that of the pretest at the 0.01 level and the mean score on the posttest was higher than 70 percent. Furthermore, the students' attitude towards teaching English reading comprehension ability using collaborative strategic reading was at a good level.

Therefore, the researcher would like to develop English reading comprehension ability using collaborative strategic reading of Matthayomsuksa 5 students at Pathumthep Wittayakarn School, Nongkhai. In this study, the researcher would like to study whether collaborative strategic reading could assist students reading comprehension ability or not and to investigate the level of their attitude towards teaching English reading comprehension using collaborative strategic reading.

## **2. Research Objectives**

This research consisted of two objectives:

2.1. To study and compare English reading comprehension ability before and after studying English reading comprehension using collaborative strategic reading of Matthayomsuksa 5 students.

2.2 To investigate the attitude towards teaching English reading comprehension using collaborative strategic reading of Matthayomsuksa 5 students.

## **3. Research Methodology**

### **3.1 Samples**

The sample in this study was 35 Matthayomsuksa 5/1 students who enrolled in English reading (E30203), in the first semester of the 2018 academic year at Pathumthep Wittayakarn School, Nongkhai selected using purposive selection.

### **3.2 Research Instruments**

In order to conduct this study, three research instruments were employed:

3.2.1. Lesson plans of teaching English reading comprehension using collaborative strategic reading consisted of 12 units, 2 hours a unit.

3.2.2. An English reading comprehension ability test with 40 items. This test was used to examine the students' English reading comprehension ability.

3.2.3. An attitude questionnaire towards teaching English reading comprehension using collaborative strategic reading.

### **3.3 Data Collection**

After all research instruments are developed, they will be employed to collect both quantitative and qualitative data. Data collection will be explained by each method as shown below.

3.3.1. Students take the pretest before studying English reading using collaborative strategic reading.

3.3.2. The teaching process will be carried out according to the 12 lesson plans for 12 weeks, 24 hours in total.

3.3.3. After the whole teaching process using collaborative strategic reading completed, students will take the posttest which the same test as the pretest.

3.3.4. An attitude questionnaire will be used to ask students' opinion towards teaching English reading comprehension using collaborative strategic reading.



3.3.5. The collected scores from the pretest and posttest and students' attitude data will be statistically analyzed and summarized later

### 3.4 Data Analysis

3.4.1. The researcher analyzed data to study and compare the English reading comprehension ability of Matthayomsuksa 5 students using mean ( $\bar{X}$ ), percentage, and standard deviation (S.D.)

3.4.2. The researcher also analyzed the data to compare the English reading comprehension ability of Mathayomsuksa 5 students before and after teaching English reading comprehension using collaborative strategic reading using t-test for dependent samples.

3.4.3. The researcher analyzed data to investigate students' attitude towards teaching English reading comprehension using collaborative strategic reading using mean ( $\bar{X}$ ) and standard deviation (S.D.) to interpret the meaning of the criteria's average.

## 4. Research Results

Results of the Study and Comparison of Scores on English Reading Comprehension Ability Before and After Teaching English Reading Comprehension Using Collaborative Strategic Reading

**Table 1** The Comparison of the Students' English Reading Comprehension Ability before and after Teaching English Reading Comprehension Using Collaborative Strategic Reading

Test	n	$\bar{X}$	S.D.	t
Pretest	35	22.40	3.94	
Posttest	35	35.43	2.92	27.93**

\*\* $p \leq .01$

From table 1, it shows that the students' pretest mean score on English reading comprehension was 22.40 and the posttest mean score was 35.43. The students' English reading comprehension ability after teaching English reading comprehension using collaborative strategic reading was significantly higher than prior at the .01 level.

**Table 2** A Comparison of the Students' English Reading Comprehension Ability After Studying English Reading Comprehension Using Collaborative Strategic Reading and a Set Criteria of 70 Percent

Test	n	$\bar{X}$	S.D.	70 Percent	t
Posttest	35	35.43	7.31	28	15.03**

\*\*p ≤ .01

From table 4, it shows that the students' posttest mean score on English reading ability was 35.43. The results explain that the students' English reading comprehension ability after study English reading comprehension using collaborative strategic reading was significantly different at the .01 level. The posttest score was significantly higher than a set criteria of 70 percent.

Results of the Investigation of the Students' Attitude towards Teaching English Reading Comprehension Using Collaborative Strategic Reading

**Table 3** An investigation of the Students' Attitude towards Teaching English Reading Comprehension Using Collaborative Strategic Reading

Attitude Test	n	$\bar{X}$	S.D.	Interpretation
Attitude towards teaching English reading comprehension using collaborative strategic reading	35	4.85	0.13	Very Good

From Table 5, it illustrates that the mean score of the students' attitude towards teaching English reading comprehension using collaborative strategic reading was 4.85. It indicates that the students' attitude towards teaching English reading comprehension using collaborative strategic reading was at a very good level.

## 5. Discussion

The results of the study can be discussed as follows:

5.1. Results of the study and comparison of English reading comprehension ability of Matthayomsuksa 5 students at Pathumtep Wittayakarn School before and after studying English reading comprehension using collaborative strategic reading.

5.1.1 It was found that teaching English reading comprehension using collaborative strategic reading could improve Matthayomsuksa 5 students' English reading ability. Their pretest and posttest scores were 22.40 or 56.00 percent and 35.43 or 88.57 percent, respectively. The students' English reading comprehension ability after studying English reading comprehension using collaborative strategic reading is higher than prior because the students had a chance to practice English reading comprehension using collaborative strategic reading, they could identify the meaning of new words in the reading text and write down the main idea of the reading text. Therefore, they could develop their English reading comprehension ability. This finding supported the idea of Klinger & Vaughn (2000, pp. 45-47), who suggest that of collaborative strategic reading is the strategy that can develop the student's reading comprehension ability and it works effectively in all levels. In order to use collaborative strategic reading, which help students learn in positive atmospheres because students have an opportunity to exchange and share the information with the members in their groups.

5.1.2 The students English reading comprehension ability after studying English reading comprehension using collaborative strategic reading was significantly improved with a mean score greater than 70 percent. This may cause from the following results. Firstly, teaching English reading comprehension using collaborative strategic reading helped develop students' English reading comprehension ability because this strategy support the learners to improve their reading comprehension ability, provide a chance to find the meaning of vocabulary and main idea in each section of the text, and develop skills to work with others. Secondly, teaching English reading comprehension using collaborative strategic reading was promoted to develop the students' English reading comprehension ability because had conducted the following stages according to teaching English reading comprehension activities using collaborative strategic reading based on the ideas of Klingner & Vaughn (Klingner & Vaughn, 1999, pp. 738-747) and Williams (Williams, 1994, pp. 37-44): Pre-reading activities, While-reading activities, Post-reading activities. Hence, it could enhance the students' English reading comprehension ability and initiate the higher score of the posttest than the pretest one. These findings related to the idea of Bryant (2001, pp.

252-253) who states that collaborative strategic reading is the strategy to teach reading comprehension. It focuses on cooperation in exchange ideas and information in group of mix-ability students which consists of preview in the pre-reading stage, understanding vocabulary in while-reading stage, get the main idea in while-reading stage, and summary in post-reading stage.

5.2. Result from an investigation of students' attitude towards teaching English reading comprehension using collaborative strategic reading at Pathumtep Wittayakarn School. The finding indicated that students' attitude towards teaching English reading comprehension using collaborative strategic reading was at a very good level. The students liked the activity because they had chance to exchange information and ideas between friends in group and to identify when they have breakdowns in understanding and they did not feel stressed. The findings also supported Karabuga & Kaya (2013) who conducted a study about Collaborative Strategic Reading (CSR) involved the use of four reading strategies in collaboration with peers and facilitates the comprehension of the text and leads to gains in terms of student achievement, participation, and motivation. The results were consistent with the idea of Savigon (1983, p. 11) who suggests that the learner's attitude is the most important factor in learning second language and Eagly & Chaiken (1993, p.1) who suggest that attitude as a physical tendency that is indicate by evaluating a particular entity with some degree of like or dislike. Therefore, learners with positive attitudes will have these attitudes reinforced.

## 6. Conclusion

A study and comparison of the pretest and posttest scores on English reading comprehension ability of Mathayomsuksa 5 students and their attitude towards teaching English reading comprehension using collaborative strategic reading can be summarized as follows:

1. The students' pretest and posttest mean scores on English reading comprehension ability were 22.40 or 56.00 percent, and 35.43 or 88.57 percent, respectively. The students' posttest mean score on English reading ability was significantly higher than the pretest and the mean score on the posttest was higher than the set criteria of 70 percent.

2. The students' attitude towards teaching English reading comprehension using collaborative strategic reading was at a very good level.

7.



## 7.2 Recommendations for further study

According to the results discussed earlier, some suggestions are proposed here for further studies. Firstly, to investigate English reading comprehension ability using collaborative strategic reading to students from various education backgrounds and integrate with other subjects. Secondly, to use collaborative strategic reading to develop other language skills as speaking, listening, and writing. Finally, identify other variables that effect student language learning English such as classroom atmosphere, motivation and learning style.

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## The Development of English Reading Comprehension Ability Using 4MAT Learning System of Matthayomsuksa 1 Students

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### Abstract

The purposes of this study were to study and compare English reading comprehension ability before and after studying English reading comprehension using 4MAT learning system of Matthayomsuksa 1 students and to investigate students' attitude towards teaching English reading comprehension using 4MAT learning system. The sample consisted of 42 of Matthayomsuksa 1/1 students at Boribanphumikhet School, Udon Thani Primary Educational Service Area Office 4 in the first semester of the academic year 2018 selected by cluster random sampling. The research was a one group pretest-posttest design. The research instruments were 12 lesson plans, an English reading comprehension ability test and an attitude questionnaire. The experiment lasted 12 weeks, 2 hours a week, or 24 hours for all. The mean, percentage, standard deviation, one sample t-test, and t-test for dependent samples were employed to analyze data. The results shows that the students' posttest score on English reading comprehension ability was higher than the set criteria of 70 percent and the students' English reading comprehension ability after the experiment was significantly higher than that of the pretest. Moreover, the students' attitude towards teaching English reading comprehension using 4MAT learning system was at a good level.

**Keywords :** 4MAT learning system, reading ability, English reading comprehension,



## 1. Introduction

In the age of social information and communication, English is a global language used in communication. Knowing English is very important and necessary because English is not only a tool for studying, researching and working, but is also a tool used for communicating, bargaining for the benefit of economy and politics. Moreover, knowing English is a tool helping to build a good relationship between people from different cultures.

Although reading English is very important, Thai students have problems reading in all levels. The study involved in English instruction reveals that the main problems of English reading are that learners cannot understand the texts, and cannot get the gist from the texts (Aksaranukrao, 1997, p 82). The cause of these problems is the learners are not being trained how to read appropriately in their learning period and lack skills for reading comprehension. The report of Boribanphumikhet school confirms that the result of English tests of Mattayonsuksa 1 students is very low. More than 70 percent of students get score lower than the required 50 percent (Academic department of Boribanphumikhet school, 2017) for English reading comprehension. From the teacher's observation, students have reading problems such as their lack of vocabulary, they do not know the meaning of vocabulary, they cannot guess the meaning of the unknown words from the context, they cannot get the main idea from the reading text, and students can't use reading strategies to comprehend the texts. For these reasons, the researcher would like to find the way and method to improve students' English reading comprehension ability.

4MAT learning system responds to brain-based learning that helps to keep the working process of right brain and left brain balance McCarthy (1990, p 31), In addition, McCarthy & Leflar (1983, p 29) supports that 4MAT learning system is the best tool to enlarge the teacher's skills, equipping the teacher with multiple methods of instruction in order to reach students of each learning style. Moreover, Khammanee (2012: 264) supports that 4MAT learning system is the process that helps students build experience and knowledge by themselves, and apply knowledge for their own benefits wisely.

From these reasons, the researcher has considered that the 4MAT learning system might be able to help students to improve English reading comprehension ability. Therefore, the researcher used 4MAT learning system to develop reading comprehension ability of Matthyomsuksa 1 students of Boribanphumikhet school.

## **2. Research Objectives**

2.1 To study and compare English reading comprehension ability of Mattayomsuksa 1 students before and after studying English reading comprehension using 4MAT learning system.

2.2 To investigate Mattayomsuksa 1 students' attitude towards teaching English reading comprehension using 4MAT learning system.

## **3. Research Methodology**

### **3.1 Samples**

The sample in this study comprised 42 of Matthayomsuksa 1 students of Boribanphumikhet school, Ban Phue district, Udonthani province, Udonthani Primary Educational Service Area Office 4 who were studying English in the first semester of the academic year 2018. The sample was selected using cluster random sampling (Taweerat, 2000).

### **3.2 Research Instruments**

The research instruments consisted of lesson plans of teaching English reading comprehension using 4MAT learning system, an English reading comprehension ability test, and an attitude questionnaire towards teaching English reading comprehension using 4MAT learning system. The statistics used to analyze the data were percentage, mean, standard deviation, t-test for dependent, and one sample t-test.

### **3.3 Data Collection**

The researcher conducted the research on the purposes of using 4MAT learning system to develop students' English reading comprehension ability. Data collection was as follows:

1. Before conducting the study, the researcher administered a pre-test for participants who enrolled in the study to evaluate students English reading comprehension ability using an English reading comprehension ability test. The test consisted of 40 multiple-choice items with four possible answers. Students had one hour to finish the test.

2. The researcher conducted the teaching English reading comprehension using 4MAT learning system followed the lesson plans that were developed by the researcher.

3. After finishing the teaching English reading comprehension using 4MAT learning system, the researcher conducted the post-test which was the same test as the pre-test to evaluate students English reading comprehension ability. The test

consisted of 40 multiple-choice items with four possible answers. Students had one hour to finish the test.

4. The researcher conducted the attitude questionnaire to examine the students' attitude towards learning English reading comprehension using 4MAT learning system.

### 3.4 Data Analysis

The researcher used the scores from the pretest, the posttest, and the attitude questionnaire towards learning English reading comprehension using 4MAT learning system to:

1. Analyze the data to compare students' English reading comprehension ability before and after studying. Statistics used in data analysis were the mean score, standard deviation, percentage, t-test for dependent samples, and One Sample t-test. Statistical Package for the Social Sciences or SPSS was used for data analyzing.

2. Investigate students' attitude towards English reading comprehension using 4MAT learning system and to find out percentage, standard deviation and level of students' attitude toward teaching English reading comprehension using 4MAT learning system. The criteria was included and interpreted the analyzed data. (Saiyos & Saiyos, 1995, pp 170-172)

## 4. Research Results

The results were presented according to the research objectives as follows:

**Table 1** A comparison of Scores on English Reading Comprehension Ability Before and After Studying English Reading comprehension Using 4MAT Learning System of Matthayomsuksa 1 Students

Test	N	$\bar{X}$	S.D.	Percent	T
Pretest	42	15.41	2.91	36.71	83.07**
Posttest	42	29.02	2.72	72.55	

From Table 1, it shows that the results of the comparison of the students' pretest mean score of English reading comprehension ability was 15.41 or 36.71 percent and the posttest mean score was 29.02 or 72.55 percent. The students' English reading

comprehension ability after studying English reading comprehension using 4MAT learning system was significantly higher than the prior at the .01 level.

**Table 2** Comparison of the Difference between Percentage of the posttest and the Set of Criteria of 70 percent

	Mean	Percentage	Df	T
Posttest	29.02	72.55	41	2.28*
The set of criteria	28	70.00		

From Table 2, it shows that the students' posttest mean score on English reading comprehension ability was 29.02. The result explained that the students' posttest mean score on English reading comprehension ability after studying English reading comprehension using 4MAT learning system was significantly different at the .05 level. The posttest score was significantly higher than a set of criteria of 70 percent.

**Table 3** The Investigation of the Students' Attitude towards Teaching English Reading Comprehension Using 4MAT Learning System

Attitude Test	n	$\bar{X}$	S.D.	Interpretation
Students' attitude towards teaching English reading comprehension using 4MAT learning system	42	4.16	.20	Good

From Table 3, it shows that the mean score of the students' attitude towards teaching English reading comprehension using 4MAT learning system was 4.16. It indicated that the students' attitude towards teaching English reading comprehension using 4MAT learning system was at a good level.

## 5. Discussions

5.1 It was found that teaching English reading comprehension using 4MAT learning system to instruct Matthayonsyuka 1 students at Biribanphumikhet school could improve their English reading comprehension ability. The result showed that students' pretest and posttest scores were 15.42 or 36.71 percent and 29.02 or 72.55 percent, respectively. This finding supports the second hypothesis. The students' mean score on English reading comprehension ability after studying English reading comprehension using 4MAT learning system was higher than prior. As shown from the results of the study, two discussions are presented as follows:

5.1.1 Teaching English reading comprehension using 4MAT learning system comprised various activities that focused on students and each activities supported the individual differences and learning style. The 4MAT learning activities helped students to connect and think about what was possible to appear in the reading text which supported imaginative learners; analytic learners were aroused to think and analyze the new information and experiences; common sense learners were motivated to apply their knowledge from what they were taught; and, dynamic learners were aroused to perform what they had learned. These findings were supported by Lochida (2007: 11) who claimed that 4MAT learning system is a method based on the principle of learner center and individual differences and McCarthy (1990: 31) who stated that people perceive knowledge and organize it in different ways.

5.1.2 4MAT learning system could help develop left and right brain at the same time. The reason might be that teaching English reading comprehension using 4MAT learning system consisted of various activities based on the principle of brain-based learning. Each activities could help to train the left and right brain equally. When students were aroused to do activities, they used their left and right brain through each activity at the same time. These findings were supported by Wongyai (1999: 13-21) who said that brain working related to human's learning. He mentioned that the human brain is divided into two parts that are left brain side and right brain side and each side has different functions. These activities of 4MAT learning system could help to keep the working process of left and right brain balance which was in accordance with McCarthy (1990: 31) who mentioned that the 4MAT learning system responds to brain-based learning that helps to keep the process of left and right brain working balance. Moreover, while students were doing activities they were trained to connect their background knowledge and, predict and imagine what they were going to read which helped them to develop their thinking skills. The result showed that students could work efficiently



supported by the study of Chankasorn (2014) who studied a comparison of academic achievement in communicative English of Matthayomsuksa 2 students instructed by 4MAT learning style and by traditional methods. The result showed that students who were instructed by 4MAT learning style had both English communicative score and attitude higher than students who were instructed by traditional methods.

5.3 From the results of students' attitude towards teaching English reading comprehension ability using 4MAT learning system, the findings showed that students' attitude towards teaching English reading comprehension using 4MAT learning system was at a good level. The results showed that teaching English reading comprehension using 4MAT learning system could help students understand the reading text. The reason might be that teaching English reading comprehension using 4MAT learning system made students interested and gained more confidence in reading English. The reason might be that English reading comprehension activities using 4MAT learning system provided pleasure to students' reading. These findings were supported by Ellis (1994: 197-201) when he stated that the learner who has a positive attitude can learn and acquire target language better than the learner who has a negative attitude. Moreover, they had fun and enjoyed doing reading activities using 4MAT learning system which was supported by Newman (1986: 646-659) who mentioned that attitude is the changing feelings towards the target in both positive and negative ways. This program supported them to gain more vocabulary and the reading texts were interesting and could motivate them to read other texts.

## 6. Conclusion

The study and comparison of the pretest and posttest scores on English reading comprehension ability and the investigation of students' attitude towards teaching English reading comprehension using 4MAT learning system of Matthayomsuksa 1 students were summarized as follows:

6.1 The students' pretest mean score on English reading comprehension ability was 15.42 or 36.71 percent and the posttest mean score was 29.02 or 72.55 percent. The students' posttest score on English reading comprehension ability was higher than the set criteria of 70%. The students' English reading comprehension ability after the experiment was significantly higher than that of the pretest.

6.2 The students' attitude towards teaching English reading comprehension using 4MAT learning system was at a good level.

## 7. Recommendations

7.1 It was found that the students' posttest mean score on English reading comprehension ability was higher than the pretest. The reason might be that 4MAT learning system could help to keep the working process of left and right brain balance to develop thinking skills that helped students understand the reading text. Therefore, 4MAT learning system should be promoted in teaching English reading comprehension.

7.2 It was found that the students' attitude towards teaching English reading comprehension using 4MAT learning system was at a good level. The reason might be that teaching English reading comprehension using 4MAT learning system activated students to pay attention to reading English text. It made them enjoy and have fun with provided activities which lead to decreased anxiety. Therefore, 4MAT learning system should be promoted in teaching English reading comprehension.

7.3 Researchers should use 4MAT learning system to study other English skills such as listening, speaking, and writing in order to know whether 4MAT learning system would be able to develop other English skills.

7.4 Researchers should investigate English reading comprehension ability using 4MAT learning system for students with various educational background knowledge and levels of education in order to know whether 4MAT learning system would be able to develop English reading comprehension of students in other levels.

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## The Development of English Vocabulary Learning Ability Using Total Physical Response Storytelling for Prathomsuksa 5 Students

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### Abstract

The purposes of this research were to study and compare the English vocabulary learning ability before and after studying using total physical response storytelling, to study English vocabulary learning retention, and to investigate the students' attitude towards teaching English vocabulary learning ability using total physical response storytelling of Prathomsuksa 5 students. The sample consisted of 20 Prathomsuksa 5 students at Banthautai School, Nongbualamphu, under Nongbualamphu Primary Educational Service Area Office 2, in the first semester of the academic year 2018. The design of this research was a one group pretest-posttest design. The research instruments were 12 lesson plans, an English vocabulary learning ability test and an attitude questionnaire. The experiment lasted 12 weeks, 2 hours a week, or 24 hours for all. The mean, percentage, standard deviation and t-test for dependent samples were used for data analysis. The findings of this research were as follows: First, the students' pretest and posttest mean score on English vocabulary ability was 39.16 or 48.95 percent, and 60.91 or 76.13 percent, respectively. Students' English vocabulary learning ability after studying English vocabulary using total physical response storytelling was higher than the set criteria of 70 percent. The students' English vocabulary ability was found to be significantly different at the .01 level. Second, the students had retention on English vocabulary learning ability. Finally, the students' attitude towards teaching English vocabulary using total physical response storytelling was at a very good level.

**Keywords :** English Vocabulary Learning Ability, TPRS, total physical response storytelling

## 1. Introduction

English is one of the most popular and important languages for all people in daily life in order to connect people around the world. So, learning English is needed in the way of applying the language to communicate with others. We can use English as a tool for education, business, politics and occupation (The Ministry of Education, 2008, p. 1). Although English is not the language which is used by the largest number of native or first language users, it has become a language of international communication. It is widely used for communication between speakers whose native languages are different from each other (Harmer, 2001, p. 1). For this reason, people are keen to learn English either as a second or as a foreign language.

For teaching and learning foreign languages, learners need to have knowledge of vocabulary. Chansin (2007, p. 2) points out that the objectives of the English curriculum in Thailand, one main aspect that the Ministry of Education has focused on is vocabulary recognition. It is generally acknowledged among language teachers and learners that vocabulary is significant in language competence. The Ministry of Education (1996) mentions that the vocabulary lexicon is one of the factors which can support learning English effectively because vocabulary is a crucial component in learning languages. Basically, the learners can be supported to learn the other skills which the learners can use for conveying the meaning in communicative situations.

As the learning achievement report of the academic affair of Banthautai, the learning achievement for English was 60.73% (Learning achievement of Prathomsuksa 5 in the academic year 2017). One of the reasons that the learning achievement of the English subject is low might be the lack knowledge of English vocabulary. According to Maley (1986, p. 3) the lack of vocabulary leads to difficulties in communicative situations. The students of Banthautai School have problems in reading, writing, speaking, and listening, so they cannot use English to communicate with others.

Total Physical Response Storytelling was improved at the same time when CLT (Communicative Language Teaching) was growing to its position (Marsh, 1998, p. 24). It contains a set of theoretical foundation and specific techniques which are to be used specially. After many changes in language teaching approach, many academics became disenchanted with the whole idea of using a singular method, as these continued to be replaced. Most people preferred the views of Communicative Language Teaching which offered the teacher much more freedom in the selection of classroom activities and techniques (Brown, 2000, p. 39). However, this autonomy also opens up the possibility of a less structured approach towards teaching and learning, which strives

towards the ambiguous goal of communicative language teaching. Though someone may shy away from total physical response storytelling because of its similarity to the failed methods of the past, it is important to give it just treatment and appreciation for the innovations it has brought to the field. Just as with all of its predecessors, total physical response storytelling is an attempt to advance language pedagogy, and is thus a step forward, not back.

The advantages of the total physical response storytelling are various. The most important is that students can remember the grammatical features and the words. They will get enough exposure by the total physical response, and they are able to remember and speak the language. Moreover, they can acquire the grammar and vocabulary through storytelling (Ray & Seely, 2015, p. 35). The following are the steps of total physical response storytelling. They are the stage of establish meaning, asking Story, and reading. In the first steps, the teacher gestures the meaning, personalizes, and asks some questions. In the second steps, the teacher asks students to be actors and perform while the teacher is telling the story. The final step, the students will perform and create their own story using the given vocabulary.

The researcher needed to develop English vocabulary learning ability using total physical response storytelling method, of Prathomsuksa 5 students, and expected that the total physical response could be used as the key tools for increasing the ability of learning vocabulary, and motivate the learners' attitude toward.

## **2. Research Objectives**

The research purposes were:

2.1 To study and compare English vocabulary learning ability of Prathomsuksa 5 students using total physical response storytelling before and after the students studying English vocabulary using Total Physical Response Storytelling method.

2.2 To study English vocabulary learning ability retention of Prathomsuksa 5 students using total physical response storytelling.

2.3 To study the students' attitude towards teaching English learning vocabulary using Total Physical Response Storytelling of Prathomsuksa 5 students.

### **3. Research Methodology**

#### **3.1 Samples**

The samples in this study were 20 students in Prathomsuksa 5 who studied English in the first semester of the academic year 2018 at Banthautai School, Naklang, Nongbualamphu Primary Educational Service Area Office 2.

#### **3.2 Research Instruments**

1. The 12 lesson plans were administered to the students in class as the materials for the experiment. The lesson plans focused on the vocabulary and the total physical response storytelling method. The lesson plans were produced in an hour duration each, and two days for a week.

2. An English vocabulary learning ability test was conducted in 2 parts. The first part would assess the pronunciation which contained 10 test items, the second part was contained 10 meaning test items, 10 spelling test items and 20 word using test items. The second part was conducted as multiple choices. Furthermore, the test will be used as the pretest, and the post test.

3. A students' attitude questionnaires towards teaching English vocabulary using total physical respond storytelling. The questionnaire was improved in Thai version based on a five-point Likert's rating scale which consists of 20 items.

#### **3.3 Data Collection**

After all research instruments were developed, they were employed to collect both quantitative and qualitative data. Data collection was explained by each method as follows.

3.3.1 Students took the English vocabulary learning ability test (part 1) before studying English vocabulary using total physical response storytelling.

3.3.2 Students took the English vocabulary learning ability test (part 2) before studying English vocabulary using total physical response storytelling.

3.3.3 The teaching process was carried out according to the 12 lesson plans for 12 weeks, 24 hours in total.

3.3.4 After the whole teaching process using total physical response storytelling completed, students took the posttest which the same test as the pretest.

3.3.5 Two week later, the students were asked to do the posttest again in order to measure the retention.

3.3.6 An attitude questionnaire were used to ask students' opinion towards teaching English vocabulary using total physical response storytelling.

3.3.7 The collected scores from the pretest, posttest, retention test, and students' attitude data was statistically analyzed and summarized later on.

### 3.4 Data Analysis

3.4.1 The basic statistics used to analyze the data included:

3.4.2 Percentage was used for analyzing the effectiveness of the English vocabulary learning ability test.

3.4.3 Mean ( $\bar{X}$ ) was used for analyzing the scores of the pretest and posttest.

3.4.4 Standard Deviation (S.D.) was used for analyzing the scores of the pretest and posttest.

3.4.5 One sample t-test was used for comparing the students' English vocabulary learning ability and the set of criteria 70%.

3.4.6 t-test for Dependent Samples was used for analyzed the differences between English vocabulary learning ability pretest and posttest.

3.4.7 The statistics used to evaluate the quality of the instruments included:

3.4.7.1 The Index of Item Objective Congruence (IOC)

3.4.7.2 Reliability of scoring checking with three experts using Scott's formula.

3.4.7.3 The statistics used to analyze hypotheses by t-test for Dependent Samples before and after learning using the computer program

## 4. Research Results

The results were presented according to the purposes of the study as follows:

4.1 The results of the students' English vocabulary learning ability of Prathomsuksa 5 students in Banthautai School before and after studying English vocabulary using total physical response storytelling are shown in Table 1:

**Table 1** Mean Standard Deviation and Percent of English Vocabulary Learning Ability Before and After Studying English Vocabulary Learning Ability Using Total Physical Response Storytelling of Prathomsuksa 5 Students of Banthautai School

Number	Pretest		Posttest	
	Score (80 scores)	Percent	Score (80 scores)	Percent
1	31.48	39.35	54.72	68.40
2	33.36	41.70	55.28	69.10
3	39.78	49.73	67.12	83.90
4	31.70	39.63	62.80	78.50
5	41.00	51.25	53.28	66.60
6	61.92	77.40	65.60	82.00
7	43.06	53.83	75.28	94.10
8	34.80	43.50	57.38	71.73
9	39.52	49.40	57.82	72.28
10	40.12	50.15	57.38	71.73
11	36.80	46.00	63.80	79.75
12	32.70	40.88	54.28	67.85
13	31.48	39.35	51.84	64.80
14	41.44	51.80	62.36	77.95
15	51.40	64.25	76.60	95.75
16	34.80	43.50	59.48	74.35
17	33.14	41.43	53.84	67.30
18	36.90	46.13	52.62	65.77
19	39.78	49.73	62.14	77.68
20	48.08	60.10	74.50	93.12
$\bar{x}$	<b>39.16</b>	<b>48.95</b>	<b>60.91</b>	<b>76.13</b>
S.D.	<b>7.63</b>	-	<b>7.69</b>	-

From Table 1, it showed that the students' pretest mean score on English vocabulary learning ability was 39.16 or 48.95 percent and the posttest mean score was 60.91. or 76.13 percent, respectively. Standard deviation of the pretest was 7.63 and the posttest was 7.69.

A comparison of scores on English vocabulary learning ability using total physical response storytelling of Prathomsuksa 5 students using t-test for Dependent Samples is shown in Table 2.

**Table 2** Mean Standard Deviation Percent and a Comparison of Pretest and Posttest Mean Scores

Test	n	$\bar{x}$	S.D.	Percentage	t
Pretest	20	39.16	7.63	48.95	15.08*
Posttest	20	60.91	7.69	76.13	

\*significantly different at the .05 level

From Table 2, it shows that the students' pretest mean score on English vocabulary learning ability was 39.16 or 48.95 percent and the posttest was 60.91 or 76.13 percent. The results explained that the students' English vocabulary learning ability before and after studying English vocabulary using total physical response storytelling method was significantly different at the .05 level. The posttest score was significantly higher than the pretest.

4.2 The sample took the retention test using an English vocabulary learning ability test with 50 items scores of 50 after 14 days from posttest. After that, the scores were analyzed by SPSS program.

**Table 3** Mean Standard Deviation Percent and a Comparison of Posttest and the Test after 14 Days Mean Scores

Test	n	$\bar{x}$	S.D.	t
Posttest	20	60.91	2.68	1.36
Retention test	20	61.72		

From Table 3, it showed that the students' posttest mean score on English vocabulary learning ability was 60.91, and the test after 14 days was 61.72. The results explained that the students' posttest and the test after 14 days were not significantly different. According to the result, which was not significantly different, it meant that



the students who learn English vocabulary using total physical response storytelling, had retention knowledge.

4.3 students' attitude towards teaching English vocabulary learning ability using total physical response storytelling

**Table 4** Mean Standard Deviation and an Investigate of Students' Attitude towards Teaching English Vocabulary Using Total Physical Response Storytelling of Prathomsuksa 5 Students

Questionnaire	n	$\bar{x}$	S.D.	Interpretation
Students' attitude towards teaching English vocabulary using total physical response storytelling	20	4.69	0.46	very good

From Table 4. It presents that the mean of students' attitude towards teaching English vocabulary using total physical response storytelling was at 0.46 It indicates that students' attitude towards teaching English vocabulary using total physical response storytelling was at very good level.

## 5. Discussion

The research findings were discussed as follows:

5.1 According to the study and comparison of the English vocabulary ability of Prathomsuksa 5 students before and after using total physical response storytelling, the results of the study illustrated that the students' pretest, and posttest scores in English vocabulary learning ability were 39.16 or 48.95 percent, and 60.91 or 76.13 percent, respectively. From the pretest score, the finding indicates that most students got low scores so the English vocabulary learning ability was at a low level. This might be because of the following: The students lack the knowledge at the appropriate vocabulary level. They might not communicate with other people. This corresponds with Stewich (1972, p. 2) who stated that the language learners cannot learn the language effectively because the students might lack the knowledge of vocabulary. Nevertheless, after the students learned English vocabulary using total physical response storytelling method, the findings showed that the students can improve their English vocabulary learning ability as shown in their posttest score. One of the reasons might be that the

students were given the opportunities to use and communicate English. Learning English vocabulary using total physical response storytelling could activate the students to act along with the words which were highlighted in each story. So, the students could understand the meaning of each word very well. Moreover, using total physical response storytelling for learning English vocabulary could provide the students many chances for practicing and retaining the vocabulary in terms of pronunciation, spelling, meaning, and word use.

5.2 According to the result of the posttest and the test after 14 days, the mean scores showed that the students' posttest mean score on English vocabulary learning ability was 60.91, and the test after 14 days was 61.72. The results explained that the students' posttest and the test after 14 days were not significantly different. According to the result, which was not significantly different, it means that the students who learn English vocabulary using total physical response storytelling, had retention knowledge. Accordingly, this finding is supported by Jennings (2009) who has done the research of three groups of Spanish 2 students: two groups using TPRS, and one control group using typical teaching methods. Control students initially scored significantly better on a unit mid-test testing vocabulary, listening, and writing, but TPRS students scored significantly better on the final unit test, which tested vocabulary, listening, reading, writing, and speaking. TPRS students also scored significantly better on the final exam. This is also related to what Castro (2010) constructed the research which is aimed to study and compare TPRS to grammar-translation for vocabulary learning in adult English as a Second Language. Students experienced each method for just three days, and learned statistically equal numbers of previously unknown words through both teaching methods, although they preferred the TPRS lessons. The result was similar to Dzedzic (2012) who constructed the research which aimed to study and compare four beginning high school Spanish classes: two receiving traditional instruction, and two receiving TPRS (total physical respond storytelling) instruction. Both groups participated in sustained silent reading. At the end of the year, 65 students with no previous exposure to Spanish took the Denver Public Schools Proficiency Assessment. The TPRS students significantly outperformed the traditional students on writing and speaking, with large effect sizes on these two production measures.

5.3 On the students' attitude towards teaching English vocabulary using total physical response storytelling, the results indicated that the students' attitude towards learning English vocabulary after using total physical response storytelling was at a very good level. Teaching English vocabulary using total physical response storytelling

activated the students' interest in learning English vocabulary as well. Moreover, the motivation could be considered a prerequisite for successful language learning because without the different factors that cause a learner to learn, the desire to learn a language would be completely absent. A definition for motivation is needed because of the significant number of factors that can cause an individual to develop the desire to learn a language. Additionally, Crookes (2003, p. 128) explains that there are two kinds of motivation: integrative and instrumental motivations. Both have been assimilated within the language classroom. Integrative motivation leans more on learners' desire to integrate themselves with the culture of the language whereas instrumental motivation is the ability to effectively use the language to communicate effectively. The finding was consistent with what Gardner (1985, p. 78) postulates that attitude has a superseding function to play in any language classroom as it determines the mode of the learner as to be engaged actively or passively. It is therefore a combination of efforts and the desire to learn and satisfy that feeling of achievement while simultaneously developing positive attitude towards learning the language. The result was similar with Brown (2000: 170) who states that motivation is internal and external factors that stimulate people to be constantly attracted to execute a job or task while at the same time persistently willing to attempt achieving a goal despite the challenges. The conscious and unconscious factors such as the desire to attain a goal, the incentive or reward value of the goal and people's expectations all contribute tremendously to boost people's motivation. Moreover, from the result, it shows that, there are the items which had the remarkable mean scores which were items of 'teaching English vocabulary ability using total physical response storytelling can help you remember the vocabulary' and 'the atmosphere in teaching English Vocabulary learning ability is fun and do not have stress, the mean scores were 4.95 and 4.84 respectively. These were supported by what Ray & Seely (2015, p. 148) states that the total physical response storytelling could maximize acquisition of vocabulary. The students could get a lot of chances to have comprehensible input. Furthermore, these were consistent with what Werstler (2002, p.3) states that the total physical response storytelling could create personal, entertaining experiences for the learner which leads to better internalization of the language.

## 6. Conclusion

A study and comparison of pretest and posttest scores on English vocabulary learning ability and an investigation of Prathomsuksa 5 students' attitude towards



7.2.1 Researchers should compare total physical response storytelling with another strategy to investigate students' English vocabulary learning ability in order to find the better strategy to apply to classes in the future.

7.2.2 Researchers should apply total physical response storytelling to other class levels to investigate the efficiency of the strategies.

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## The Development of English Speaking Ability Using Active Learning Activities of Matthayomsuksa 3 Students

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### Abstract

The purposes of this research were to study and compare the English speaking ability before and after learning using active learning activities of Matthayomsuksa 3 students and to study the students' attitude towards teaching English speaking using active learning activities. The sample consisted of 33 Matthayomsuksa 3 students in the first semester of the academic year 2018, at Bandonkha Khampaknam Prachasamakkee school, under Udon Thani Primary Educational Service Area Office 1. They were selected by cluster random sampling. The design of this research was a one group pretest-posttest design. The research instruments included 12 lesson plans, an English speaking ability test, and an attitude questionnaire. The experiment lasted 12 weeks, 2 hours a week, or 24 hours for all. Statistics used in the study were mean, percentage, standard deviation, and t-test for dependent samples. The findings of the research were as follows. First, the students' pretest and posttest mean scores on English speaking ability were 74.95 or 20.82 percent and 270.02 or 75.01 percent respectively. The students' posttest mean score was higher than 70 percent and the students' posttest mean score was higher than the pretest one. Second, the students' attitude towards teaching English speaking using active learning activities was at a very good level.

**Keywords :** English Speaking Ability, Active Learning, Video, Games, Think-pair-share

### 1. Introduction

English is a global language which has spread to many countries and citizens around the world (Crystal, 2003, p. 2). The language is important because it is used as a tool to communicate, sharing knowledge, ideas and culture with other countries. As Harmer (2015, p.1) claims, English has become one of the world's main languages of international communication and commerce. As a result, English speakers around the

world have increased for many years. The Statistics Portal (2018, p. 1) shows that there are 378 million native speakers and about 743 million people who speak English as a second language. Moreover, Northrup (2013, p. 148) supports that the nations in Asia use English language as the academic lingua franca.

According to The Ministry of Education, foreign language policy, Thai students need to study English from primary school to university, aiming to improve all four skills: listening, speaking, reading and writing (The Basic Education Core Curriculum A.D. 2008, p. 246). Thai students learn English as a foreign language (EFL) with the ultimate goal to apply the language for communication in various situations, seeking knowledge, engaging in a livelihood and pursuing further education at higher levels. Among the four skills: listening, speaking, reading and writing, speaking is the most frequently used in English communication as Luoma (2009, p. 1) states that the ability to speak a foreign language becomes the heart of communication, to reason and express people' thoughts, and to speak to friends, colleagues, visitors and even strangers. Moreover, Harmer (2015, p.343) argues that if students want to be able to speak fluently in English, they need to be able to pronounce phonemes correctly, use appropriate stress and intonation patterns, and speak in connected speech, including to be able to speak in a range of different genres and situations.

Because of the significance of speaking skills, being competent in speaking English is the goal of the instruction. However, students still face many problems in speaking because they lack speaking ability in terms of accent, grammar, vocabulary, fluency and comprehension. The problems are faced by Thai students because they lack the language experience in their daily life and are always worried while speaking. These problems also apply to students of Bandonkha Khampaknam Prachasamakkee School. According to the English subject results of Matthayomsuksa 3 students, the average GPA score is 2.19 or 54.75 percentage and the average score in the speaking section is 29.50 percentage much lower than the required 70 percent, the school standard (Bandonkha Khampaknam Prachasamakkee School Academic Office, 2017, p.5). This report reveals that the students need more intensive English lessons through Communicative Language Teaching (CLT) and active learning activities that can motivate and engage them to speak. As a study by Kamprated (2012, p. 40) indicates, some students hardly use English language outside the classroom, thus classroom activities which encourage them to speak English are an ideal way to allow them time to practice their English.



In order to develop the English speaking ability, the students must engage in higher-order thinking task as analysis, synthesis, and evaluation. In fact, active learning is defined as instructional activities involving students in doing things and thinking about what they are doing. Moreover, there are many types of active learning activities that could be employed in language classrooms such as McKinney (2009, p. 3) proposes: concept mapping, writing and producing newsletters, keeping journals or logs, analyzing case studies, compiling mini-research proposals or projects, student-generated examination questions, arranging student debates, analysis or reaction to videos, games, arranging student-led review sessions, collaborative learning groups, think-pair-share, oral presentations, and cooperative learning. Thus, the researcher would like to apply the active learning activities to develop the English speaking ability of Mathayomsuksa 3, Bandonkha Khampaknam Prachasamakkee School. The researcher would like to investigate whether active learning activities could improve the students' English speaking ability after the implementation. The researcher also studied students' attitude towards teaching English speaking using active learning activities. The results of this study could be the key to develop an effective way for teaching English speaking effectively.

## **2. Research Objectives**

The research objectives were:

2.3 to study and compare students' speaking ability before and after teaching English speaking using active learning activities.

2.2 to study students' attitude towards teaching English speaking using active learning activities.

## **3. Research Methodology**

### **3.1 Samples**

The population in this study was 148 Matthayomsuksa 3 students in Naphu Chiangwang Schools Network consisting of 6 schools, Pen District, Udon Thani Province, in the first semester of 2018 academic year.

### **3.2 Research Instruments**

3.2.1 There were 12 lesson plans created by using active learning activities linked on the topics.

3.2.2 The Pretest and Posttest of English speaking ability with 12 questions, was to explore students' speaking ability.

3.2.3 The attitudinal questionnaire consisted of 20 items, based on a Likert's rating scale, towards teaching English speaking using active learning activities.

### 3.3 Data Collection

After constructing all the research instruments, with the purpose of developing the English speaking ability of students using active learning activities, they were then used to collect both quantitative and qualitative data. The process of collecting data was as follows:

3.3.1 The students took an English speaking ability pretest which consisted of 12 interview items.

3.3.2 The researcher then taught the 12 lesson plans within 12 weeks meeting the sample group 2 hours a week making a total of 24 hours for the entire experiment.

3.3.3 After conducting the teaching program, the researcher administered the same English speaking ability test which they took for the pretest as their posttest.

3.3.4 The researcher distributed the questionnaires to the subjects to examine students' attitude towards teaching English speaking using active learning activities.

3.3.5 The researcher statistically analyzed and interpreted the data collected from the pretest, posttest and students' attitude questionnaire.

### 3.4 Data Analysis

3.4.1 The basic statistics used to analyze the data include:

3.4.1.1 Percentage was used to analyze the effectiveness of the speaking ability test by all the subjects.

3.4.1.2 Mean ( $\bar{X}$ ) was used to analyze the scores of the pretest and posttest.

3.4.1.3 Standard Deviation (S.D.) was used to analyze the scores of the pretest, posttest and students' attitude.

3.4.2 The statistics used to evaluate the quality of the instruments include:

3.4.2.1 The Content validity of the lesson plans, English speaking ability test and students' attitude questionnaire items' correctness and relation were evaluated by using the Index of Item Objective Congruence (IOC). The value of IOC was calculated from the following equation Rovinelli & Hambleton (1977, pp. 49-60)

3.4.2.2 Inter-Rater Reliability was examined based on Scott (1955, p. 323)

$$\pi = \frac{Po - Pe}{1 - Pe}$$

$\pi$  means the proportion of agreement.

$Po$  means the proportion of items the annotators agreed on the category pairs.

$Pe$  means the proportion of items for which agreement was expected by chance when the items were randomized.

### 3.4.3 Statistics for hypothesis testing

3.4.3.1 The first hypothesis was to compare students' posttest score with the 70% criterion using one sample t-test, analyzed using Statistical Packages for the Social Sciences (SPSS) for Windows.

3.4.3.2 The second hypothesis was to compare between students' pretest and posttest scores using t-test for Dependent Samples. The hypothesis was also analyzed using SPSS for Windows.

## 4. Research Results

The results were presented according to the purposes of the study.

4.1 The results of the students' English speaking ability of Mattayomsuksa 3 students in Bandonkha Khampaknam Prachasamakkee School before and after studying English speaking using active learning activities are displayed in Table 1

**Table 1** Mean Standard Deviation and Percent of English Speaking Ability Before and After Studying English Speaking Using Active Learning Activities of Mattayomsuksa 3 Students at Bandonkha Khampaknam Prachasamakkee School.

Number	Pretest		Posttest	
	Score (360 scores)	Percent	Score (360 scores)	Percent
1	72.00	20.00	270.67	75.19
2	67.33	18.70	258.00	71.67
3	59.33	16.48	230.00	63.89
4	58.67	16.30	226.67	62.96
5	62.00	17.22	265.00	73.61

Table 1 (Continue)

Number	Pretest		Posttest	
	Score (360 scores)	Percent	Score (360 scores)	Percent
6	70.00	19.44	265.33	73.70
7	68.67	19.07	263.33	73.15
8	65.67	18.24	252.33	70.09
9	68.67	19.07	261.67	72.69
10	66.00	18.33	265.67	73.80
11	57.00	15.83	233.00	64.72
12	64.67	17.96	256.67	71.30
13	57.00	15.83	230.33	63.98
14	56.00	15.56	223.67	62.13
15	56.33	15.65	221.67	61.57
16	74.33	20.65	279.67	77.69
17	117.67	32.69	319.67	88.80
18	82.00	22.78	297.67	82.69
19	119.33	33.15	322.00	89.44
20	84.00	23.33	301.67	83.80
21	87.00	24.17	302.67	84.07
22	76.00	21.11	275.67	76.57
23	80.67	22.41	303.33	84.26
24	64.67	17.96	232.67	64.63
25	75.33	20.93	246.67	68.52
26	112.00	31.11	318.00	88.33
27	78.00	21.67	295.00	81.94
28	81.33	22.59	299.67	83.24
29	75.00	20.83	297.67	82.69
30	84.67	23.52	301.33	83.70
31	111.33	30.93	319.00	88.61
32	60.67	16.85	242.67	67.41
33	60.00	16.67	231.67	64.35
<b><math>\bar{X}</math></b>	<b>74.95</b>	<b>20.82</b>	<b>270.02</b>	<b>75.01</b>
<b>S.D.</b>	<b>17.63</b>		<b>32.15</b>	

From Table 1, it was found that the students' pretest mean score on English speaking ability was 74.95 or 20.82 percent and the posttest mean score was 270.02 or 75.01 percent, respectively. Standard deviation of the pretest was 17.63 and the posttest was 22.06.

4.2 The results of the comparison of scores on English speaking ability before and after studying English speaking using active learning activities of Mattayomsuksa 3 students using t-test for Dependent Samples is shown in Table 2.

**Table 2** Mean, Standard Deviation, Percent and a Comparison of Pretest and Posttest Mean Scores.

Test	n	$\bar{X}$	S.D.	Percentage	t
Pretest	33	74.95	17.63	20.82	
					60.73**
Posttest	33	270.02	32.15	75.01	

\*\*significantly different at the .01 level

From Table 2, it shows that the students' pretest mean score on English speaking ability was 74.95 or 20.82 percent and the posttest was 270.02 or 75.01 percent. The results explain that the students' English speaking ability before and after studying English speaking using active learning activities was significantly different at the .01 level. The posttest score was significantly higher than that of the pretest.

4.3 The effect of teaching English speaking to students' attitude. The attitude questionnaire utilized a five-point Likert's rating scale. The questionnaire was administered after completing the teaching program, is shown in Table 3.

**Table 3** Mean, Standard Deviation and Investigation of Students' Attitude towards Teaching English Speaking Using Active Learning Activities of Mattayomsuks 3 Students.

Questionnaire	n	$\bar{X}$	S.D.	Interpretation
Students' attitude towards teaching English speaking using active learning activity	33	4.64	0.12	Very good

From Table 3. it presents that the mean of students' attitude towards teaching English speaking using active learning activities was at 4.64. It indicates that students' attitude towards teaching English speaking using active learning activities was at a very good level.

## 5. Discussion

The research findings can be discussed as follows:

5.1 The results of the students' English speaking ability of Mattayomsuksa 3 students in Bandonkha Khampaknam Prachasamakkee School before and after studying English speaking using active learning activities showed that the pretest mean score was 74.95 or 20.82 percent and the posttest mean score was 270.02 or 75.01 percent. The results revealed that the posttest mean score was higher than the set criterion of 70 percent which was in accordance with the first hypothesis. It showed that teaching English speaking using active learning activities was a very effective way to develop students' speaking ability. The results of pretest scores indicated that the students' English speaking ability was at a low level. This might be because the students lacked the background knowledge on English and they were not motivated in English speaking. In addition, they had anxiety in speaking English; for example, they were shy and worried to make mistakes when they had to speak English. Moreover, they had limited language experiences in speaking English in their daily life. As a result, their speaking ability in terms of accent, grammar, vocabulary, fluency and comprehension was low. However, after the instruction of teaching English speaking using active learning activities based on McKinney (2009, p. 3) for 12 weeks, the students have improved their speaking ability because they actively participated in learning activities by themselves through learning by doing.

According to the findings, teaching English speaking using active learning activities was very effective in developing the students' English speaking ability. The active learning activities were very helpful in turning students from passive to dynamic and active learners. The classroom climates changed from quiet into an interactive class. Students were empowered, motivated, and provided with chances for language practice through authentic learning activities which enhanced the development of their speaking ability in terms of accent, grammar, vocabulary, fluency and comprehension based on Hughes (2003, pp. 131-133). This is consistent with Tuji (2006, p. 2) who affirms that when students are taught with active learning authentic instructional tasks, they become active and highly involved with the teaching and learning process. In addition, Bell &

Kahrhoff (2006, p. 1) also support that through active learning activities in a classroom, the students do not just sit still and listen to the teacher but they can be activate participants in the tasks and activities that will enable them to improve their learning performance. Nevertheless, there were some students who were diagnosed as learning disabled, who did not meet the set criterion of 70 percent, but their posttest mean scores after learning through active learning activities showed much more progress than that before the instruction.

5.2 The results of the comparison of the students' scores on English speaking ability before and after studying English speaking using active learning activities indicated that the students' speaking ability was significantly different at the .01 level. The posttest mean score was higher than that of the pretest which was in accordance with the second hypothesis. This might be because of these following reasons:

First, after the students learned English speaking using active learning activities, the result presented that the students had a significant improvement in their posttest score. One of the reasons might be the students were provided with more exposure and chances to communicate in English by themselves during three active learning activities including analysis or reaction to videos, games, and think-pair-share based on McKinney (2009, p. 3) who suggests that active learning activities are especially important to promote interest and learning in a class and develop language learning. As a result, their English speaking ability has been significantly improved and they are able to speak English more correctly and fluently in daily life situations. Harmer (2015, p. 343) argues that if students want to be able to speak fluently in English, they need to be able to pronounce phonemes correctly, use appropriate stress, and intonation patterns and speak in connected speech, including speaking in a range of different genres and situations. The results of this research correspond with Michel & Varela (2009, p. 401) who claim that active learning has a number of advantages for students including raising motivation, engaging in tasks and activities, engaging in higher order thinking skills such as synthesis and evaluation, and avoiding passive learning. It is also consistent with the study by Ruksapon (2015) who studied using active learning activities to develop students' English communicative skill. It was found that the posttest average score of English communicative skill of the students after learning using activities based on active learning was significantly higher than the pretest one. The results revealed that active learning activities could develop English communicative skills effectively.

Second, learning through active learning activities could develop the students' speaking ability efficiently because it is in accordance with communicative language teaching which promotes student centred, active learning and collaborative learning. In communicative classrooms, students need to actively use the language through a variety of communicative activities and active learning activities while the teacher takes part as a facilitator. As Hedge (2014, pp. 57-58) suggests, in a communicative classroom the learners' needs should be the focus of the content of the activities aiding them to produce concepts and forming opinions of their own. They should endeavour to make meaning out of situations by using different approaches to get information. They should not depend a lot on the teacher nor on books but on themselves and their peers.

Finally, the students learned English speaking through active learning activities including analysis or reaction to videos, games and think-pair-share through the steps of communicative language teaching by Harmer (2015, pp. 65-66).

5.3 The results of students' attitude towards teaching English speaking using active learning activities indicated that the students' attitude towards learning English speaking using active learning activities was at a very good level.

It is found that teaching English speaking using active learning activities can activate the students' interest in learning English. Moreover, active learning activities help the students gain confidence and motivation to participate in learning activities and develop speaking ability. The use of active learning activities could help students to be more confident in using English as seen on item 18 in the questionnaire with the mean of 4.82. Results from the respondents indicate that they enjoyed and were engaged when learning English speaking through active learning activities. The findings also indicate that a significant number of students learned vocabulary, expression and contents from the videos. They made students interested in learning. Furthermore, games could promote students to work in team successfully. Students could have fun and be relaxed with the games as seen on item 5 and 7 with the mean of 4.79. The results above are in line with Jones (1999, p. 623) who argues that active learning is not only effective in increasing students' learning retention and encouraging higher order thinking skills, but it is also presenting students with different learning styles and strategies, and thereby increasing students' motivation for learning. In addition, the findings above corresponds with the concept of Brown (2000, pp. 170) who states that motivation has internal and external factors that stimulate people to be constantly attracted to execute a job or task while at the same time persistently willing to attempt achieving a goal despite the challenges.



## 6. Conclusion

A study and comparison of pretest and posttest scores on English speaking ability and an investigation of Mattayomsuksa 3 students' attitude towards teaching English speaking using active learning activities can be summarized as follows:

6.1 The students' pretest mean score on English speaking ability was 74.95 or 20.82 percent and that of the posttest was 270.02 or 75.01 percent, respectively. English speaking ability of students after studying English speaking using active learning activities was higher than the set criterion of 70 percent. The students' English speaking ability was found significantly different at the .01 level.

6.2 The students' attitude towards teaching English speaking using active learning activities was 4.64, referring to a very good level.

## 7. Recommendations

The recommendations from the study are as follows:

### 7.1 Recommendations from the study

In order to make use of this study, the researcher proposes the following recommendations.

7.1.1 From the research results, the students' posttest score on English speaking ability was higher than the set criterion of 70 percent and the students' posttest score speaking ability was higher than the pretest score. It showed that active learning activities could facilitate and motivate students to use the language in speaking effectively and confidently. Therefore, active learning activities should be promoted in teaching English speaking by English teachers.

7.1.2 From the research results, it was found that the students' attitude towards teaching English speaking using active learning activity was at a very good level because it actively activated and motivated students to pay attention to practicing and speaking. It made them enjoy the challenge of doing activities. They had positive attitudes towards teaching English speaking using active learning activities. Therefore, active learning activities should be promoted in teaching English speaking by English teachers.

7.1.3 Based on the research results, analysis or reaction to videos, games and think-pair-share could be actively used to engage students' speaking ability through pair work and small group work and helped facilitate students to speak English. As a result, these activities should be promoted in teaching English speaking by English teachers.

## 7.2 Recommendations for further study

According to the results discussed earlier, some suggestions are proposed here for further studies.

7.2.1 Researchers should investigate using active learning activities to develop other English language skills: listening, reading, and writing because the students are also engaged in these skills while learning through these activities.

7.2.2 Researchers should promote and apply other active learning activities to develop the students' language proficiency.

7.2.3 Researchers should investigate teaching English speaking ability using active learning activities to students of other educational levels, for instance, primary students, high school students or even university students.

7.2.4 Researchers should investigate using active learning activities with other subject area.

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## The Development of English Speaking Ability Using Four Communicative Activities for Matthayomsuksa 3 Students

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### Abstract

The proposes of this research were to study and compare the English speaking ability before and after learning through four communicative activities of Matthayomsuksa 3 students, and to study students' attitude towards the teaching of English speaking using four communicative activities. The sample group was 30 first year Matthayomsuksa 3 students at Dongmafaiwittaya School under The Secondary Educational Service Area Office 23. The research was conducted in the first semester of the academic year 2018. This experiment followed a one group pretest-posttest design. The research instruments were 12 lesson plans, an English speaking ability test, and an attitude questionnaire. The experiment lasted for 12 weeks, 2 hours a week, or 24 hours in all. The mean, percentage standard deviation, and t-test for dependent samples were employed to analyze data. The findings of this research were as follows: first, the students' pretest and posttest mean scores in English speaking ability were 260.53 or 72.37% and 299.43 or 83.17% respectively. The posttest score was significantly higher than the pretest which was not less than the given criteria of 70% and students' English speaking ability was found to be significantly different at the .01 level. Second, the students' attitude towards teaching English speaking using four communicative activities was at a very good level.

**Keywords :** English Speaking Ability, four communicative activities

## 1. Introduction

Learning a foreign language is the most important thing that everybody should know to communicate with other people. It is the most important tool for communication, education, and livelihood. Foreign languages allow us to understand other country culture and vision. They foster universal awareness to the learners. Thus the learners can have strong cooperation and friendship with many countries. In addition, the learners are able to know and understand the differences of languages and culture, personalities and thinking, tradition and society, politics and administrations. They should be able to use the foreign language for communication, seeking the way for greater opportunities and more convenient and promising life. The goals, learners' key competency, and the bodies of knowledge of the Basic Educational Core Curriculum emphasize knowledge and skill for communication.

Teachers who teach English language have many tasks on how to improve and develop speaking skill to students. They need to search for the appropriate methods, tasks or activities to suit their English speaking ability. Harmer (2002: 269-271) pointed out that teaching English has shifted from grammatical competence to communicative competence. It is found that teachers have to focus on communicative competence rather than grammar. On the other hand, it was emphasized that English speaking skill is the most important key for communication and needed to be developed first in order that Thai students will achieve in using English for communication. Teachers have to use methods or activities that allow and activate students to use the target language inside and outside the classroom.

As mentioned, it was emphasized that English speaking skill is the most important for communication. However, speaking ability outweighs the other skills. Although in this study, it will be a challenge for the researcher to conduct this work that aims to develop speaking ability with Thai students who usually do not speak English in everyday life. It is assumed that speaking should be more emphasized than other abilities and needs to be improved so that Thai students will achieve in using English language for communication.

The researcher was conducted about the subject of studying English as a foreign language at Dongmafaiwittaya School. The learning achievement report of the academic affair of Dongmafaiwittaya School for English was 53.78% (Learning achievement of Matthayomsuksa 3 in the academic year 2017). One of the reasons for the poor learning achievement of the English subject is lack of knowledge of English speaking. According to Nunan (2003: 48-49) speaking always occurs in real time and

cannot be edited as writing. It can be claimed that speaking skill is more important than other skills. The students of Dongmafaiwittaya School have problems in reading, writing, listening and especially speaking, so they can understand the conversation but cannot speak in long sentence form, and some of them can speak, but cannot use the language in daily life. They have no confidence to communicate with people.

Communicative activities are the activities which help students to use language in real situation. However, there are several communicative activities (Grant, 1988: 14). The researcher uses the four communicative activities that were chosen to be utilized in this study, Information-gap, Identifying the differences, Personal Information exchange and Describing pictures follow Klippel (1985:23-30). Harmer (1996: 48) also introduced the information gap activities, in which two students have different information to exchange so that they can practice speaking in the classroom. Second, Identifying the Difference which is an activity where learners work in pairs, find the difference and similarity of the pictures that they ask each other for the result. Third, Describing picture is an activity that encourages learner to say something about the picture. Fourth, Interviews is an activity where learners make some questions to interview other people in the school or somewhere. Lastly, Storytelling which is an activity where learner tells a story based on their own experience or imagination such as fairytales or short stories. Learners can also develop their speaking skill, and know how to start and end a story. In addition, the other activity from Dornyei (1995: 131-143) proposed using personal Information exchange which is an activity where learners exchange their own information by using the target language. These four communicative activities that will be utilized in this study; Information-gap, Identifying the differences, Personal Information exchange and Describing pictures.

The advantages of the four communicative activities are various. The most important is that students can communicate with people in daily life. They will get enough production by the four communicative activities, so that they can be able to remember and speak the language. Moreover, they can acquire speaking through the teaching and learning activity in developing English speaking ability. The following are the steps four communicative activities. They are the stage of presentation, practice, and production. On the first step, the presentation stage is divided into three main parts: Lead in, Elicitation and Explanation for the purpose of making the students procure clear pictures in performing the activities by predicting the vocabulary when they look at pictures and listen to the audio tracks from native speaker's accent. Next, in the practice stage, students have to practice the new target language and drill dialogue or

sentences by restating audio track until they can speak correctly and fluently. Furthermore, the other practice activities are matching parts of sentences, completing sentences or conversation, and asking and answering questions using the target language. Lastly, in the production stage, students are encouraged to use freely the new language in their own way that follows the topic of the lesson is provided by the teacher. The activities may be in the form of a role play, a communication task or a simulation activity.

As the mentioned problems, the researcher needs to develop English speaking ability using four communicative activities, which are developed by Klippel (1985:23-30), Dornyei (1995:131-143), Harmer (1996: 48) and the teaching processes are from Littlewood (1995:22-64).

## **2. Research Objectives**

The research purposes were:

2.1 To study and compare students' English speaking ability using four communicative activities before and after the instruction of Matayomsuksa 3 students

2.2 to investigate students' attitude towards teaching English speaking using four communicative activities.

## **3. Research Methodology**

### **3.1 Samples**

The samples in this study were 30 students in Matayomsuksa 3 who had studied English in the first semester of the academic year 2018 at Dongmafaiwittaya School, Muang, Sakon Nakhon Secondary Educational Service Area Office 23.

### **3.2 Research Instruments**

3.2.1 The 12 lesson plans were administered to the students in class as the materials for the experiment. The lesson plans were focused on speaking and the four communicative activities; the lesson plans were produced in two hours duration each, and two days for a week.

3.2.2 An English speaking ability test was conducted in 12 interview questions that follow the criteria of English speaking ability. Furthermore, the test will be used as the pretest, and the post test.

3.2.3 A students' attitude questionnaire towards teaching English speaking using four communicative activities. The questionnaire was improved in Thai version based on five-point Likert's rating scales which consists of 20 items.





4.1 The results of the students' English speaking ability of Matthayomsuksa 3 students in Dongmafaiwittaya School before and after studying English speaking using four communicative activities are shown in Table 1

**Table 1** Mean Standard Deviation and Percent of English Speaking Ability Before and After Studying English Speaking Ability Using Four Communicative Activities of Matthayomsuksa 3 Students of Dongmafaiwittaya School

Number	Pretest		Posttest	
	Score (360)	Percent	Score (360)	Percent
1	298	82.78	328.35	91.21
2	260	72.22	300.00	83.33
3	255	70.83	295.00	81.94
4	255	70.83	291.65	81.01
5	240	66.67	291.65	81.01
6	242	67.22	290.00	80.56
7	260	72.22	316.65	87.96
8	300	83.33	335.00	93.06
9	280	77.78	321.65	89.35
10	270	75.00	301.33	83.70
11	260	72.22	296.65	82.40
12	255	70.83	308.35	85.65
13	298	82.78	325.00	90.28
14	230	63.89	281.65	78.24
15	270	75.00	296.65	82.40
16	275	76.39	305.00	84.72
17	261	72.50	291.65	81.01
18	265	73.61	295.00	81.94
19	230	63.89	280.00	77.78
20	280	77.78	311.65	86.57
21	285	79.17	345.00	95.83
22	260	72.22	308.30	85.64
23	255	70.83	290.00	80.56

**Table 1** (Continue)

Number	Pretest		Posttest	
	Score (360)	Percent	Score (360)	Percent
24	260	72.22	300.00	83.33
25	255	70.83	296.65	82.40
26	250	69.44	285.00	79.17
27	235	65.28	270.00	75.00
28	230	63.89	265.00	73.61
29	260	72.22	295.00	81.94
30	242	67.22	265.00	73.61
<b>Mean</b>	<b>260.53</b>	<b>72.37</b>	<b>299.43</b>	<b>83.17</b>
<b>S.D.</b>	<b>19.43</b>	<b>5.40</b>	<b>19.07</b>	<b>5.30</b>

From Table 1, it shows that the students' pretest mean score on English speaking ability was 260.53 or 72.37 percent and the posttest mean score was 299.43 or 83.17 percent, respectively. Standard deviation of the pretest was 5.30 and the posttest was 5.40

A comparison of scores on English speaking ability using four communicative activities of Matthayomsuksa 3 students using t-test for Dependent Samples is shown in Table 2.

**Table 2** Mean Standard Deviation Percent and a Comparison of Pretest and Posttest Mean Scores

Test	N	$\bar{X}$	SD	T
Pretest	30	260.53	19.43	22.233-**
Posttest	30	299.43	19.07	

\*significantly different at the .01 level

From Table 2, it shows that the students' pretest mean score on English speaking ability was 260.53 or 72.37 percent and the posttest was 299.43 or 83.17 percent. The results explain that the students' English speaking ability before and

after studying English speaking using four communicative activities was significantly different at the .05 level. The posttest score was significantly higher than the pretest.

**Table 3** Mean Standard Deviation Percent and a Comparison of Pretest and Posttest and the Instruction with the Criteria of 70 percent

Test	Criteria	N	$\bar{x}$	S.D.	%	t
Post-test with the criteria of 70%	75 Percent = 2 70 scores	30	299.43	19.07	83.17	8.452**

\*significantly different at the .01 level

From Table 3, it shows that the students' posttest mean score on English speaking test was 299.43 or 83.17 percent. According to the result, which was at statistically significant level (.01), it means that the students who learn English speaking using four communicative activities, have posttest score higher than the criteria 70 percent.

4.2 students' attitude towards teaching English speaking ability using four communicative activities

**Table 4** Mean Standard Deviation and an Investigate of Students' Attitude towards Teaching English Speaking Using Four Communicative Activities of Matthayomsuksa 3 Students

Attitude Test	N	$\bar{x}$	S.D.	Interpretation
Student's attitude towards teaching English speaking ability by using four communicative activities	30	4.55	0.17	Very good

From Table 4, it presents that the mean of students' attitude towards teaching English speaking using four communicative activities was at 0.46. It indicates that students' attitude towards teaching English speaking using four communicative activities was at a very good level.

## 5. Discussion

The research findings can be discussed as follows:

5.1 According to the study and comparison of the English speaking ability of Matthayomsuksa 3 students before and after using four communicative activities, the results of the study demonstrated that the students' pretest, and posttest scores in English speaking ability were 260.53 or 72.37 percent, and 299.43 or 83.17 percent, respectively. From the pretest score, the finding indicates that most students got low score so the English speaking ability was at a low level. This might be because of the following: The students lack the knowledge on the appropriate vocabulary and structures to be used on most of the given situations. They may not communicate with other people. This corresponds with Richards & Renandya (2002) who stated that socio cultural factor at the same time the affective factor of the learning of Thai students. Students were used to listening to the lecture. The students were only familiar with the conventional teacher-directed teaching. This made them lose the opportunity to practice the target language, thus their reluctance to speak in the communicative classroom where they were not used to or haven't experienced before in their student life. Students were used to memorizes and prefer listening to lectures. The findings showed that the students can improve their English speaking ability as shown in their posttest score. Learning English speaking using four communicative activities could activate the students to act along with the conversation which were highlighted in each situation. The students could understand the meaning of conversation very well. Moreover, using four communicative activities for learning English speaking could provide the students many chances for practicing and retaining the speaking in terms of accent, pronunciation, comprehension, vocabulary, and fluency use.

5.2 The comparison of posttest mean scores showed that the students' posttest mean score on English speaking ability was 299.43 or 83.17 percent. The results explain that the students' posttest was not significantly different. According to the result, which was not significantly different, it means that the students who learn English speaking using four communicative activities, have knowledge. This finding is supported by Nanthaboot (2012) who studied using communicative activities to develop English speaking ability of Mathayomsuksa 3 students at Watsantikaramwittaya School, Ratchaburi. It was found that using communicative activities in class helps students develop their English speaking behaviors. The effort of communication by using spoken language and gesture were at excellent levels. The English speaking ability development level in fluency and accent was well strong. This is also related to what

Kaddour (2016) study about Enhancing EFL learners' Speaking Skill Through Effective Communicative Activities and Strategies, The Case of First Year EFL students. It was found that the EFL learners' attitude who were taught through the communicative activities and strategies were more aware and mindful about the importance of speaking activities to improve their oral proficiency. EFL teachers agreed that using communicative activities is the one of the most effective and beneficial tools to reinforce first year English students' speaking. The research suggests that allows English communicative teaching through the communicative activities and strategies EFL learners to flourish and evolve in their learning process. The result was with Sanichon (2017) studied the development English speaking skill by using communicative activities of Prathomsuksa 6 students at Banlaoklaunonsomporn School, Udonthani. It was found that the students' English achievement who were taught through the communicative activities was higher than the students' achievement's pretest. The research suggests that English speaking ability teaching by using communicative activities help learners speak and can use English fluently in the real situations.

5.3 On the students' attitude towards teaching English speaking using four communicative activities, the results indicated that the student's attitude towards learning English speaking after using four communicative activities was at a very good level. Teaching English speaking using four communicative activities activated the students' interest in learning English speaking as well. Moreover, the four communicative activities offered enjoyable experiences and the students could apply the knowledge they learned in their daily lives. Students' confidence level improved a lot after learning English speaking using four communicative activities. Furthermore, they helped the students gain confidence and be motivated enough to do the activities and developed naturally speaking ability for use not just inside the classroom but also outside in any situation which they may be in. The finding was consistent with what Gardner (1985: 78) postulates: that, attitude is considered as the main factor to succeed in developing language in a classroom. Also, it can be defined as the combination of effort and desire to achieve the goal of language learning, as well as, the development of preferable attitudes towards learning the language. The result was similar to with Brown (2000: 160-163) studied that motivation involves both internal and external factors that stimulate desire and energy in people to be interested in and committed to a job or subject, and to exert persistent effort in attaining that goal. Motivation results from the interactions among conscious and unconscious factors such as the intensity of desire or need, incentive or reward value of the goal, and expectations of the individual and

of his or her significant others. Furthermore, from the result, it shows that, there are the items which had got the remarkable mean scores which were items of ‘teaching English speaking ability using four communicative activities helps students communicate with their pair or other people and ‘they want to study English more because they have more confident speaking and do not have anxious in teaching English Speaking ability, which the mean scores were 4.55 respectively. These are supported by what Klippel (1985:23-30), Dornyei (1995:131-143), Harmer (1996: 48) and the teaching processes are from Littlewood (1995:22-64), stated that the four communicative activities could maximize acquisition of comprehension. The students could get a lot of chances to have comprehensible input. Moreover, it could create good personality, entertaining experiences for the learner which leads to better internalization of the language.

## 6. Conclusion

A study and comparison of pretest and posttest scores on English speaking ability and an investigation of Matthayomsuksa 3 students’ attitude towards teaching English speaking using four communicative activities can be summarized as follows:

6.1 The students’ pretest mean score on English vocabulary ability was 260.53 or 72.37 percent, and posttest was 299.43 or 83.17 percent, respectively. English speaking ability of students after studying English speaking using four communicative activities was higher than the set criteria of 70 percent. The students’ English speaking ability was found to be significantly different at the .05 level.

6.2 The students’ attitude towards teaching English speaking using four communicative activities was at a very good level. The mean was 4.55.

## 7. Recommendations

The recommendations from the study are as follows:

7.1 The recommendations form the study

In order to make use of this study, the researcher proposes the following recommendations.

7.1.1 From the research results, the students' posttest score on English vocabulary learning ability was higher than the pretest score. The reason might be, that the four communicative activities in teaching English speaking is beneficial in developing English speaking ability because they were proven to be effective in teaching English speaking. This unconventional approach of teaching English speaking arouses so much interest in learning English speaking and was appreciated by the students

after they understood the process of the tasks that they were going to perform on each of the lessons which used four communicative activities: consisted of Information gap, Identifying the differences, Personal Information exchange, Describing picture activity.

7.1.2 From the research results, it was found that the student's attitude towards teaching English speaking using four communicative activities was at a very good level. The reason might be that The four communicative activities are very effective in pair interactions, and sharing ideas with pairs. Another member had to be responsible in their own. Then, they needed to share their concepts and ideas to their pair or whole class. They had to agree on the idea and helped each other complete the tasks and performed better as com being alone then they positive attitude towards English speaking.

#### 7.2 Recommendations for further study

According to the results discussed earlier, some suggestions are proposed here for further studies.

7.2.1 Researchers should compare the four communicative activities with another method to investigate other English language skills such as listening, reading, and writing using four communicative activities to be applied to classes in the future.

7.2.2 Researchers should apply the four communicative activities to other students in various levels and educational backgrounds.

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## The Development of English Vocabulary Learning Ability Using Visual Aids of Prathomsuksa 1 EFL Thai Students

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### Abstract

The purposes of this research were to compare the English vocabulary learning ability of Prathomsuksa 1 students before and after teaching using visual aids, to determine the retention of the vocabulary learning ability of Prathomsuksa 1 students 14 days after teaching using visual aids, and to analyze the students' attitude toward teaching English vocabulary using visual aids. The sample group was selected using cluster random sampling consisting of 35 Prathomsuksa students of Banmakaeng School in Udon Thani. The research was undertaken in the second semester of the academic year 2017. The research was a one group pretest-posttest design. The research instruments were 12 lesson plans; an English vocabulary ability test that had 2 parts a) 30 multiple-choice items and b) 10 items that assessed the students' pronunciation; and an attitude questionnaire. The experiment lasted for 12 weeks, 2 hours a week, or 24 hours in all. The mean, percentage, standard deviation, and t-test for dependent samples were employed to analyze data. The findings of this research were as follows: (1) The students' pretest and posttest mean scores on English vocabulary learning ability test were 24.26 or 60.65 % and 31.06 or 77.65 % respectively. The posttest was significantly higher than the pretest. (2) The students showed vocabulary retention. And (3) the students' attitude towards teaching English vocabulary using visual aids was at a good level.

**Keywords** : L2 vocabulary development, visual aids, and retention

## 1. Introduction

English has been an invaluable tool for the global community in this modern age. The development of the English language for communication has been gaining popularity among the non-native English speaking countries because of the demands of technological advancement, higher educational achievement, economic growth and simply to survive the global scene. The position of English in Asia as a working language has increased over the years and countries like South Korea, Japan and China have been improving the quality of English as a foreign language (EFL) in their countries in response to this development. The difficulties in learning a foreign language though set the barrier for the achievement of these goals especially in establishing English as a lingua franca. Nonetheless, developing countries are willing to take on the challenge. According to Honna (2012), many Asian countries are mostly aware of the importance of the English as an “intranational” (as used inside the country itself) and international language so the inclusion and expansion of EFL in the curricula is noticeable.

The four language skills are considered as the goal and instrument to achieve communicative competence (Klimova, 2014: 87) in the EFL setting and teaching vocabulary is an essential part of this process. Equipping the second language (L2) learners of with the necessary vocabulary knowledge can help them successfully communicate in the target language. Barcroft, Sunderman & Schmitt (2011: 573) define vocabulary as “words in a language, the entire vocabulary of a language.” This gives strength to the assumption that vocabulary is essential in language acquisition. Many researchers suggest that the knowledge of vocabulary plays an important role in the successful functioning of the four language skills of listening, speaking, reading and writing (Alqahtani, 2015: 22). Additionally, the lack of proper knowledge of vocabulary makes learning a second language even more difficult. Wilkins (1972: 112) asserts that there is no use of being able to construct a grammatically correct sentence without the proper words to express meanings. These reasons emphasize the researcher’s assumption of the importance of vocabulary knowledge in the EFL learning. The mastery of the language and the competence in communicating rely on the amount of vocabulary instilled in the learners. Moreover, it is observable that learners of L2 acknowledge this fact. According to Schmitt’s (2000: 4) observation, language learners typically have dictionaries rather than grammar books.

The adaptation of English as lingua franca in Thailand has been relevant in the educational system of the country but there is still the growing concern on the proficiency level of the use of the language. One of which is the result of the 2015 Test

of English as a Foreign Language (TOEFL) where Thailand scored 77 out of 100 (TOEFL iBT Tests, 2015). Kongkerd (2013: 7) states that one of several factors to this problem is the English teaching itself. Many reports and research studies criticize the teaching of English in Thai schools because of the emphasis on grammar translation and focus on English Examination (Jenprai & Weerawong, 2013: 75). Prasongsook (2010: 8) also claims that teachers depend excessively on textbooks that could result to negative attitudes of students towards learning English. Moreover, Todd & Keyuravong (2004: 15) scrutinize the English teaching strategies of teachers in Thailand that despite the establishment of communicative competence, they still teach English passively. This is also true for the status of teaching vocabulary where the emphasis lies on simple repetition and memorization (Boonkongsan & Intaraprasert, 2014: 1).

The Ministry of Education in Thailand has seen the need to address the issues of the effectiveness of current English curricula through its revision with the emphasis of English for communication (Ministry of Education, 2008, 252). To communicate efficiently, learners need the four skills of listening, speaking, reading, and writing, but learning vocabulary is also given importance. As McCarthy (1990: viii) explains, without words to properly express a variety of meanings, mastery of the second language cannot be achieved. Vocabulary is typically a skill that is touched in every language teaching either overtly or not. It is an essential entity to the mastery of any language and one of the very first observable skill acquired by new learners. In addition, Ur (1996: 60) defines teaching vocabulary in the second language teaching as the words that are taught that could be a single word that can be made up of two or three words that express a specific idea. Similarly, Nunan (1991, 121) states the necessity of teaching vocabulary since the absence of broad knowledge of vocabulary would limit the learner's ability to facilitate the use of structures and functions needed in a successful communication process.

The challenge now to achieve any of the language skills is the use of effective teaching techniques. One of these is the use of visual materials that have greater impact to young learners. Visual aids include tangible objects, collages, and flashcards (Oxford, 2000, 105) that give a more meaningful connection between the word and the idea they convey. Linse (2005, 120) asserts that one of the three main learning channels that teaching young learners should be based on is visual which pertains to their ability to easily recall visual images. Supporting language context with pictures encourages greater learning outcome. Another advantage of using these kinds of teaching materials

is that they make understanding of concepts easier without the teacher constantly translating the words to the first language.

In a study done by Sinatra, Beaudry, Stahl-Gemake, and Gustello (1990, 613) they assert that visual literacy offers a foundation for the language skills to prosper since the necessary and “meaningful connections are made between experience and language” before the learners are taught with any of the language skills. Also, visuals provide relevant input that are easy to understand and can support their level of learning as Fotos (2001, 267) points out that input forms the second language acquisition that a learner receives. Mannan (2005: 108) summarizes the importance of using visual aids in the language classroom by saying that these materials “help the teacher to clarify, establish, correlate and coordinate accurate concepts, interpretations and appreciations, and enable him to make learning more concrete, effective, interesting, inspirational, meaningful and vivid.”

Using different strategies to teach students in achieving communicative competence in the English language is one of the main goal that Ban Makkhaeng School of Udon Thani adheres to that prompt them to hire foreign English teachers since 2010. British, American and Filipino teachers have been employed to teach their students English as a core subject. And with the implementation of the Intensive English Program (IEP) three years ago, they also offer elective classes in Mathematics, Science, and Socials with English as the medium of instruction. The school is also equipped with the necessary modern and innovative technologies to help aid in teaching such as the E-library, audio-visual equipment, and a sound laboratory. Although the success of the aim for the improvement of the English skills of the students is increasing, the school still intends to find more and better ways for them to learn. Despite the considerable achievement of the school’s performance for the standardized O-Net (Ordinary National Education Test) exam, there is still a growing concern that it has not achieved the average level.

The primary objective of second language acquisition teaching is to be able to provide the students with an effective tool for them to learn successfully and become competent user of the language. Thus, to provide solution to the problem presented, the researcher has explored and dug deeper in the utilization of visual aids as one of tools for language learning, specifically for teaching vocabulary. And based on the result of this study, it has been confirmed that using visual aids is effective in improving the vocabulary learning ability of Thai EFL students at Ban Makkhaeng School.

## 2. Research Questions

The primary objective of second language acquisition teaching is to be able to provide the students with an effective tool for them to learn successfully and become competent user of the language. Hence, this study seeks to explore answers to the following questions:

2.1 Does the use of visual aids in teaching English vocabulary improve the English vocabulary ability of Prathomsuksa 1 Students?

2.2 Do Prathomsuksa 1 Students have vocabulary retention?

2.3 What is the attitude of Prathomsuksa 1 Students towards teaching using visual aids?

## 3. Purposes

The research objectives were:

1. to compare the English vocabulary learning ability of Prathomsuksa 1 students before and after using visual aids,

2. to determine the retention of the vocabulary learning ability of Prathomsuksa 1 students,

3. to analyze the students' attitude towards teaching English vocabulary using visual aids.

## 4. Literature Review

This study examined the use of visual aids to develop the English learning vocabulary of the learners. The following discussions will focus on the use of visual aids:

Visual aids as the teaching materials that can only be seen. These are the teaching materials that serve as concrete models of instruction which is aimed to enable the learners to recognize the target vocabulary (Shabiralyani, Hasan, Hamad, & Iqbal (2015: 226). According Koren (1999: 1), if there is something to associate words in the second language, the learners will lean easily that with the words alone. As it is stressed by Chun & Plass (1996: 183), human learning is mostly based on visual memory.

Yunus, Salehi & John (2013: 116) assert that visual aids stimulate interest among the learners. Many researchers and scholars name the kinds of visual aids available in teaching vocabulary.

Vocabulary acquisition may be the heart of language learning but there is still a need to further enhance the techniques to be able to achieve the success in the aims of the language classroom.

Usually, vocabulary is learned through memorizing the meanings of the target words and although this is an effective strategy, exposing learners to the visual imagery of the words can make provide them with a more concrete input. Novak & Wurst (2005: 95) asserted that visualization allows the inherent processing of information and aids in providing learners with the ability to express themselves. Schmitt and Schmitt (1995: 113) theorize that incorporating concepts or words into a familiar channel allow easier recollection. They also added that creation of mental image incorporated with the words also enhances the ability of the learners to conceptualize related words which is better than mere rote memorization. To this Uberman (1998: 20) also said that the learner remember better the material that has been presented by means visual aid.

Visual aids have been used in the language classroom especially for vocabulary instructions. The images or pictures that the learners see do not only tap into their background knowledge but also the opportunity to remember the words associated with them. As Nation (2006: 85) explains, objects, pictures and diagrams that the learners are exposed to instances of meanings that re most likely to be remembered.

Moreover, Mamun (2014: 20) claims that the use of visual aids in the second language classroom has proven to be a good way to encourage learners to be more attentive and active in class. Presenting pictures allows the learners to contextualize their ideas and improve their comprehension. He also added that, in recent years, visual aid materials are easier to access because of the internet so using this method is very practical.

Allen & Marquez (2011: 5) mentions that these visual aids stimulate the learners' comprehension as they present clearer representation of the knowledge they are acquiring as well as allow them to think more beyond what is presented. Ur (1988: 30) also notes that these visual aids are necessary for learning for the simple reason that they appeal to interest and encourage the learners to focus on their learning. In addition, pictures contain many details that could aid different topics and provide different information (Nation, 2006: 85).

The acquisition of vocabulary is important but somewhat given lesser attention compared to the other language skills. The knowledge of vocabulary compliments with the acquisition of these other language skills of listening, speaking, reading and writing (Pikulski & Templeton, 2004: 2). For the second language acquisition setting, Nunan

(1991: 117), emphasizes the need to acquire sufficient word knowledge to be able to facilitate communication.

The effectiveness of using visual aids in teaching English vocabulary is demonstrated in the study done by Phillips (2016), the effects of visual vocabulary strategies on vocabulary knowledge was explored. The purpose of the study was to examine the effects of picture word pairing and semantic mapping strategies on the vocabulary understanding of second grade students. Also, the study explored the effectiveness of pictures alongside words to teach a foreign language; the researchers found that it was very effective in adult learners. It was found out that the practice of teaching vocabulary words paired with visuals helped students to better learn vocabulary words than independent teaching of words. In addition, Liangpanit (2015) conducted a study on the extents to which Thai secondary teachers' reflection of vocabulary teaching and their implementation its vocabulary pedagogy which includes in their EFL classroom. In this qualitative study, data were collected by way of in-depth interview with 10 teachers in different high school teachers both experienced and non-experienced teachers. The results revealed that teachers show some different reflections on the implementation of the vocabulary pedagogy in classrooms. Accordingly, the study strengthened the idea that vocabulary is an important sub skill in improving students' English four skills of communication in speaking, listening, reading and writing.

In summary, the use of visual aids in teaching English vocabulary is prevalent in language teaching. The method has been tested in many and diverse situations and the result has always been alike. It has always been effective.

## **5. Research Methodology**

### **1. Population**

The population of this study was 297 Prathomsuksa 1 students of Banmakaeng School enrolled for the subject Basic English Communication for the second semester of the academic year 2017.

### **2. Sample**

The sample of this study was comprised of 35 Prathomsuksa 1/1 students of Banmakaeng School. Ban Makkhaeng has 8 classes for primary 1 level. Cluster random sampling was implemented in selecting the sample. The researcher divides the 8 classes which was the total population into 8 clusters and then Prathomsuksa 1/1 was selected.







5 = Misplaced word stress is rare and causes no distraction or miscommunication.

3.2.3 Constructed 30 items of English vocabulary test to test spelling, meaning, and use which will be consisted of matching and or multiple choice.

3.2.4 Handed in the constructed test to the thesis advisers in order to examine the correctness and relation between the objective and the test items.

3.2.5 Revised the test according to the thesis adviser's suggestion and hand in the correctness of questions, language and content validity following the criteria below:

+ 1 means sure that the test item is correct and appropriate to objectives

0 means unsure that the test item is correct and appropriate to objectives

-1 means sure that the test item is incorrect and inappropriate to objectives

The scores are collected from the three experts. It was found to be 1.0.

3.2.6 Revised the test according to the expert's advice and submit the test that has been re vised to the thesis adviser for rechecking.

3.2.7 Carried out the pilot testing using the pilot samples for the first semester.

3.2.8 Selected 30 items of the test that have a difficulty index (p) between 0.20-0.70, the discrimination index (r) score needed to be from 0.23 – 0.67 and the reliability of the test was found at 0.76.

### 3.3 Attitude questionnaire

The students' attitude questionnaire towards teaching using visual aids was constructed following the steps:

3.3.1 The theories related to the attitude assessment and evaluation of English language curriculum were studied.

- |   |                         |
|---|-------------------------|
| 5 | Means Strongly agree    |
| 4 | Means Agree             |
| 3 | Means Undecided         |
| 2 | Means Disagree          |
| 1 | Means Strongly disagree |

3.3.2 The 15 items for the student's attitude questionnaire related to content using five point Likert ranging from strongly agree, agree, undecided, disagree, and strongly disagree (Best & Kahn, 2006: 330- 331) were constructed.

3.3.3 Hand in the student's attitude questionnaire to the thesis advisors in order to examine the correctness.

3.3.4 Hand in the student's attitude questionnaire that has been revised to the three experts in order to inspect the content validity, and language accuracy. Next, the collected scores from the three experts will be analyzed for index of item objective congruence (IOC).

(+1) means sure that the attitude questionnaire is relevant to objective

(0) means unsure that the attitude questionnaire is relevant to objective

(-1) means sure that the attitude questionnaire is relevant to objective

3.3.5 Revise the students' attitude questionnaire and submit to the three experts to check the Index of Item Objective Congruence (IOC) that was found to be 1.0.

3.3.6 Use the students' attitude questionnaire to the sample for the teaching program. This is shown in figure 4 on the next page.

#### 3.4. Data Collection

The data collection stage was prepared into 5 steps:

3.4.1 The students took the pretest of English vocabulary tests of 30 items and with the duration of 1 hour.

3.4.2 The researcher conducted the teaching using the 12 lessons that were planned.

3.4.3 The students took the posttest using the same vocabulary tests with the same procedure with the pretest.

3.4.4 The students took the retention test 14 days after the posttest using the same test as the pretest and the posttest.

3.4.5 The researcher distributed the students' attitude questionnaire to check the students' attitude towards teaching using visual aids.

3.4.6 The researcher analyzed the data from the pretest, posttest, and attitude questionnaire towards learning using visual aids.

#### 4. Result

The researcher used English vocabulary ability and retention test which consisted of 10 items oral vocabulary test for retention and a 30 items written vocabulary test to test spelling, meaning, and use. The selected 30 items of the test that have a difficulty index (p) between 0.20-0.70, the discrimination index (r) score needed to be

from 0.23 – 0.67 and the reliability of the test was at 0.76. The pretest was conducted before the teaching program. After the experiment the posttest was given with the same test.

The result of the study of pretest and posttest scores of the English vocabulary learning ability using visual aids of the Prathomsuksa 1 students of Banmakkaeng School is presented in Table 2 on the next page:

**Table 2** The scores on the pretest and posttest of Prathomsuksa 1 Thai EFL students on their English vocabulary learning ability using visual aids

No.	Pretest		Posttest	
	Score (40)	Percentage (%)	Score (40)	Percentage (%)
$\bar{X}$	24.26		31.06	
S.D.	5.42		4.30	
Percentage		60.65		77.65

The table above shows that the students’ pretest mean scores of their English vocabulary learning ability was 24.26 or 60.65 percent. Additionally, it demonstrates that the posttest mean score is 31.06 or 77.65 percent.

The comparison of the result of the study of pretest and posttest scores of the English vocabulary learning ability using visual aids of the Prathomsuksa 1 students of Banmakkaeng School is presented in Table 2.

**Table 3** The comparison of pretest and posttest scores on students’ English vocabulary ability before and after the instruction using visual aids

Test	n	$\bar{X}$	S.D.	t-test
Pretest	40	24.26	5.42	10.65**
Posttest	40	31.06	4.30	

\*\*p < 0.01

Table 2 demonstrates the comparison of pretest and posttest scores of Prathomsuksa 1 students’ English vocabulary ability before and after the instruction

using visual aids. Using One Sample t-test, it was found out that the pretest mean score is 24.26 while the posttest mean score is 31.06. The result also indicates that the students' English vocabulary using visual aids was significantly different at 0.01 level.

In order to measure the retention level of the sample, a retention test similar to the pretest and posttest was given to the sample after a period of 14 days.

The results of the study of posttest and retention scores of the English vocabulary retention of Prathomsuksa 1 students after teaching English vocabulary learning ability using visual aids is presented in Table 4 below.

**Table 4** The results of the study of posttest scores of the English vocabulary retention of Prathomsuksa 1 Thai EFL students after teaching English vocabulary learning ability using visual aids

Test	n	$\bar{X}$	S.D.	t-test
Posttest	35	31.06	4.30	3.69*
Retention	35	31.34	4.04	

The table above shows that the students' posttest mean scores of their English vocabulary retention was 31.06 or 77.64 percent. Also, it reveals that the retention mean score is 31.34 or 78.35 percent.

The comparison of posttest and retention scores on students' English vocabulary retention before and after the instruction using visual aids of Prathomsuksa 1 students is shown in Table 5 on the next page.

**Table 5** The results of the study of posttest scores of the English vocabulary retention of Prathomsuksa 1 Thai EFL students after teaching English vocabulary learning ability using visual aids

No.	Posttest		Retention	
	Score (40)	Percentage (%)	Score (40)	Percentage (%)
$\bar{X}$	31.06		31.34	
S.D.	4.30		4.04	
Percentage		77.64		78.35

\*p > 0.01

The table above shows that the posttest mean score of the students' English vocabulary retention was 31.06 and the retention score is 31.34. The result indicates that the students' English vocabulary retention was not significantly different at the 0.01 level.

After the instructions for English vocabulary learning ability using visual aids through the use of the 12 lesson plans, the researcher also investigated the students' attitude towards teaching method mentioned. An attitude questionnaire consisting of 15 items were given to the 35 Prathumsuksa students of Banmakkaeng School. The results of this survey is shown in Table 6 below:

**Table 6** Students' Attitude towards English vocabulary learning ability using visual aids

Attitude Test	n	$\bar{X}$	S.D.	Interpretation
Student's attitude towards English Vocabulary Learning using Visual Aids	35	4.33	0.18	good

Table 6 shows that after teaching English vocabulary learning ability using visual aids, the students mean score is 4.33. The interpretation of this score showed that the students' attitude towards the instruction was at a good level.

## 5. Discussions

This study was an experimental research with one group pretest - posttest design. The aim of this study was to study and compare the students' English vocabulary learning ability before and after using visual aids. Also, it investigated the students' attitude towards teaching English vocabulary learning through using visual aids. The research findings are discussed further below:

1. From the study and comparison of the English vocabulary learning ability of Prathumsuksa 1 students before and after using visual aids, it was found out that the students' pretest and posttest scores on English vocabulary learning ability were 60.65 percent and 77.65 percent, respectively. These findings were in accordance with the first hypothesis set in this research. The findings indicated that the students' pretest score of English vocabulary learning ability was at a lower level.

It can be assumed that the reason would be from the lack of the basic vocabulary skills of the students. As English being used as a foreign language in Thailand, people, especially young learners have limited access to it. The result of the students' low pretest scores show that English words especially once used in context pose difficulty for the learners to understand. This can also result to the failure for them developing the other language skills of listening, speaking, writing and reading as mentioned by Alqhatani (2015: 22). This problem might be an effect of another that Kongkerd (2013: 7) recognized as the consequence of poor English language instruction. In some studies done, among the reasons mentioned were the passive methods of teaching and giving emphasis to memorization and repetitions. Given this problem, Coady (1993: 3) suggested that concrete learning activities should be practiced to alleviate the pressure of learning. Consequently, after learning English vocabulary through the use of visual aids, there is a significant improvement on the students' performance. With the assessment done, it showed that the students were: motivated and confident that they know the words presented to them, able to easily associate the words to the visual images, contextualize ideas and have a clearer comprehension of facts given.

Firstly, as pointed out by many experts including Yunus, Salehi & John (2013: 116), visual aids is a good medium for stimulating the students to learn, especially young second language learners who need to be given more motivation in the teaching process. Since they were presented with visual representation of the words, they were able to relate them to their own background knowledge of those words, thus making them confident that they know what they are learning and more open to possibilities of having further knowledge of the words as used in context. The exposure to visual aids also gave the students concrete representation that they can relate to their real environment. This allows them to be assured that what they are learning is something familiar taking away the pressure of the learning anxiety they might face.

Additionally, the learners became even more active during the lesson since they were able to access their own experience or knowledge of the words. This allowed them to express their thoughts using the grammar structure they learned along the teaching process. This finding of this study was also similar from the result of the research done by Miller (2011) where grade 12 students exposed to three different visual approaches. It was found out that the students' engagement to the lesson, as well as their own perception of learning, had increased. Accordingly, these are in accordance

to Mamun's (2014: 20) assertion that using pictures give the learners encouragement to be attentive and active in class.

Secondly, by using visual aids to teach English vocabulary, it enabled the students to associate the words to the visual images thus, stimulating their comprehension. Additionally, once the teacher presented the words using the target grammar structure, the students were able to understand other details that could support their comprehension. Teaching the words in context also became easily understood by the students since they had a clearer mental image of the idea presented.

This finding is also similar to the separate studies done by Phillips (2016) and Mansourzadeh (2014) where both found that the teaching of vocabulary along with pictures enabled better understanding of vocabulary words. As emphasized by Nunan (1991: 117), the acquisition of sufficient word knowledge could facilitate communication. In connection to this, the learners were also able to be aware that the words possess more meaning in their contextualized presentation allowing them to be better at expressing their thoughts as well as understanding information given to them. As the theory of vocabulary acquisition proposes, mastery happens in two stages: mental understanding and observable usage (Spellery, 2002: 2). The moment there is an evident processing, negotiating and application of the words the learners learned, it can be assumed that they have acquired their vocabulary knowledge.

Graves (2006: 4) pointed out that part of the framework for teaching vocabulary is that the students should be provided with rich and varied language experiences. The visual aids do not only teach the students new words but also allowed them to consciously use the vocabulary words they learned in particular situations as provided by the information given to them. As explained by the Dual Coding Theory proposed by Paivio (1971: 438), with the support of the non-verbal codes from the visual aids, the vocabulary words were better understood and processed through the teaching with the use of visual aids.

2. From the study and comparison of the English vocabulary retention of Prathomsuksa 1 students 14 days after the posttest, it was found out that the students have English vocabulary retention. This is in accordance to second hypothesis of this study that the students would have vocabulary retention after teaching English vocabulary using visual aids. This result shows that the students were able to retain the words they encountered during the lessons. From this finding, it can be concluded that using visual aids to teach English vocabulary could aid in the vocabulary retention of the learners.



After the posttest was done, a retention test was given to determine the ability of the learners to recall the vocabulary words they learned. The result of this test indicated that more than 70 percent of the students gained retention which is consistent to both Uberman (1998: 20) and Nation's (2006: 85) assertion that learners exposed to visual materials as used in teaching tend to remember more what they had learned. The students recognized the target vocabulary through the pictures shown to them as well as the words that they were expected to read.

In connection to this, it also confirms the premise of the Dual Coding theory (Paivio, 1971: 438). The students used the familiar cues provided to them by the pictures as a stimuli to be able to conceptualize the words that they have learned. This assertion is also similar to the findings of the study done by Halson (2014) that the emphasis of using imagery is an essential strategy for long-term vocabulary retention.

As Chun & Plass (1996: 183) asserted, humans mostly rely on their visual memory for learning. Therefore, the combination of oral and visual cues gave a more meaningful association of words that could reinforce better recall and could lead them to gain better vocabulary knowledge. Consequently, this ability to retain vocabulary in could help them in ultimately learning the other language skills of listening, speaking, reading, and writing.

3. From an investigation of the students' attitude towards teaching English vocabulary learning ability using visual aids, the findings showed that the students' attitude towards teaching English learning ability using visual aids was at a good level. The reasons might be that English vocabulary learning through the use of visual aids lessen the pressure of learning a second language as well as it provided a pleasurable learning experience to the young learners.

Through the use of visual aids, it stimulated the students' background knowledge of the vocabulary words that they were going to learn. Since pictures provided a sense of familiarity, it encouraged them that they have idea of the lesson and be optimistic towards learning. They found the activities easy to do since the pictures helped them in answering. This enthusiasm could be translated to having positivity that they are learning and they are capable of learning especially a second language that could pose numerous difficulties.

Their confidence in using the English language is also very visible. The students managed to be active participants in the course of the lesson because they understood easily what they were learning. Visual aids also assisted them in expressing their thoughts and completing their activities both in oral and written tasks. Hence,

using pictures to teach vocabulary encouraged the students towards learning the other language skills of listening, speaking, writing and reading.

It could be said that the students' attitude towards teaching English vocabulary learning ability using visual aids has an impact to the students' vocabulary learning ability. Considering the positive attitude of the students towards vocabulary learning, they could be confident through the course of the lesson and be active participants. This could also promote their vocabulary retention to further develop their capability to learn the other English language skills.

## 6. Conclusion

From the result of the study, it can be concluded that the use of visual aid materials in teaching English vocabulary is effective for Thai EFL students. The images the students see from the visual aids shown by their teacher helps them to retain the vocabulary they learned. Majority of the learners are able to determine the meaning of the words they learned through the pictures and images they saw from each lesson.

To make learners active and comprehend the lessons efficiently, teachers use a variety of methods and using visual aids is still one of the most effective in drawing students' attention, making lessons comprehensible and helping to develop students' long-term memory solid.

Thus, after teaching English vocabulary using visual aids for 12 weeks, it can be concluded that this teaching method is effective and efficient in developing the English vocabulary ability vocabulary retention of Prathom 1 students. It can also be added that teaching using visual aids provoke a positive effect towards the students' attitude that boosted their confidence in learning English vocabulary.

## 7. Recommendations

The findings of this study indicated that the students' English vocabulary learning ability was significantly different at the .01 level. More than 70 percent of the students had the mean score on the posttest higher than that of the pretest. Additionally, there is also a significant a .01 level of difference for the retention after the posttest.

From the stated findings, the researcher presents the following recommendations:

1.1 It was found out that visual aids supports vocabulary learning and retention. Besides the usual presentation of vocabulary words by giving translation, showing pictures and other kinds of realia gives better opportunity for the learners to

understand the words right away. Students could even recognize the words even without the translation which could help them further in learning the other English language skills. These visual aids also acted as an agent that tapped into the background knowledge of the learners and gave them the assurance that they are learning something familiar so they became confident in using the vocabulary words they learned. Also, realia items like bright and colorful picture cards with clearer representation of the vocabulary words in real life have a positive effect on capturing the learners' interest.

With this, teachers should equip themselves with more visual materials to aid their teaching process. The wide variety of these materials offers different kinds of possibilities in terms of activities and topics that could support the students' vocabulary ability development. Also, there should be an abundance of visual aids accessible to learners that even during their breaks; they will be exposed to pictures and words. Thus, visual materials should be displayed around the classrooms.

1.2 It was found out that presenting the vocabulary items in context allowed the student to be conscious of the uses of the words in different situations or circumstances. The vocabulary words used in sentences supported with the pictures enhanced the students understanding of not only using the target vocabulary words but also related words that they already stored in their vocabulary knowledge. Using them in context also helped the students create their own sentences thus developing their English language ability in communicative way.

Thus, teachers should design instructions for vocabulary that includes pictures, word meanings, and the individual words used in context. The students should have the opportunity to engage in using the words around the target grammar context. Teachers should provide activities that allow exposure to the vocabulary words such as creating dialogues or roleplays among themselves as well as the teacher.

1.3 It was found out that the use of both written and oral assessments in determining vocabulary learning are effective tools to have a reliable result. Written assessment allowed the learners to practice their over-all knowledge of the vocabulary words as well as their ability to recognize correct spellings. Speaking assessment, on the other hand, gave the teacher relevant information on the students' ability to, not only recognize the vocabulary words, but also for them to pronounce them correctly. Both these types of assessments also helped to measure the learners' retention.

With these findings, the researcher suggests for teachers to not limit themselves in a particular assessment of vocabulary but design a combination of activities that could give more credible view on the students' development. Also, the

use of pictures in the assessment helped in reducing the pressure that could affect the result of the test so it is recommended that they should be used in any forms of assessment.

1.4 It was found out that picture-cued task used in teaching and assessing vocabulary is an effective means that stresses the effectivity of visual aids. Through this tasks, the students had a positive attitude towards their assessment. They became confident in completing activities such as constructing answers around the target vocabulary. The picture-cued tasks also allowed them to be creative and use their initial English language knowledge to produce other ideas similar to the ones presented by the teacher.

Thus, teachers should use assessment techniques like picture-cued task in their vocabulary class that could provide more information on the students' development. Additionally, the assessment techniques should also have a positive effect on the students.

## 8. Recommendations for further study

From the results presented, the researcher proposed the following suggestions for further study:

8.1 Researchers should investigate the use of visual aids to other English language skills such as reading, writing, listening and speaking.

8.2 Researchers should study the English vocabulary learning ability using visual aids of students of other levels.

8.3 Researchers should investigate the use of specific visual aids such as realia or audio-visual materials to develop English language skills

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## Problem-posing Approach in English Language Teaching: A Critical Study of Thai Undergraduate Students

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### Abstract

In the traditional Thai classroom, students are seen as empty containers waiting to be loaded, instead of engaging in dialogue where teacher and students are equal partners. Teachers in traditional education only deposit knowledge while students patiently receive, memorize, and repeat information (Freire, 1970). As a result, students were not encouraged to express their voice or to initiate creativity (Keowkanya, 2004). Moreover, English curriculum in Thailand tends to follow the native English norms and overlooks local knowledge and students' subject matter (Geerson, 2012). On the contrary, researchers and educators have found that when the learners' background and interests are taken into account, they often learn better (Freire, 1970; Hall, 1995; Shor, 1992; Wallerstein, 1987; Auerbach, 1992). Therefore, a problem-posing approach advocates for a student-centered curriculum by putting emphasis on the creation of intellectual knowledge. The objective of this paper is to critically study Thai undergraduate students' reflections toward a problem-posing approach used in an English language classroom. The data was collected from the reflections of 15 Thai university students attending a 15-hour course developed from Paulo Freire's literacy work (Freire, 1970). Data included classroom observations, students' reflective diaries, and in-depth interviews. The results showed that the students had positive perceptions towards problem-posing and, considered it practical and important method to use in an English classroom. It is suggested that problem-posing be considered in English language teaching in Thailand to empower Thai students to think for themselves as agents to negotiate or transform their learning and their own life.

**Keywords :** problem-posing, English language teaching, Thai undergraduate student, social issues



## 1. Introduction

Problem-posing is a method used in ESL/EFL learning. It is an alternative approach to teaching derived from critical pedagogy that aims to empower learners by observing the subjects that matter from the learners' perspectives and empowering them to think for themselves in having agency and as knowledgeable people (Shor, 1992). This approach is an attempt to challenge the traditional canon of classroom learning, which disregards social, cultural, political, and economic factors within language learning. The problem-posing approach was initially discussed in the work of Paulo Freire, a Brazilian educator. In the late 1950s, Freire established a literacy program by using local issues to educate Brazilian farmers to read and write. He used pictures to stimulate learners to think critically about their lives and start to take over their own paths. In literacy classes, he developed dialogues from '*generative*' words representing participants' emotions and social problems; generative words are the words generated from learners' daily lives and experiences which have an emotional impact on them. The dialogue happened by using generative words or themes to motivate learners' understanding of what caused issues and how they could bring change (Wallerstein, 1987). Freire's literacy program allowed learners to take part in the political process (Freire, 1973). As a result of his work, which helped lessen the power of the dominance in their lives, he was imprisoned and forced into exile by the Brazilian military in 1964. Over the last few decades, Freire's ideas and notions for transformation have influenced different fields worldwide, such as education, labor, peace and health, and community. On the educational platform, his main concept is that education is not neutral. No matter if it happens in a classroom or in a community, the dialogues between teachers and students do not occur in a vacuum, which means that the dialogue needs other factors (Freire, 1970). The factors are that people have their cultural expectations, their experience of life, discrimination, life pressures, and their toughness to survive. Therefore, the purpose of education should take place according to the relationship between the learners and the world they live in. To achieve this ideal education, Freire proposed a dialogical approach or problem-posing approach in order to replace the narrative education, Freire called 'banking education', where students sit, and teachers are in the front of the classroom and give one-way information to students.

Problem-posing has gained more attention in western countries in the past few decades (Behrman, 2006; Ko & Wang, 2009). There are several studies and implementation of problem-posing in ESL contexts (e.g. Norton and Toohy, 2004; Auerbach, 1995; Shor, 1992). An example ESL problem-posing study is from Wallerstein

(1983). She adopted the problem-posing approach to teach ESL by proposing three stages of the approach: listening, dialogue, and action. Beginning with listening, she states that teachers have to know their students' cultural conditions, the conditions of their lives, and their current concerns. In the dialogue stage, teachers and students are equal partners involved in co-learning. Freire (1970) stated that dialogue in problem-posing is teacher-student with student-teacher, replacing teacher of the students. In problem-posing education, the role of the teacher is to ask questions and also to provide enough information to enhance the students' critical consciousness toward their lives (Freire, 1970). Wallerstein used Freire's (1973) mode of development that lead to critical consciousness. The three levels are: intransitive, semi-transitive, and critical-transitive thoughts. Intransitive consciousness stage, learners refuse to accept human agency by making personal and social change. Semi-transitive thought is partially empowered because it believes in the power of human beings can change their lives or society. Finally, critical transitivity allows people to make broad connections between individual experience and social issues, between small issue and the large social system. Action is the last stage she mentions in her work; even though she argues that action does not come easily, she believes that if educators generate an atmosphere and persuade students to say what they think, they will take over control of their own lives. Similarly, Freire (1970) states that problem-posing encourages students to see themselves as an "agent", in sociological terms, which means a person who has the capacity to act independently in order to make his or her own free choice and take control over their lives. In an EFL context, Kuo (2009) employed problem-posing by imposing picture books as based teaching in critical literacy perspectives. The researcher applied different learning tasks, such as a poster based on the discussions, or a reflection paper. The study found the activities related to the student's lives and it therefore challenged them to think differently. Additionally, materials and activities that incorporated students' lives, their cultural, political, and historical aspects, could generate their critical perceptions in learning.

In English language teaching, there are various English language teaching approaches that have influenced teachers and educators around the world. These approaches have been imposed over the past few decades, such as the Grammar-Translation Approach, which was proposed by Western Europeans; the main concern of this approach is to concentrate on written forms and less on oral procedures (Mondal, 2012; Canale & Swain, 1980). After the Grammar-Translation Approach was introduced, it became popular not only for Europeans but also in the United States. As the influence

of the approach grew in the academic community of America, it made American universities popular around the world. Due to the popularity of the academic programs, many rules were set for foreign students to be accepted by those universities. Consequently, another approach was adopted, which was the Audio-Lingual approach.

The Audio-Lingual Approach uses drills to teach structural patterns, which was successfully implemented in the military for a fast outcome (Richards & Rodgers, 2001). After language learning started to draw more interest from scholars, linguists began to doubt the effectiveness of those approaches. Then in the 1980s, Communicative Language Teaching emerged, based on Progressivism. The notion of this approach was to transfer students from being passive receivers to active participants. Recently, Task-Based Teaching has become popular in the 20th century, which presented as the development of CLT. The purpose of this approach is to make the learners acquire linguistic knowledge, in order to achieve tasks (Prabhu 1987).

As mentioned above, it can be seen that previous language teaching approaches focused merely on the effectiveness of language and only assessed the learner's accuracy and proficiency, or communicative skills, but did not include sociocultural, political, and historical dimensions within the language teaching curriculum (Okazaki, 2005). In addition, they do not present optimal approaches to language learning, which are demanded by different learning conditions (e.g., Davis, 1995; Hall, 1995; Norton, 1995 & 2000; Lantolf, 2000; Ohta, 2000; Breen, 2001; Block, 2002; Canagarajah, 1999 & 2002b; Krashen, 2002).

In sum, it is widely recognized that Thai students' English proficiency is alarmingly low, even though they spend over ten years learning English language (Baker, 2008). I strongly believe that if a problem-posing approach is implemented, it shall boost Thai learners to learn the English language effectively. In short, problem-posing is a positive alternative approach in English language learning. In an EFL context, there is not much of the implementations and articles (Crooks, 2010). Therefore, research and the actual implementation of problem-posing should be encouraged, particularly, in Thailand.

## **2. Research Objective**

This study aims to critically study Thai undergraduate student's reflections towards the problem-posing approach used in an English language classroom.



## Methodology

The set course for this study was 15 hours, which were divided into five sessions (three hours per session). The materials chosen for the classes were articles brought by students and pictures chosen based on the students' generative theme. The problem-posing in this methodology followed a similar structure to Freire's literacy education program and contained three phases: listening (investigating the issues), dialogue (codifying issues into the discussion), and action (strategizing the changes students envision following their reflections). At the end of each session, students wrote on the reflective diary to reflect on their own learning. The in-depth interview was held after the course finished.

*Leading reflective questions for students individually:* How do you feel about this picture? How does this picture relate to your experience? What is the reason for this problem? How does it affect your community and other people? What can we do about this problem? Did you have a difficult time writing your topic? What was that? How is your group discussion today? What have you learned for today? What is a social issue, in your opinion? What do you think about using social issues as topics in this course, do you think it helps you present better? What do you think after you've learned social issues in this course? From all topics, which topic can be linked to you? And why?

### 3.4 Data Analysis

The collected data were categorized into three groups: reflective diary, observation, and interview. The data were organized into a stanza form (Gee, 1999, 2011). After that, the stanzas were grouped into themes.

Critical pedagogy (Freire, 1970) was used as a theoretical framework or the lens to explain the phenomena that occurred from collected data.

## 4. Results and Discussion

According to the research objective of this study, 15 students had positive perceptions toward problem-posing. They mentioned that this method was not only helping them to learn English but also encouraging them to share and work collectively with their peers. Related to their interview and reflective diary, they expressed that less pressure in the classroom meant they would get more motivated. For example,

*Stanza 1 (Impact)*

- (Win)Line 1 I liked it. I could share my opinion with friends
- (Keow) 2 I think it was good, no pressure and helping me think more than usual
- (Nut) 3 I liked this method, it was less pressure
- (Rak) 4 I think it was good that I could expressed my own opinions, I didn't like to sit and to learn only grammar
- (Ton) 5 I felt good, I could recall from my own experiences and I had chances to discuss freely

From Stanza 1, it was obvious that the students had positive perceptions toward problem-posing. Keow and Nut explained that the problem-posing classroom created less pressure. According to their statements, it could be implied that they felt uncomfortable and pressured in the classroom since they had learned from their experiences that they would get reprimanded by teachers or peers if their answers were wrong. Moreover, this situation made them feel restrained because teachers acted as an authoritarian who had a right to assess their students by using scores to be the motivation in the class. Therefore, this is the reason why students had a lot of pressure to answer the right answers and please their teachers. Some students were blocked, and they were afraid to voice their own opinion or interact with their teachers. As Freire (1970) mentioned, this kind of classroom is considered a 'banking education'. Thus, when students were introduced to the problem-posing, a democratic classroom, they felt comfortable and less pressure since they were allowed to express their own opinions in order to help create their intellectual knowledge, as Win, Rak, and Ton mentioned. Teachers who use problem-posing methods will act as a facilitator and advocator for their students to be successful in learning. Moreover, the lessons that they learned also allowed them to recall and compile their experiences in the past and present in order to articulate their opinions.

Besides the positive perceptions toward problem-posing, there were consequences after using problem-posing on the English language learning. The examples of the consequences are shown in Stanza 2.

*Stanza 2 (Subject matter)*

- (Pan) 1 *I think it was good, like if I was interested in it something like this, I was looking for more information because I wanted to know what exactly it caused.*
- (Mon) 2 *Now I looked at it differently after I learned women's rights, I thought we couldn't do anything about women's rights, when I read more there was a law to guard women's rights.*
- (Pan) 3 *For me I think misuse of social networking relate to me because I use it every day.*
- (Mon) 4 *Me too, misuse of social networking I think I have to be careful about sharing things on social network.*

From Stanza 2, after students were introduced to social issues, they voted on a topic that would be used in discussion. The most selected topic was misuse of social networking. They explained the reason why they selected this topic was that they use it every day. They recognized the way it worked and realized the issues about it. As Pan and Mon articulated in the stanza above, they were activated by the topic in that they could see themselves in it. After the class, they got an assignment to find information about the topic around the social issues they chose in group and later present to the class. They had motivation to find more information on the topic to read and understand more. Similar to what researchers and educators claimed, when the learners' backgrounds and interests are taken into account, they often learn better (Freire, 1970; Hall, 1995; Shor, 1992; Wallerstein, 1987; Auerbach, 1992). The clear example of this claim can be seen in Mon's reflection on her learning. Mon and her group chose women's rights as the main topic. She explored some articles and found that there was a law to guard women's rights which she had never known before. As Freire's (1973) model of critical consciousness could position, Mon expressed in a level of semi-transitive thought, it is partially empowered, as she believed in human agency in the making of personal and social change (Shor, 1992).

Even though there was no negative perception towards the problem posing, there were some suggestions from the participants in order to make this method more effective. Examples of the suggestions are shown in Stanza 3, below.

*Stanza 3 Mint (Suggestion)*

(Mint)Line 1a *It's not that I don't like [the method]. I worried about some friends who do not participate in group discussion much.*





successful in learning. The punishment was found in English classrooms, from salient data, which showed that punishment in school could lead to hindrance in the learning process. As shown in Stanza 4,

*Stanza 4 Nut (punishment)*

*Line 1 I studied English since primary school.*

*2 but I was not interested in learning [English] because I had a  
bad memory with an English teacher.*

*3a When I was a first grader, the teacher was using chalk to mark  
on my forehead and got a scar,*

*3b so I did not want to learn English.*

*4a Maybe the teacher thought because I was disobedient, I was  
teasing with my friend during the class.*

*4b I think she was too strict, but at that time, I was just a first  
grader.*

*5 So, it left me a wound in my heart.*

This is unbelievably frustrating to acknowledge a cruel punishment in this early age like what Nut encountered when he was only six or seven years old. There is no evidence that school punishment empowers or grants children's learning in the classroom (Elizabeth, 2017). Nut's situation is called corporal punishment; his teacher was using chalk to mark his forehead and he got a scar. He believed that the reason why he received punishment was because he was teasing with a friend. As Elizabeth (2017) mentioned, it is believed that school punishment maintains appropriate student behavior; children's misbehavior can distract their own learning and their peers'. Indeed, there were no children in any country who act or behave well all the time (Elizabeth, 2017). In Nut's opinion, he thought it was too cruel for him as he was only a first grader at that time, and he thought that the reason that the teacher decided to mark chalk on his forehead was maybe because he was a disobedient pupil. It seems that the consequence from the punishment are that it turned him to dislike not only that teacher but English language and left a permanent scar in his heart.

## **5. Conclusions and Suggestion**

This study was about Thai undergraduate students' reflections toward the problem-posing approach used in the English language classroom. The findings show that the students had positive perceptions toward problem-posing in the English

classroom. It was considered feasible and important to use problem-posing in the English classroom. It promoted a democratic classroom and encouraged students to direct their own learning. Although there were no negative perceptions on this method, the students gave some suggestions for the course development. However, the main purpose of this method is to advocate students to have a critical consciousness. According to the study, students have not yet reached the transformative stage. Only a few of them were considered in the semi-transformative stage, but it is possible for them to develop their critical consciousness if they explore problem-posing more. Moreover, they all have received balanced instruction between problem-posing and language learning by understanding their learning problems, after they explore some articles and pictures, and then reflect on their learnings, which followed Freire's steps: listen, dialogue, action (praxis).

Limitations this study was conducted in only fifteen hours. The limited time for the students to be exposed to the material, to discuss, and to me was too short to elicit a thorough understanding. Second, a smaller classroom seems to be more effective than the larger classrooms because the teacher has to observe during the discussion by walking around to make sure to facilitate students throughout the whole class. It is hoped that the practices and interactions discussed here can encourage thought and action in different contexts and culture, especially in the EFL classroom. In addition, this research was mainly qualitative research as it aimed to elicit data from students comprehensively and to reach in-depth interpretations. Looking back, I could have administered a perception questionnaire to support and strengthen the interview data.

Further studies- the sessions provided for the students should be longer. A lesson plan should be well prepared before the session begins but flexible based upon the class situation. It is best to let students be exposed to various sources of information from many different directions of perspectives towards one particular issue. I believe that when the students are exposed to various sources of information, it will give them some ideas to reflect on the topic and find the path to transform. I believe that problem-posing can liberate Thai students to lead them to having their own an agency, to take control of their learning, and to take control of their lives.

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## Teachers' Perceptions towards Teaching English Vocabulary Techniques at Foreign Language Department, Savannakhet Teacher Training College

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### Abstract

The purpose of this research was to describe two points: firstly, to examine the most perceptions techniques the teachers use in teaching vocabulary at Savannakhet Teacher Training College (STTC). Another purpose is to investigate different groups of teachers' preferences for using particular teaching English vocabulary techniques in the Foreign Language Department. The samples were 40 teachers of English as a convenience sampling for this study. The 35-item questionnaire copies were asked about the frequency and per cent for doing teaching English vocabulary techniques using the questionnaires. Program SPSS version 21 was used to analyse to calculate percentage, mean, standard deviation, independent samples t-test, and one-way ANOVA. The data of the study were gathered using questionnaire. The data were analysed using description statistics in two phase methodology approaches. **Phase1: descriptive statistics** (percentage, mean, standard deviation), and **Phase2: Inferential analysis** (the independent samples t-test analysis and one-way ANOVA).

The results indicated that the study also found that teachers have had the most perception teaching English vocabulary techniques used by teachers of English at (STTC) is 'teaching words from contexts', because the mean is found to be 5.99 (See Table: 4.4.b). On the other hand, 'teaching the form of words' is the least perception teaching English vocabulary techniques used by teachers of English at (STTC), because the mean is found to be 5.50 (See Table: 4.2.b). In addition, the results found that the null hypotheses (H0) are not rejected, and say that there are no differences in teaching English vocabulary techniques relating to teaching the form of words, teaching meaning of words, teaching words from the contexts, and teaching words through games based on teachers' gender, teachers' status, and teachers' years of teaching experience

teachers of English because the observed  $P$  value is greater than alpha level (0.05), ( $P > 0.05$  alpha level).

**Keywords :** Perceptions towards teaching English vocabulary techniques

## 1. Introduction

Vocabulary is deemed as a basic aspect of learning foreign language. According to Satakram (2012:5), vocabulary knowledge is necessary in comprehending language because the number of words that a learner gains is greatly related to competent language use (Siriwan, 2007:8). It is important to point out that research of vocabulary teaching techniques was continual for years in second and foreign language studies. In recent years, vocabulary started to get more importance and focus as expressed by the increase in the number of publications and research related to learning of lexicon in the context of second and foreign language studies. While Grammar was the focal study area for second language research up to the 1980s, vocabulary has been increased enormously (Ahlam, 2016). Furthermore, Nguyen & Khuat (2003) states students usually feel bored in vocabulary lessons because they ignore to change the way how their vocabulary learning style or technique, writing words on paper, trying to learn by heart or learning passively through the teacher explanations. Otherwise, they are applying games in the class it's to help both teachers and learners feeling and effectiveness of games in vocabulary learning. They show the ability, more interesting in the lesson to improve their vocabulary building skills.

## 2. Research Objectives

This research consisted of two objectives:

2.1. To examine the most perceptions techniques the teachers use in teaching vocabulary at STTC.

2.2. To investigate different groups of teachers' preferences for using particular teaching English vocabulary techniques in the Foreign Language Department.

## 3. Research Methodology

### 3.1 Samples

The sample population for this study was composed of 40 teachers of English, who are teaching the English language.

The teachers of English participating in this study are volunteered their data to the researcher. All data were compiled to avoid identifying any particular person in any of the research findings. The researcher contacted the administration of Foreign Language Department to solicit assistance.

In this study, convenience sampling was employed because the researcher could gain access to the Foreign Language Department. where the researcher had built up a trusting relationship with the teachers of English.

### **3.2 Research Instruments**

The method employed to collect data in this study was survey questionnaires. This method helps the researcher investigate the perceptions of the various participants in teachers of English teaching vocabulary techniques. The 35-item questionnaire copies were asked about the frequency and per cent for doing teaching English vocabulary techniques using the questionnaires. Program SPSS version 21 was used to analyse to calculate percentage, mean, standard deviation, independent samples t-test, and one-way ANOVA.

### **3.3 Data Collection**

The data of the study were gathered through using questionnaires for teachers. The purpose is to use questionnaires (Likert rating scale) are to get information about teacher's perception toward teaching English vocabulary techniques and aims to collect information about their attitude, and improve their knowledge in the classroom.

#### **3.3.1. Preparation**

In preparation for designing the questionnaire for this survey study, the researcher studied the content of teaching strategies, vocabulary teaching strategies, and how to construct a questionnaire from many sources: journals, textbooks, other research studies and by consulting with the supervisor. The survey questionnaire was based on Schmitt's taxonomy for vocabulary teaching strategies since it is one of the most comprehensive lists of strategies available and it matched with the researcher's purpose of the study. However, modifications were made in order to suit the perceptive teaching vocabulary techniques.

#### **3.3.2. Questionnaire Construction**

The questionnaire used in this survey study was constructed by the researcher with some adaptations from Schmitt's questionnaire (1997) presented in his taxonomy of vocabulary teaching strategies. The information from this preparation step was used in the process of designing the questionnaire. A pilot study was conducted with 15 teachers of English who are currently teaching English at Foreign



Language Department. The questionnaires in English language was constructed and revised under the guidance of the supervisor.

### **3.3.3. Procedures of Survey Questionnaire Development**

1. The first step was a review of literature about language teaching strategies to overview and familiarize. The questionnaires in English language were used to collect data. There are consisted of 35 items for teachers of English, which were adapted from the vocabulary teaching strategy based on Schmitt's Taxonomy (1997) "teaching the form of words", "teaching meaning of words", "and teaching words from the contexts "and" teaching words through games".

2. The questionnaires were checked by the supervisor and were tested with all teachers in Foreign Language Department.

3. The 35 items for teachers' questionnaires were introduced by the researcher. The respondents were also told that they had to answer in terms of how well the explanations of each item described them. They collected questionnaires were collected right after the respondents finished them.

4. All of the collected respondents' answers with 35 item questionnaires had been distributed and 40 questionnaires were returned; that is, 100% of the respondents' responses. All of the questionnaires were analysed. They were retrieved and were ready for coding.

### **3.4 Data Analysis**

The data were analysed using description statistics in two phase methodology approaches.

#### ***Phase 1: descriptive statistics***

In this first phase of the data analysis, tables of frequencies were employed to present the data. The frequency tables were also used to determine the most important factors regarding teaching English vocabulary techniques; namely, (teaching the form of words, teaching meaning of words, teaching words from the contexts, and teaching words through games), and they were further used in phase 2 of the data analysis.

#### ***Phase 2: Inferential analysis***

In this phase, the independent samples t-test analysis and one-way ANOVA was used to investigate possible differences in vocabulary teaching techniques (teaching the form of words, teaching meaning of words, teaching words from the context, and teaching words through games) between teachers' gender, teachers' years of teaching experience, and teachers' status.

## 4. Research Results

### 4.1. Results from the Descriptive Statistical Analyses

This section presents the data collected in tables of frequencies. Tables were used to present and describe the data collected from the teaching English vocabulary techniques.

#### 4.1.1. Demographic Information

**Table 1** Frequencies of selected characteristics of English teacher respondents to teaching English vocabulary techniques questionnaires

Characteristics	Per cent	Valid per cent
Gender		
Male	47.5	47.5
Female	52.5	52.5
Teachers' Teaching Experiences		
Less than 5 years	15	15
5-10 years	50	50
Over 10 years	35	35
Teachers' Status		
Local teachers	87.5	87.5
International teachers	12.5	12.5
<b>Total</b>		
<b>Percentage</b>	<b>100</b>	<b>100</b>
<b>N</b>	<b>40</b>	
<b>Missing</b>	<b>0</b>	<b>0</b>

Table 1 represents the number of English teacher respondents to teaching English vocabulary techniques questionnaires to a set of demographic items.

Table 1 firstly show almost 52.5% are female teachers, but there just over are 47.5% are male teachers. Secondly, it is interesting to note that 50% of teaching English vocabulary techniques teachers' teaching experience with 5-10 years, but there just over are 35% of teaching English vocabulary techniques teachers' years of teaching experience over 10 years. Just 15% of them are less than 5 years. Finally, almost 87.5% are local teachers of teaching English vocabulary techniques. Just 12.5% are international teachers of (See Table 1).

**Table 2** Summary of responses to ‘Teaching the form of words’ items (Mean and Std. Deviation)

Teaching the form of words items	N	Mean	Std. Deviation	Level of agreement
I show the mouth movements involved in saying the words.	40	3.55	1.26	Agree
I show the body or writing the words.	40	3.48	1.06	Agree
I use letters made of wood, cardboard, paper, and so on, so the students can feel the shapes of the letters that make up the words.	40	3.35	1.25	Agree
I show hand movements that draw the letters of the word in the air.	40	3.13	1.11	Agree
I show wooden or plastic letters that spell the word.	40	3.00	1.06	Agree
I write the words, letter by letter, on the learner's hand.	40	2.88	1.38	Disagree
I use a system of writing like braille.	40	2.60	1.15	Disagree
<b>Total:</b>	<b>40</b>	<b>5.50</b>		

As shown in Table 2, there are seven strategies items on teaching the form of words in which vary degrees of mean, standard deviation. The teaching the form of words by teacher of English with level of some agreement used strategies items were “Agree” “I show the mouth movements involved in saying the words.” (M =3.55, S.D. = 1.26), followed by “I show the body or writing the words” (M =3.48, S.D.=1.06), and “I show wooden or plastic letters that spell the word” (M =3.00, S.D. = 1.06), respectively. On the other hand, the two frequently used strategies items were “Disagree agree” I write the words, letter by letter, on the learner's hand” (M =2.88, S.D. = 1.38), and “I use a system of writing like braille” (M =2.60, S.D. = 1.15), respectively (See Table 2).



## 5. Discussion

The findings from quantitative analysis are discussed in hypothesis-by-hypothesis order.

### 5.1. Hypothesis One

The hypothesis one ( $H_{01}$ ) stated that ‘there is no statistically significant difference in relating to teaching the form of words between male and female teachers based on teachers’ gender’.

The findings of the study supported this hypothesis. As shown by the summary of group in Table 4.6, teaching English vocabulary techniques relating to teaching the form of words was found that the mean relating to teaching the form of words of males is 0.56; the standard deviation is the sample of 19 male teachers is 0.605, and the standard error of the mean (given the same size of 19) is 0.139 units. In contrast, the mean teaching English vocabulary techniques relating to teaching the form of words of female teachers is 0.9, the standard deviation in the sample of 21 female teachers is 0.731, and the standard error of mean (given the same size of 21) is 0.159 units (See Table 3).

There is no statistically significant difference in teaching English vocabulary techniques relating to teaching the form of words between male and female teachers based on gender; this was further confirmed by the results of independent samples t-test analysis shown in Table 3, it’s relating to teaching the form of words analysis.

This finding is similar to the earlier finding shows that teaching English vocabulary techniques relating to teaching the form of words was employed by both male and female teachers as teaching English vocabulary techniques that are appropriate classroom activities that interest the students and help them to understand vocabulary in the minds of the students” (Bancroft, 2003; & Nation, 1990, p.67). Therefore, the result was conformity with the researchers; namely, Rosenthal & Ehri (2008) who showed a study of the teaching English vocabulary techniques using the form of words students’ memory for pronunciation; spelling improves dimension an experimental study to determine, and knowledge of new vocabulary. They found that using form of words help students to remember meanings of new vocabulary words when they meet the written forms of the words during instruction.

Consequently, students in STTC have learnt vocabulary by teaching form of the words to help them understand the meaning of the new vocabulary.

## 5.2. Hypothesis Two

The hypothesis two (H<sub>02</sub>) stated that ‘there is no statistically significant difference in teaching English vocabulary techniques relating to meaning of words between male and female teacher’s based on gender’.

The findings of the study supported this hypothesis. As shown by the Summary of group in Table 4.8, teaching English vocabulary techniques relating to teaching meaning of words was found that the mean relating to teaching the meaning of words of males is 0.44; the standard deviation is the sample of 19 male teachers is 0.484, and the standard error of the mean (given the same size of 19) is 0.111 units. In contrast, the mean relating to teaching the meaning of words of female teachers is 0.8, the standard deviation in the sample of 21 female teachers is 0.739, and the standard error of mean (given the same size of 21) is 0.161 units

There is no statistically significant difference in teaching English vocabulary techniques relating to teaching meaning of words between male and female teachers based on gender; this was further confirmed by the results of independent samples t-test analysis shown in Table 4.9 to the teaching English vocabulary techniques relating to teaching meaning of words analysis. This finding is similar to the earlier finding of (LuuTrong Tuan, 2012) Phillips (1993) states that the techniques in teaching meaning of words between male and female teachers of English has no statistically significant difference in relating to teaching meaning of words between male and female teachers based on gender because learners learn words from teaching new words. Therefore, the techniques in teaching meaning of words are so important for learners learn words. For instance, Nash & Snowling (2006) conducted a study of the efficacy of two forms of vocabulary intervention using definition method with participants with poor vocabulary knowledge. They found that using definition method help students to understand greater knowledge of the taught vocabulary directly after instruction. Therefore, one of the goals of vocabulary instruction is to help students learn the meanings of many words by using definition method so they can communicate effectively and achieve academically.

## 6. Conclusion

The findings from Tables of frequency imply that the most perceptions teaching English vocabulary techniques used by teachers of English at STTC is ‘teaching words from the contexts’ is the one of the most techniques that teachers used in the Foreign Language Department at STTC because the mean is found to be 5.99 Whereas,

'teaching the form of words' is the least perceptions teaching English vocabulary techniques used by teachers of English at STTC because the mean is found to be 5.50. From the data collected of group statistics and independent samples t-test. Tables were used to present and describe the data collected from the teachers teaching English vocabulary techniques relating to teaching the form of words, relating to teaching meaning of words, relating to teaching words from the contexts, and relating to teaching words through games.

Therefore, the very common application of this test is the comparison of male and female teachers of English on particular variable. The independent samples t-test was used to test whether there is difference between the mean of one group (male) and the mean of the other (female), and the mean of one group (local teachers) and the mean of the other (international teachers) teachers of English.

The results were found to be that the null hypotheses ( $H_0$ ) are not rejected, and says that there are no difference in teaching English vocabulary techniques relating to teaching the form of words, teaching meaning of words, teaching words from the contexts, and teaching words through games based on teachers' gender, teachers' status, and teachers' years of teaching experience teachers of English because the observed  $P$  value is greater than alpha level (0.05), ( $P > 0.05$  alpha level).

## **7. Recommendations Regarding to Teachers of English**

Overall, it is recommended that it is crucial for teachers to consider learners' background in learning English level, learners' knowledge, and ability to learn English. Along with this, it is also suggested that English teachers be more encouraged and motivated to further their studies focusing on effective various techniques in teaching English vocabulary. Having done this, it does help the teachers to broaden their content knowledge of English which make them be more capable of imparting the knowledge to the students with greater success.

Additionally, Teachers are suggested that they could think over in manipulating other new ways of teaching the form of words, teaching meaning of words, teaching words from the contexts, and teaching words through games by recycling and revising the former learnt vocabulary items in the real-life contexts suitable for the Lao students systematically at the final stage of each lesson, not just only following techniques.

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## Development of Multi – Cultural Curriculum for Primary School in Yala Province

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### Abstract

This dissertation is aimed at 1) developing a multi-cultural curriculum for Primary Schools in Yala Province 2) finding out the efficiency of the multi-cultural curriculum for primary schools in Yala Province. The methods of conducting the dissertation are as follows; Phase 1 consists of the development of a multi-cultural curriculum for primary schools in Yala Province starting with the study and analysis in order to develop the curriculum, the structure of the curriculum and how to apply the curriculum. The sample of the structure curriculum development consists of 9 experts in curriculum and teaching, in multi-cultural and in assessment and evaluation by purposive sampling. The tool used in the study includes the draft of the multi-cultural curriculum. The statistics are used to analyze the data as an average and standard deviation. Phase 2, is the study of the performance of the multi-cultural curriculum for primary schools in Yala Province. The sample consisted of 15 grade-5 students in Thairatwitta94 (Banbonumron) Betong District in Yala Province by purposive sampling. The tools used in the study are pre-test and post-test tests, satisfaction assessment form for teaching and learning management assessment of students' life skills for teaching and learning management, and interview form for participants in curriculum development. The statistics are used to analyze the data as an average standard deviation and t-tests.

The results of the study were 1) the development of the multi-cultural curriculum structured for primary schools in Yala Province. The multi-cultural curriculum development consists of Concepts Principles of curriculum, Instructional Objectives, and learning outcome. Course description Structure of curriculum and 4 learning units. There

are Unit1: Colorful Flowers Unit2: Companion from Saiburi Unit3: Beautiful tradition Unit4: Way of culture which takes 40 hours to study. 2) The result of the performance study of the multi-cultural curriculum for primary schools in Yala Province by using the curriculum revealed that learning achievement is higher than before learning with a statistically significant level of 0.5. The students are satisfied with the multi-cultural curriculum as a whole at the highest level. The students had high scores by following the teaching of students' life skills for teaching and learning management.

**Keywords :** curriculum, multi-cultural, primary school, Yala Province

## 1. Introduction

Thai society is considered a multi-cultural society. This diversity covers ethnicity, language, live styles, ways of life, religion and beliefs, especially in view of cultural differences. This is caused by the area being near the border of Thailand. With areas adjacent to neighboring countries such as in provinces in the upper north the population will consist of Thai Lanna people and Thai hill tribes. In the eastern region, some provinces such as Sisaket, Buriram, Surin, have in some sub-districts tribes with Khmer descent and traditions, living with Thai people in the northeast. In the western region which borders Myanmar such as Kanchanaburi, Ratchaburi, Phetchaburi provinces, people of Burmese, Mon, Karen and Lao descent live with Thai people and Thai people of Chinese descent. This diversity results in a proportion of groups of students of different ethnicity studying with Thai students of different races, languages, religions, traditions, and way of life. All these factors affect the educational institutions and teachers to get a greater workload and additional obstacles in teaching management.

Because of this situation and the importance of it, the researcher considered to develop a multi-cultural curriculum for primary school students in Yala Province focused on two main objectives. The first is the unrest in the three southern border provinces, including 4 districts of Songkhla province. The government has therefore tried to solve the problem systematically, quickly and efficiently, and announced three southern border provinces and 4 districts of Songkhla province as a special area by using the policy to create peace and introduce policies to understand, access and develop to be the norm in conflict management, in order to create love, unity, reconciliation and public peace. The second, most schools are still teaching by adhering to the core curriculum that was sent from the Ministry of Education. It does not meet

the needs and diversity of people in society and of students, who have a multi-cultural background. Therefore the need for the development of a multi-cultural curriculum with content that is consistent with local life and culture. It includes the history and local beliefs with activities for primary school relating to the multi-cultural society particular to the three southern border provinces and 4 districts of Songkhla province (Chana District, Thepha District, Nathawi District, and Sabayoi District). The students in primary level in this special area will be educated and taught on how to create peace, harmony, and life skills so that they can live well-adjusted and confidently in a multi-cultural society. The multi-cultural curriculum based on local culture responds to the students' needs and uses learning methods that are equally diverse leading to reconciliation, peace and national security.

## 2. Research objectives

Research objectives were:

1. To develop a multi-cultural curriculum for Primary Schools in Yala Province
2. To find out the effect of the multi-cultural curriculum for primary schools in Yala Province.

## 3. Research Methodology

The method of the research

In terms of the development of the multicultural curriculum for primary students in Yala province, the project has 4 stages of research. It is developed in four ways as follows.

**Stage 1:** Study basic information, divided into 4 steps:

Step1: Study basic information in order to select schools for the research  
Step2: Study and analyze the documents, theories, concepts, relevant research results, problems and suggestions from teaching, using the core curriculum

Step3: Explore the needs and hopes of learners, teachers, administrators and other involved parties in the community.

Step4: Exploring the content of the curriculum by lecturers in the community who are associated with schools in a group discussion. After getting focused content and all data, the researcher prepares the multi-cultural curriculum and defines the structure of it.

**Stages 2:** Development of the curriculum draft

The researcher used all the data from the study to prepare the multi-cultural curriculum for primary school students in Yala province which consisted of 1) concepts, principles of the curriculum, 2) objectives of the curriculum, 3) curriculum content, 4) organizing learning activities 5) Instructional media/teaching aids 6) assessment and evaluation and 4 learning units for 40 hours as follows; Unit1: Colorful Flowers (5 hours) Unit2: Companion from Saiburi (5 hours) Unit3: Beautiful tradition (15 hours) Unit4: Way of culture (15 hours).

**Stage 3:** Assessment of the draft of the multi-cultural curriculum by 9 experts, consisting of the experts in curriculum and teaching, 3 students, 3 experts of multi-cultural learners for primary school and the expert of assessment and evaluation. The result of the assessment of the multi-cultural curriculum suitability appeared at the highest level. The average is 4.64 and the draft of multi-cultural curriculum is consistent and consistency index is 0.86 respectively.

**Stage 4:** Assessment of curriculum performance by conducting a trial. The researchers conducted as follow;

#### **Trying out the curriculum**

The sample was acquired by purposive sampling, from the students in the fifth grade from Thairath Witthaya 94 School (Banbonumron), Betong District, Yala Province, 15 people in total proceeded as follows

1. The researcher prepares the teachers to understand the curriculum manual and all details as lesson planning and participated in the planning to try out the multi-cultural curriculum for primary school students in Yala Province

2. Implementation of the multi-cultural curriculum that was prepared for 15 students the fifth grade in Thairath School (Banbonumron) and studied for 40 hours. The research instrument consisted of 1) Multi-cultural curriculum for primary school students in Yala province, 2) Pre-test and post-test test, 3) Student satisfaction assessment form for teaching and learning management, and 4) Life skills assessment form

#### **4. Results**

The results of the study after using the multi-cultural curriculum for primary school students in Yala province are classified by the following points:

- 4.1 Assessment by students using the multi-cultural curriculum for primary school students in Yala Province

**Table 1** Comparison of results before and after study with a multi-cultural curriculum for primary school students in Yala Province

Multi-cultural curriculum	Pre-test		Post-test		Improvement
	Score (30)	Percentage	Score (30)	Percentage	
Experimental group 15 people	14.13	47.11	21.80	72.67	8

Table 1 the results of the study showed that students before studying the multi-cultural curriculum for primary school students in Yala province had an average score of 14.13 points, representing 47.11 percent of the full score and afterwards having an average score of 21.80 points, representing a percentage. 72.67 of the full score, with the development revealed 8 points increasing. It can be concluded that the primary school students in Yala province have higher scores after studying with the multi-cultural curriculum than before learning. In order to confirm the hypothesis, the researcher has tested the hypothesis using the t-test Dependent method as follows.

**Table 2** The result of hypothesis testing of learners studying the multi-cultural curriculum for primary school students in Yala Province

t-test Dependence of the multi-cultural curriculum				
Experimental group	n	$\bar{x}$	S.D.	t
Pre-test	15	14.13	2.47	15.53
Post-test	15	21.80	1.82	

\*P< .05

From Table 2, the results of the study showed that the average score of the multicultural curriculum assessment of the students after learning was higher than the average score of the students before studying at the significant level of .05.

## 2. Assessment of student satisfaction towards teaching and learning management

The result of the satisfaction assessment of primary school students in Yala Province who studied by using the multi-cultural curriculum. The overall picture is



in accordance with the concepts of Sleeter and Grant (2003). Education management in the five general approaches is 1) Teaching the exceptional and culturally different students 2) The Human Relations Approach 3) The Single-Group student Curriculum 4) The Multicultural education Approach 5) The Multicultural and social deconstructionists Approach

The results of the assessment of student satisfaction towards multi-cultural teaching and learning management, the overall rating, the satisfaction is at the highest level. With a mean of 4.55 and standard deviation equals to 0.17. The most satisfactory evaluation was the content with an average value of 4.69 because in this multi-cultural curriculum development, the focus was on the various groups. To participate in the preparation of the curriculum as well by looking at yourself what contents you want students to learn therefore a curriculum has a wider scope. In accordance with the concept of Bank j. (1994, referred to in Thitima Dee Phatthananon. 2008) said that the contribution Approach is to add roles, events, experiences of various races by providing content that represents the role of representatives of learners in society, such as referring to famous people in history, the important days of groups with different cultures from large groups

The results of life skills assessment after teaching and learning with the multi-cultural curriculum. The overall picture is at the highest level with an average of 3.27 and a standard deviation of 0.15. The point that the learners have the most life skills is the fourth aspect in creating good relationships with others with an average of 3.50 and a standard deviation of 0.01. This is because the multi-cultural curriculum developed by the researcher is due to participation. The content and activities in teaching and learning are aimed at creating a good relationship with each other.

## 6. Conclusion

This research concluded that the multi-cultural curriculum had developed the primary school students in Yala province, with the results of the study found that students have higher post-graduate assessments with an average score of 21.80, equivalent to 72.67 percent which was higher than before learning with statistical significance at .05. The results of the satisfaction assessment on the curriculum showed that the students were satisfied. The overall picture is at the highest level, with an average ( $\bar{x}$ ) 4.55 and standard deviation (S.D.) 0.17 and the results of life skills assessment of the learners after studying the multicultural curriculum found that the

learners have life skills. The overall picture is at the highest level with an average ( $\bar{x}$ ) 3.27 and standard deviation (S.D.) 0.15

## 7. Suggestions

### 7.1 Suggestions for applying research results

In order to be able to apply the multi-cultural curriculum for primary school students in Yala province to use effectively, the researcher has some suggestions on how to apply the curriculum as follows:

7.1.1 Teachers should carefully study the contents and stories in each unit of the multi-cultural learning handbook as well as learn more information from other sources.

7.1.2 In organizing learning activities, the time may not be as planned. The instructors should be flexible about the time to fit the learning activities.

7.1.3 Some activities such as studying various resources, spending time on holidays or presentations can be done outside school or during free time on the school schedule.

### 7.2 Suggestions for the further research

The researcher has suggestions for the further research for those who are interested in continuing to develop the following courses or curriculums

7.2.1 There should be development of executive training courses on multi-cultural curriculum development. In order for executives to realize and see the importance of participation in curriculum development as well as being able to be a leader in academics and management in developing a multi-cultural curriculum effectively.

7.2.2 There should be done a research study about the impact of education management by using the multi-cultural curriculum in order to see the effect to communities, schools, administrators, teachers and other stakeholders that are in the desired direction or not.

7.2.3 The teachers should be encouraged to develop more knowledge and skills in using the research process to achieve the goal. The teachers can use the research results to improve their teaching and managing to be more effective.





## A Comparison of Scripted and Unscripted Role Play Techniques on Lao EFL College Students' Speaking Ability

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### Abstract

The purposes of this research were 1) to compare Lao EFL college students' English speaking ability before and after being taught by using scripted role play technique, 2) to compare Lao EFL college students' English speaking ability before and after being taught by using unscripted role play technique, and 3) to compare the speaking ability of Lao EFL college students taught by using scripted and unscripted techniques. The samples were two classes of third year English major students who studied English for Specific Purpose II in the second semester of academic year 2017 at Savannakhet Teacher Training College, Lao PDR. The former class with 20 students was assigned to be taught by scripted role play while the latter class with 20 students was assigned to be taught by unscripted role play. They were selected by using simple random sampling technique using the classrooms as a sampling unit. The instruments were lesson plans of 24 hours, pre-test and post-test of speaking performance. The obtained data were analyzed by using mean, standard deviation and t-test. The findings revealed that the learning achievement using both scripted and unscripted role play techniques of students' post-test mean score was higher than pre-test mean score with statistically significant difference at .01 level. In addition, the students' mean score using unscripted role play technique was higher than those mean score using scripted role play technique with statistically significant difference at .05 level.

**Key words** : Scripted role play, unscripted role play, speaking ability, Lao EFL students

## The Current States of Teachers' Doing Classroom Action Research at Savannakhet Teacher Training College, Lao People Democratic Republic

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### Abstract

This study aimed: 1) to survey the current states of Classroom Action Research (CAR) of teachers at Savannakhet Teacher Training College (STTC) in Lao People's Democratic Republic (Lao PDR), and 2) to develop teachers' knowledge, understanding, and ability to do CAR at STTC in Lao PDR. The samples of this study were from two groups: 153 teachers for quantitative data, and 4 administrators and 7 key trainers of CAR for qualitative data. The research instruments were a survey questionnaire and structured interview. The quantitative data were analyzed by mean and standard deviation while the qualitative data were analyzed by descriptive analysis. This findings revealed that there were three dimensional factors affecting to the capacity doing CAR of teachers at STTC, namely teachers' CAR knowledge, CAR process promotion, and CAR importance giving and its curriculum. In addition, the solution from the administrators and key trainers for CAR was to develop the coaching and mentoring system for the teachers to do classroom action research.

**Keywords :** Development, Coaching and Mentoring System, Classroom Action Research, STTC Teachers

### 1. Introduction

In the regime of globalization, each country has very high competition in every aspect, for example, socio-economy and culture to grow with rapid changing sciences. The most essential factor to bring a country civilization is to develop human resource effectively and capable to meet social needs and Lao government strategies. The major

objective of Lao Socio-Economic Development Plan 2001-2020 is to have Lao PDR out of the least developed country list (Central Party, 1996). Therefore, the Ministry of Education and Sports has established Strategic Educational Plan by assigning reforming equivalent Quality of Education to the region and internationals to produce Qualified Education under the Vision of MoEs: Being a good citizen, nation loyalty, science vision, having knowledge and skills, having moral and ethics, respect regulation, respect discipline, hardworking, being healthy, and life-long learning (Normal Education Department, 2007, p. 37).

Savannakhet Teacher Training College (STTC) is an educational center in the middle part of Lao PDR for the development of Qualified Human Resource by promoting teachers doing research and meet the government policy which can join the ASEAN countries and internationals, preserve and promote elegant culture, to promote human resource moral and ethical, deep knowledge and capabilities under 5 Pillar Principles of Education (Savannakhet Teacher Training College, 2014, pp. 156).

Research is essential fundamental tool to create knowledge domain and development new technology to develop education, economy, society, politic and security of the country. It is also a process and techniques to overcome problems of a man by studying progressive method continuously. Another significance of a research is to improve quality and standards of the practice effectively and efficiently to real life (MoEs. 2010).

The Ministry of Education and Sports of Lao PDR (2002, p 36) has assigned on Lao Education Law in 2005 (Revised Version) that a teacher in both normal and professional institutes (teachers in both colleges and universities) have to do a research in each academic year. The government of Lao PDR also believes that doing research can build up new knowledge and can be a part of education development. Besides, research is very important to develop the whole country in general.

The Educational Development Plan 2015 (MoEs. TTD. 2015, p 89) has established the teacher standard for doing research in four aspects: 1) a teacher should have knowledge and understanding of definition and its importance of research, 2) a teacher should apply those knowledge and understanding to improve learning and teaching effectively and efficiently, 3) a teacher can do and give a hand to other colleagues or novice (new) teachers to do research to overcome their problems, and 4) a senior (experience) teacher must coach and mentor young teachers or even colleagues to do research or develop innovations and new teaching techniques to produce quality of learning.

However, in previous years, Teacher Training College is a famous and old educational institute in Lao PDR which made a survey of teachers who have done research and found that most TTC teachers had done few research. Over 70% of the TTC teachers did not bring new methods and teaching materials to utilize and overcome to their real teaching, but mentioned only deep content of the lesson matters to finish the National Curriculum on time in each year. The reasons why those teachers had not brought or had not created new innovations because they thought doing a research was a way of difficult thing, low knowledge and abilities of doing research, lack of research doing experience, no time to do research, and lack of management promotion. As a result, the quality of learning and teaching management at TTC learners had shortages of effective working systems, creative thinking skills, unsatisfied learning outcomes (STTC, 2017, pp. 36-39).

Towards the current status and the problem stated, the researcher is an education management and plays a very important role to STTC educational management in Lao DPR, has aware of its importance of Classroom Action Research (CAR). It is believed that classroom action research is a way to bring new method and develop attractive activities to learning and teaching of a teacher. Therefore, teachers, guardians, and communities should pay attention to the abilities of teacher's research at STTC by assigning principles of classroom action research to be a way for development concept, take the research result to improve, overcome and develop qualities of learners effectively and efficiently according to meet educational curriculum objectives.

## **2. Research Objectives**

2.1 To survey the current states of doing classroom action research of teachers at Savannakhet Teacher Training College in Lao PDR.

2.2 To find out knowledge, understanding, and ability to do classroom action research of teachers at Savannakhet Teacher Training College in Lao PDR.

## **3. Research Methodology**

### **3.1 Population and Samples**

The population of this study included 211 administrators, key trainers for CAR and teachers from four offices including 1) Natural Science Office, 2) Social Science Office, 3) Foreign Language Office, and 4) Primary Teacher Training Office at Savannakhet Teacher Training College, Lao PDR in the second semester of academic year 2018.

The samples were from two groups. The former group consisted of 153 teachers for quantitative data were selected through the table of Krejcie and Morgan, stratified random sampling, and simple random sampling, respectively. The latter group comprised 4 administrators and 7 key trainers for CAR for qualitative data. They were selected by purposive sampling technique.

### **3.2 Research Instruments**

The research instruments used in this study were the questionnaire and structured interview. The details of each instrument were as follows:

3.2.1 The questionnaire included three parts: checklist, a 5-rating scale and open-ended form. Part 1 was about demographic information of the samples namely, sex, offices, and experiences in doing CAR. Part two was about opinions toward the current status, statement of the problem, and needs for development of teachers on CAR. Part three was in the form of open-ended questions concerning doing CAR. The questionnaire was written in Lao language in order to minimize problems of ambiguity and misinterpretation. To ensure the validity of the questionnaire, the draft questionnaire version constructed by the researchers were modified and revised based on the suggestions of five experts. After that, a pilot study was to test the effectiveness of the questionnaire and to improve language correctness and appropriateness of the questionnaire. The 30 samples of the pilot study were requested to fill out the questionnaire, to comment on the content and wording, and to give suggestions on items that should be added or excluded. Finally, the final draft of the questionnaire was revised before administrating with the target group. In terms of the reliability of the questionnaire, alpha coefficient of Cronbach was calculated. The result revealed that the alpha reliability coefficient of the questionnaire was 0.89. Therefore, it could be justifiable to claim that this instrument had both validity and reliability.

3.2.2 The structured interview was used to obtain the in-depth information about problems on doing CAR, ways to solve those problems, knowledge, understanding, and ability to do CAR of teachers at Savannakhet Teacher Training College in Lao PDR. The three interview questions written in Lao language were gradually formulated and submitted to the five experts to check for the correctness and appropriateness. Finally, the researcher revised and edited the interview questions to be part of the interview.

### **3.3 Data Collection**

#### **3.3.1 Questionnaire**

To obtain the quantitative data, 153 teachers were asked to fill out the questionnaire. They were allowed to ask the researcher about technical questions or

unclear information in the questionnaire during the survey. Also, a consent form for taking a questionnaire was distributed to all the samples. Only the teachers who agreed to participate in the study signed the form. The research data provided were kept in confidential.

### 3.3.2 Structured Interview

The final version of structured interview guide was administered to 4 administrators and 4 key trainers for CAR at STTC in Lao PDR. The Lao version was used to interview the administrators and key trainers for CAR. Each of the 11 interviewees was interviewed for approximately 5 minutes. Each interview was audio-taped to ensure that all the information is recorded and can be reviewed afterwards. After the interviews had been completed, the audiotapes were transcribed.

## 3.4 Data Analysis

### 3.4.1 Questionnaire

After checking the completion of each questionnaire, the data gathered from the questionnaires were statistically analyzed by using Statistic Package for Social Science (SPSS) mainly focusing on the descriptive statistics analysis i.e. alpha coefficient, frequency, percentage, mean, and standard deviation. The statistical devices employed in this study were as follows:

3.4.1.1 Alpha coefficient of Cronbach was used to calculate the reliability of questionnaire.

3.4.1.2 Frequency (f) and percentage (%) were used to calculate the data of the personal information of the samples.

3.4.1.3 Mean ( $\bar{x}$ ) and standard deviation (S.D) were used to investigate the current status, statement of the problem and self-development needs for CAR of teachers at STTC in Lao PDR. The following criteria were employed for interpretation adapted by Srisa-ard (2002) as shown in table 1 below.

**Table 1** Criteria for Scoring of Questionnaire

Scores	Score Range	Interpretation
1	4.50-5.00	The most difficult
2	3.50-4.49	Very Difficult
3	2.50-3.49	Average Difficult
4	1.50-2.49	Little difficult
5	1.00-1.49	Least Difficult

3.4.1.4 Descriptive analysis technique was used to analyze the data from the open-ended form.

### 3.4.2 Structured Interview

The data obtained about problems on doing CAR, ways to solve those problems, knowledge, understanding, and ability to do CAR of teachers at Savannakhet Teacher Training College in Lao PDR from the structured interview were analyzed by descriptive analysis technique.

## 4. Research Results

### 4.1 The current states for doing classroom action research of teachers at Savannakhet Teacher Training College in Lao PDR

The current states of doing classroom action research of teachers at Savannakhet Teacher Training College in Lao PDR can be classified into 3 factors: teachers' CAR knowledge, CAR process promotion, and CAR importance giving and its curriculum. The results of those current states were illustrated in Table 2-4 below.

**Table 2** Teachers' knowledge on classroom action research at Savannakhet Teacher Training College in Lao PDR (n=153)

Teachers' CAR knowledge	$\bar{X}$	S.D.	Interpretation
1. Assigning the problem	3.78	0.78	Very Difficult
2. Entitle	3.80	0.78	Very Difficult
3. Setting up the objectives	3.78	0.76	Very Difficult
4. Setting up hypothesis	3.75	0.74	Very Difficult
5. Scoping	3.74	0.74	Very Difficult
6. Definition of terms	3.69	0.81	Very Difficult
7. Reviewing literatures	3.92	0.87	Very Difficult
8. Assigning research tools	3.88	0.90	Very Difficult
9. Assigning data collection	3.91	0.93	Very Difficult
10. Using statistics for analysis	4.01	0.89	Very Difficult
11. Writing results	3.99	0.86	Very Difficult
12. Writing discussion	3.99	0.83	Very Difficult
13. Writing report	3.73	0.73	Very Difficult
14. Using reference	3.69	0.84	Very Difficult
<b>Total</b>	<b>3.84</b>	<b>0.82</b>	<b>Very Difficult</b>



As shown in Table 2, teachers' knowledge on doing classroom action research at Savannakhet Teacher Training College in Lao PDR in overall was at "very difficult" ( $\bar{X} = 3.84$ , S.D. = 0.82). When considering each item, it was found that the highest mean score was no. 10 "Using statistics for analysis" ( $\bar{x} = 4.01$ , S.D. = 0.89), followed by no. 12 "Writing discussion" ( $\bar{X} = 3.99$ , S.D. = 0.83), and no. 11 "Writing results" ( $\bar{X} = 3.70$ , S.D. = 0.89), respectively. In contrast, the lowest mean score was no. 14 "Writing reference" ( $\bar{X} = 3.69$ , S.D. = 0.84) and no.6 "Definition of terms" ( $\bar{X} = 3.69$ , S.D. = 0.81).

**Table 3** Teachers' CAR process promotion at Savannakhet Teacher Training College in Lao PDR (n=153)

CAR Process Promotion	$\bar{X}$	S.D.	Interpretation
1. STTC's policy on CAR	3.73	0.92	Very Difficult
2. STTC assigning unit for CAR	3.69	0.87	Very Difficult
3. STTC assigning personnel for CAR	3.64	0.81	Very Difficult
4. STTC supporting CAR	3.80	1.02	Very Difficult
5. STTC providing stage for CAR	3.85	0.98	Very Difficult
6. STTC allocating the budget for CAR	4.00	0.92	Very Difficult
<b>Total</b>	<b>3.79</b>	<b>0.92</b>	<b>Very Difficult</b>

As shown in Table 3, the result showed that the teachers' CAR process promotion at Savannakhet Teacher Training College in Lao PDR in overall was at "very difficult" ( $\bar{X} = 3.79$ , S.D. = 0.92). When considering each item, it was found that the highest mean score was no. 6 "STTC allocating the budget for CAR" ( $\bar{X} = 4.00$ , S.D. = 0.92) while the lowest mean score was no. 3 "STTC assigning personnel for CAR" ( $\bar{X} = 3.64$ , S.D. = 0.81).

**Table 4** Teachers' CAR importance giving and its curriculum at Savannakhet Teacher Training College in Lao PDR (n=153)

Importance Giving and CAR Curriculum	$\bar{X}$	S.D.	Interpretation
1. STTC giving the importance of CAR	4.05	0.98	Very Difficult
2. Curriculum of CAR	3.97	0.90	Very Difficult
3. Content of CAR	3.88	0.83	Very Difficult
4. Training having continuously and for all	3.80	0.94	Very Difficult
5. Completion of CAR	3.75	0.87	Very Difficult
<b>Total</b>	<b>3.89</b>	<b>0.90</b>	<b>Very Difficult</b>

As shown in Table 4, the result showed that the teachers' CAR importance giving and its curriculum at Savannakhet Teacher Training College in Lao PDR in overall was at "very difficult" ( $\bar{X} = 3.89$ , S.D. = 0.90). When considering each item, it was found that the highest mean score was no. 1 "STTC giving the importance of CAR" ( $\bar{X} = 4.05$ , S.D. = 0.98) while the lowest mean score was no. 5 "Completion of CAR" ( $\bar{X} = 3.75$ , S.D. = 0.87).

In conclusion, the survey showed that the 3 dimensional factors affecting to the capacity of teachers doing CAR. Firstly, the statistical analysis, result and discussion writing, and data collecting were the factors which had an impact on the teachers' knowledge. Secondly, the budget, the stage of CAR Report, management support, and the policy factors were regarding the process promotion of CAR. Thirdly, the STTC giving importance, curriculum, content, and training were factors of the CAR promotion.

#### **4.2 Knowledge, understanding, and ability to do classroom action research of teachers at Savannakhet Teacher Training College in Lao PDR**

To find out knowledge, understanding and solution or overcome the existing problems of CAR for teachers at Savannekht Teacher Training College, the administrators and the key trainers for CAR were asked to have the interview under the three main specific questions as follows:

4.2.1 What is the current situation of learning-teaching at Savannakhet Teacher Training College?

The administrators said that the learning-teaching and doing classroom action research is the starter between the teachers and the students. However, doing

classroom action research of teachers was not the heart of research process under the vision of the college.

The key trainers for CAR mentioned that the learning-teaching at STTC was like lecturing and giving assignments to students to make a report to the class without synthesizing the elements or making critical thinking. In brief, learning and teaching was rote learning. The classroom action research of teachers at STTC was only a few and the quality of the research seemed to be unreliable. The groups of teachers who made a classroom action research were mainly two groups, namely English Office and Natural Science Office out of the 10 offices in STTC.

#### 4.2.2 What is the statement of the problem of classroom action research?

All administrators gave similar comments on the problems of classroom action research that the content of CAR was not unique, out of date source. The teachers used their own experience to fulfill the content of CAR for the students. The workload of the teachers would be another obstacle that made the teachers ignore doing it.

The key trainers for CAR stated that most of the teachers had lack of knowledge and skills of doing the classroom action research, so it had brought many of them were afraid of doing it. Some of the main problems were assigning the research problem, setting up the objectives, and the statistics.

#### 4.2.3 The solution to promote and develop the classroom action research for STTC teachers

The administrators provided the comments to overcome the problem of teachers doing classroom action research as the following points:

- 1) The Teacher Training College Council should formulate the textbook of classroom action research uniquely for all teachers among the 8 Teacher Training Colleges. The teachers should seek the new method or innovation to develop their learners' learning well.

- 2) The teachers should increase extra time for the students to practice more about doing classroom action research. The Teacher Training College Council should have a standard or believable model of classroom action research for the teachers and the students.

- 3) The Teacher Training College Council should increase the capacity of teachers on classroom action research frequently in every year. The teachers should do classroom action research to find the answers to their own problems. It also sharpened their own skills.

4) The Teacher Training College Council should lead the students do classroom action research to solve several problems of learning-teaching to make doing research competitive and cheerful. The most important thing, STTC should assign clear plan to make the teachers and the students get involved in the work of classroom action research in all levels according to their abilities to meet our vision.

The key trainers gave the comments to those problems that STTC should hold the statistical training regarding to the statistics, especially SPSS, provide the sufficient budget, and locate the professional experts on CAR.

## 5. Discussion

The following points based on the research results were discussed:

5.1 The research had been conducted in line with the samples' current states, the statement of the problem and needs, so their answers were analyzed their factors affecting to their classroom action research doing. The problems of the teachers' knowledge were based on statistics for analysis, result and discussion writing, and the data collecting. This is identical to the process proposed by the scholars who said that the current status of most teachers doing classroom action research come from the limited knowledge, and they have the idea of doing classroom research a difficult thing (Phounlabthavy & Saenpathepthing, 2002)

5.2 Secondly, the budget, stage of CAR Report, the management support, and the policy were the factors regarding the process promotion of STTC to CAR. It is in the line with Lao National Educational Plan 2015-2020 (TTD, 2015, p. 89) that pointed out that all the Teacher Training Colleges ensure that all new graduates could perform CAR and the Teacher Training Colleges must monitor and coach them effectively and regularly.

5.3 Thirdly, the STTC giving importance, the curriculum, the content, and the training of the teachers were the factors of the CAR promotion. This is identical to the process proposed by the scholars who developed the classroom action research curriculum to improve the teachers' knowledge and understanding, and could perform the CAR effectively (Sitthisomboun, 2006).

5.4 The solution to the problems for teachers doing classroom action research at the STTC in Lao PDR as the administrators and the key trainers for CAR was in terms of providing creating system of productive training to input the knowledge to the teachers, monitor them, and coach them until they reach the last destination. According to the following scholars, the best way to overcome the problems of STTC teachers is

to develop the coaching and mentoring system for teachers to do classroom research at Savannakhet Teacher Training College in Lao PDR. Marlene and McHenry (2002, pp. 2-5) mentioned that mentoring is the act of a person who has the specific knowledge and skill accepted by others or is a management in a unit to give consult and advice to junior workers or subordinates in an organization to work productively and to increase the effective works.

## 6. Conclusion

The samples thought that they had problems of statistics, result and discussion writing, and data collecting. The samples also wanted the STTC management to provide the budget, stages for reporting the research result, to set up clear policy to classroom action research. Some of these would affect knowledge and the ability of teachers to do classroom action research. They would also require the STTC give the importance of CAR, reform the curriculum, the content of the existing textbook of CAR, and set up the sufficient and regular training of teachers. Some of the solution from the management and the key trainers at STTC were training system, monitoring, and coaching them new graduate teachers.

## 7. Recommendations

The following are some recommendations based on the research results:

7.1 The perspectives of teachers towards the factors affecting their classroom action research performance could be the effective reflective journals of STTC teachers, the policy makers, and the management to develop coaching and mentoring them doing classroom research.

7.2 It is also recommended that further studies should be conducted for developing coaching and mentoring system for teachers to do classroom action research at Savannakhet Teacher Training College in Lao PDR.

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## Pre-Service Training to Improve Teacher Quality in Myanmar Educational System

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### Abstract

Education is very dynamic. It depends upon the society which is fast changing. Due to the advancement in the field of science and technology, there is an explosion of knowledge. Accordingly, the curriculum and syllabus are also being changed rapidly. Continuous education of the teacher can save the teacher from facing dire consequences. This research examines Myanmar teachers' perceptions regarding: (1) teacher competence and improving education quality and (2) ensuring teacher quality through pre-service teacher training. This research used questionnaire that targeted student-teachers from Mandalay Education College. In 2018, 50 copies of questionnaires were distributed, and 40 copies were collected. The results indicated that (a) respondents realized and indicated explicitly that competent teachers do help contribute to student's learning and promote the level of education quality, and (b) respondents recognized the importance of pre-service training because it helps make teachers more confident in the profession and increases people's respects and trust in teachers. This research concludes that Myanmar teachers acknowledge the important of their profession. They further desire to upgrade their pedagogy by means of continuous professional development through effective training programs. Thus, structuring feasible pre-service training models for them is beneficial to all stakeholders.

**Key words:** Myanmar, quality of education, teacher competence, teacher quality, pre-service teacher training

## 1. Introduction

There are formal and informal programmes of pre-service education organized from time to time. The higher authorities concerned with education in Myanmar want to ensure that the standards of education are raised and maintained. That is possible only if the teachers refresh their knowledge and keep it current in their field. Now, as a result in Myanmar different agencies, therefore keep on organizing teacher education programmes for enriching the knowledge of teachers and also for over all proficiency and improvement. People in the globe also trust in the power of education, according to the recent survey of the United Nations (UN), as people around the world have voted six priorities. 'A good education' is at the top of the six followed by 'better job opportunities; an honest and responsive government; protection against crime and violence; protecting forests, rivers and oceans; and the sixth is affordable and nutritious food'(Lee,2014). The reason people have in general is that education makes other priorities happen. In this regard; future growth, poverty eradication, improvements in health, political and social development depend on education that has qualified teacher at its centre. Ensuring the quality of teaching activities and learning environments is a challenge that all countries, regardless of their levels of development, have continue to focus on. The main reason why teachers are necessary is because they have a great impact on their students' learning; therefore, ensuring qualified teachers is at the forefront of the challenges. In terms of Myanmar, an agricultural Southeast Asian country of about 50 million people, the government is committed to moving the country out of its least developed country status and achieves other greater social development targets even though the majority of its people have not completed primary school. Despite some visible developments such reduced poverty and better education in Myanmar. The task is not fully complete regarding some issues such as children's and women's health and nutrition, and control of threatening diseases. Therefore, the Ministry of Education of Myanmar intends to accelerate its efforts and to continue giving highest priority to ensure educational access for all children to a basic education by 2021. Some improvements have been made, but there still are several challenges such as addressing teacher shortage, and qualified teachers.

## 2. Method

This research intends to address the issues concerning teachers without pedagogical training. It appears significant to take a particular look on teachers' conditions in Myanmar so as to ensure qualified teachers and a high quality of teaching



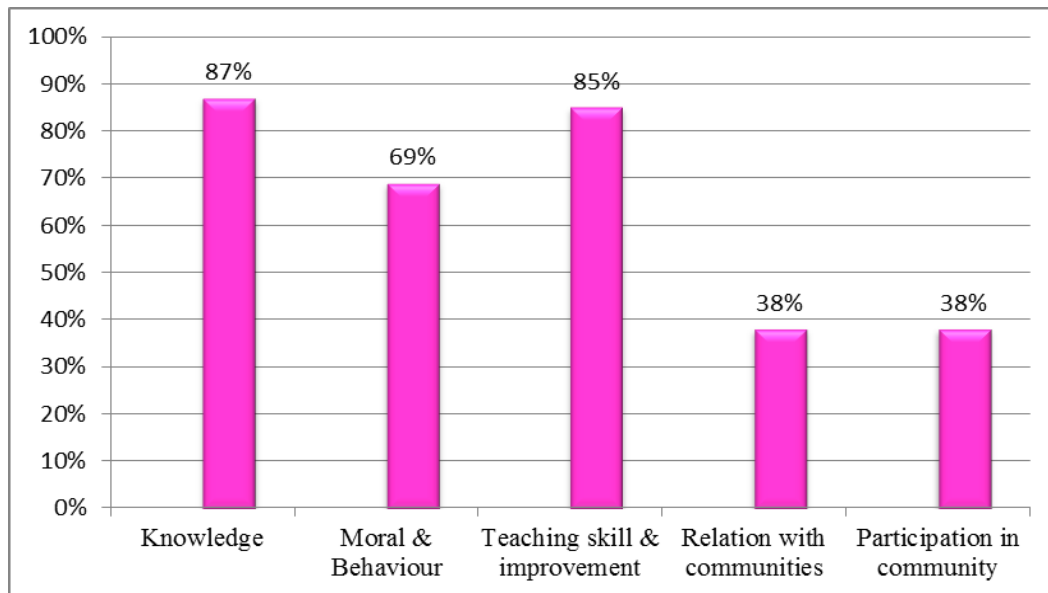
and learning. Thus, this research intends to examine Myanmar student teachers' perceptions regarding: (1) teacher competence and quality improvement of education, and (2) ensuring teacher quality and pre-service teacher training. Five choice scales are provided in both questionnaires: A = very important, B = quite important, C = moderately important, D = not so important and E = not important at all. Regarding teacher competence and quality of education, the percentage was calculated to find out the respondents' perceptions concerning teacher competence and quality of education toward the significance of related matters in the five questions. To find out teacher quality and pre-service teacher training, the percentage was also calculated in this section. Respondents acknowledged the significance of pre-service teacher training programs for their continuous professional development. Needless to say, progress of students to secondary education and to relevant higher education will not complete without enrolment and success of primary education. The ultimate goal is not just to bring students to school to complete a course of primary education, but to provide them a quality education with qualified teachers. This study utilized questionnaires targeted .A well-trained qualified teacher educates students confidently in core subject matters in a manner that can raise literacy, numeracy and related skills. A teacher, thus, is defined as a person whose professional activity involve in the transmission of knowledge, and attitudes and skills that meet the students enrolled in the educational programs. With such regard, the need of components involved in this research are four variables: (a) teacher competence, (b) quality of education, (c) teacher quality and (d) pre-service teacher training.

### 3. Results

#### Teacher Competence and Quality of Education

The impact of investing in modern curriculum, facilities, instructional materials, textbooks, and other technologies on the student's learning depends on the capacity of teachers to use the resources accordingly (Raudenbush et al., 1993). Teacher education has become one of the biggest constraints of educational reform that many nations have faced. Many countries worldwide have shifted from quantitative improvement of children's school access to qualitative improvement in the entire education. In Myanmar, there is a recognition that a strong knowledge 87% of the student teachers who responded that capability of the subject matter, and knowledge and skills is needed to transform the students. In particularly students in developing countries are learning very little or nothing and the fundamental reason has been identified the acute shortage of

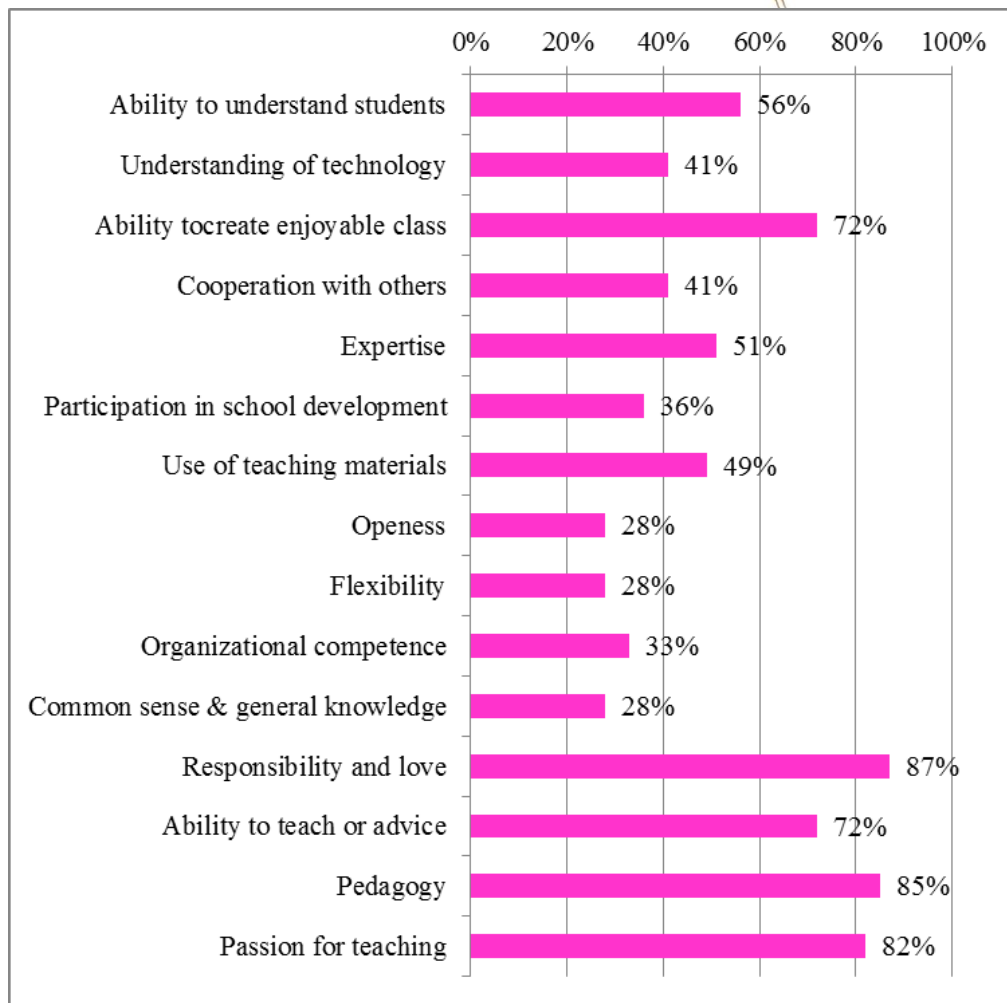
well-trained teachers. In addition, over half of the respondents described that teachers require better understanding of the core competencies such as knowledge, teaching skills and attitudes.



**Figure 1** Responses of student-teachers towards teachers' competence and quality for improvement of education

The results indicate their significance among each other and that the highest percentage, which is 87%, goes to general knowledge and solid knowledge of all subjects that they are going to teach, followed by teaching skill and improvement, 85%, high professional consciousness, moral goodness of character and behavior, 69%, and relation with community and participation in community, 38%. High professional consciousness, moral goodness of character and behavior, 69%

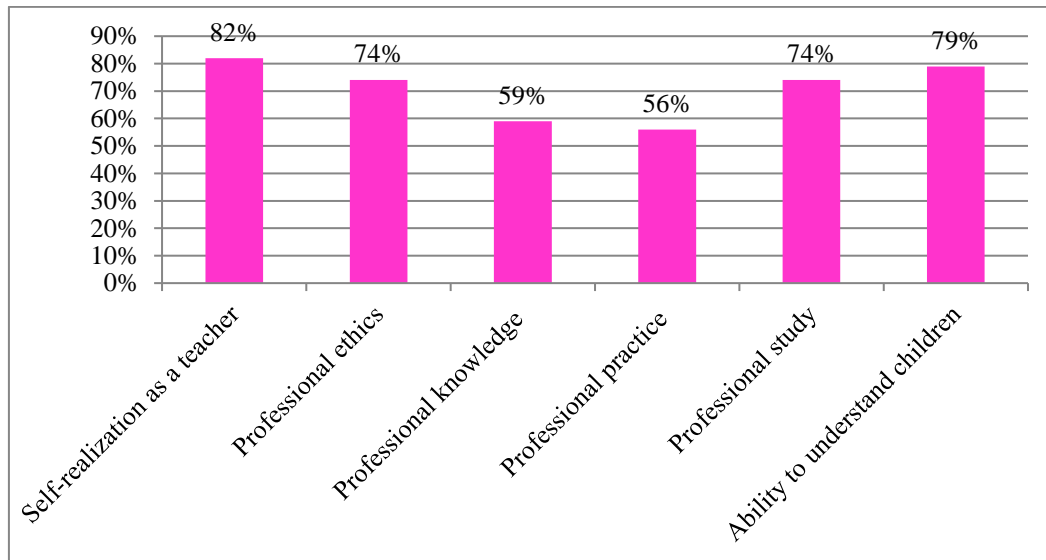
In Myanmar, the government has committed all the efforts to increase access of children to school and reduce the primary school dropout rate. In addition, support of availability of health-related facilities such as drinking water, school uniforms and learning facilities such as textbooks, libraries is also a focus the government. However, there are also additional needs.



**Figure 2** Responses of student-teachers towards ensuring teacher's quality and competence

The respondents described the importance of responsibility and love, 87% importance of pedagogical know-how, 85%, and string passion for teaching and pride for teaching students, at 82%, Furthermore, in the quality of teachers, ability create enjoyable class, and ability to teach and advice recognized as another key factors by 72% of the respondents. To this response, an appropriate structure to secure the quality of the teachers becomes important. Ability to understand students, 56%, being expertise, 51%; use of teaching materials, 49%, are also regarded as important factors. 41% of respondents agreed to importance of understanding technology, and cooperation with others. These are followed by participation in school development, 31%. In the developing and changing world, flexibility and openness in teaching which is absolutely crucial for all teachers whether or not they are in classrooms appears as 28% in Myanmar.

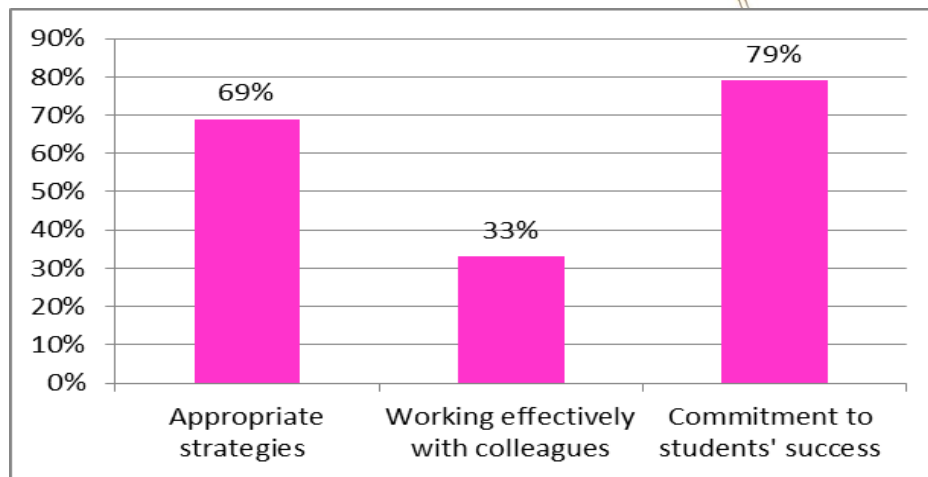
In order to provide a quality education to people in Myanmar, there are needs to supply and adequate number of necessary educational services such as facilities and enough trained teachers.



**Figure 3** Responses of student-teachers towards the professional standards

The results indicate that the highest percentage, which is 82%, goes to self-realization as a teacher followed by ability to understand children, 79%. The professional ethics are professional study recognized as very important by 74% of the respondents. The respondents expressed another two statements: professional knowledge, 59% and professional practice 56%.

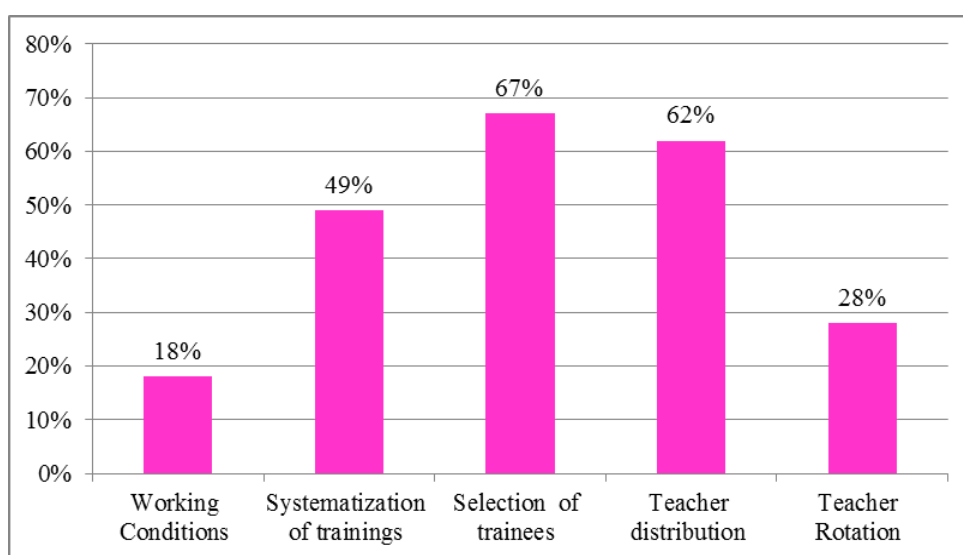
Key findings from recent and emerging local and international research on educational effectiveness show that 'what matters most' is quality teachers and good teaching, supported by strategic teacher professional development. Teachers' ability is important to equip their learners with the necessary intellectual skills and that this in turn, depends on the quality of their training at the higher education level.



**Figure 4** Responses of student-teachers towards reasons of equipping teachers' quality

According to the results, the respondents believe that teachers have to have enthusiasm, creativity and commitment to students' success, 79%, for being used a wide range of teaching strategies appropriate for students need, 69%, and to work effectively with colleagues and the community, 33%.

The quality of education requires quality teachers at its centre. Quality teachers can contribute to a healthy education. They ensured teacher certification, proper working conditions, appropriate evaluation and assessment, commitment and pride of teachers themselves in the profession, and continuous professional development.



**Figure 5** Responses of student-teachers towards the important issues for teacher's quality and competence

Most of the respondents, 67%, agreed that selection of trainees as the most important factor. After that, 62% of them suggested for teacher distribution. Furthermore, systemized trainings for teachers, 49%, appears also very important for ensuring teacher's competency. There were flowered by teacher rotation, 28% and working condition, 18%. These results demonstrate that respondents explicitly indicated that competent teachers do contribute to student's learning achievement and also take part in promoting quality education.

#### 4. Discussion

According to the data, respondents acknowledged the significance of pre-service teacher training programs for their continuous professional development. As stated previously, the purpose of this research is to examine Myanmar teachers' perception regarding: (a) teacher competence and quality improvement of education, and (b) ensuring teacher quality and pre-service teacher training. The empirical results are presented in the figures respectively, obtained from the questionnaire survey conducted with Myanmar student-teachers from pre-service primary teacher training.

While many countries in the world are on track for meeting the Education for All targets, there is a growing recognition of the need to improve the quality of education and that a focus on pedagogy and its training implications needs to be at the heart of this commitment. There are at different stages of development with regard to the reforming of teacher education, this research explores the challenges with regard to the development and strengthening of pre-service training. The tension between quality and breadth is explored together with a broader discussion of key principles to be taken into account when enhancing teacher education in the country as a whole.

This research explores to address two findings. First it reports that competent teachers do help contribute to student's learning and promote the level of education quality. Second the review reports on importance of pre-service training because it helps make teachers more confident in the profession as it can bring people's respects and trust. The research concludes that a lack of well thought out policy, few resources, and limited understanding of inclusion seems widespread in the country. As yet special education and related service expertise and teacher education for inclusion, is not in place to support teachers to work inclusively.

## 5. Conclusion

“Good education requires good teachers” therefore it is essential that the most capable and appropriate be recruited into the teaching profession, provided with high quality pre-service programmes of teacher education, and then offered opportunities to upgrade their knowledge and skills over the full length of their career. It is, therefore, essential that there is a major reorientation of teacher education to ensure that teachers are furnished with the necessary knowledge and skills to cope with the new demands placed on them.

This research examined Myanmar teachers’ perception regarding: (1) teacher competence and quality improvement of education and (2) ensuring teacher quality and pre-service teacher training. Ensuring the quality of education requires competent teachers, based on the results of this research. Then, ensuring qualified teachers is the forefront of challenges that all countries, regardless of their levels of development, have been focusing. In Myanmar, the training is, however, inadequate and not regular; as a lower secondary school provided in the present questionnaire that training provided by the government is still limited. Myanmar teachers, now, demand effective pre-service teacher training. A sustainable system model of proper-and-feasible continuous professional development opportunity for teacher is crucial, and it urgently needs to be structured. Teacher has a central role to play in student’s learning achievement, quality improvement of education, and lifting citizenship of nations, but teaching is a very challenging profession particularly when teacher has to struggle due to limited resources to implement their responsibilities.

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## EFL Teachers' and Learners' Perceptions towards Culture and Culture Learning in Myanmar Context

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### Abstract

Language is considered a socio-cultural resource because that allows the human being through communication interact in their own context and opens doors for interaction in different contexts, which enable identification, processing and construction of diverse social environments, and each individual has the capacity to intervene positively or negatively it. The language goes hand in hand with social and cultural development, none of them are static because they adjust and complement according to particular needs. Thus, the aim of this research is to investigate EFL learners' and teachers' perspectives on understanding of 'culture'; attitudes towards culture teaching; and finally, their attitudes towards intercultural communicative competence. The data were collected through a Likert type questionnaire in which 52 Myanmar teachers of English and 86 Myanmar university learners were asked questions to respond with the purpose of finding the importance of cultural aspects in learning the target language. Finally, we investigated to what extent Myanmar teachers of English supported cultural objectives, including the objective to promote the acquisition of intercultural competence. Data analyzed showed that the teachers and learners had positive attitude towards the culture and culture learning. They all preferred to the intercultural communicative competence. And the teachers and learners are actively involved in cultural activities in language classrooms and had the positive attitudes to the cultural activities.

**Keywords** : culture, intercultural, attitude, competence; cultural awareness, perception



## 1. Introduction

Language always carries meanings and references beyond itself: The meanings of a particular language represent the culture of a particular social group. To interact with a language means to do so with the culture which is its reference point. We could not understand a culture without having direct access to its language because of their intimate connection. A particular language points to the culture of a particular social group. Learning a language, therefore, is not only learning the alphabet, the meaning, the grammar rules and the arrangement of words, but it is also learning the behavior of the society and its cultural customs. Thus, language teaching should always contain some explicit reference to the culture, the whole from which the particular language is extracted. Growing up in a particular society, we informally learn how to use gestures, glances, slight changes in tone or voice, and other auxiliary communication devices to alter or to emphasize what we say and do. We learn these culturally specific techniques over many years, largely by observing and imitating.

We are also aware of that in traditional education programs, language teaching was seen as teaching the forms and usage of the target language and such implications were also seen as representatives of cultural values of the target language. That is, as the use of language is related to social and cultural values, language learning is considered to be a social and cultural phenomena. Canale and Swain (1980) in their 'communicative approach' stated that "a more natural integration" of language and culture takes place "through a more communicative approach than through a more grammatically based approach". Language learners are not only expected to acquire the forms of the target language but also to use these forms appropriately in social situations when they encounter. The notion of communicative competence does not just rely on grammatical competence but includes also sociolinguistic competence, strategic competence and finally discourse competence (Canale and Swain, 1980).

## 2. Aim and Objective of the Research

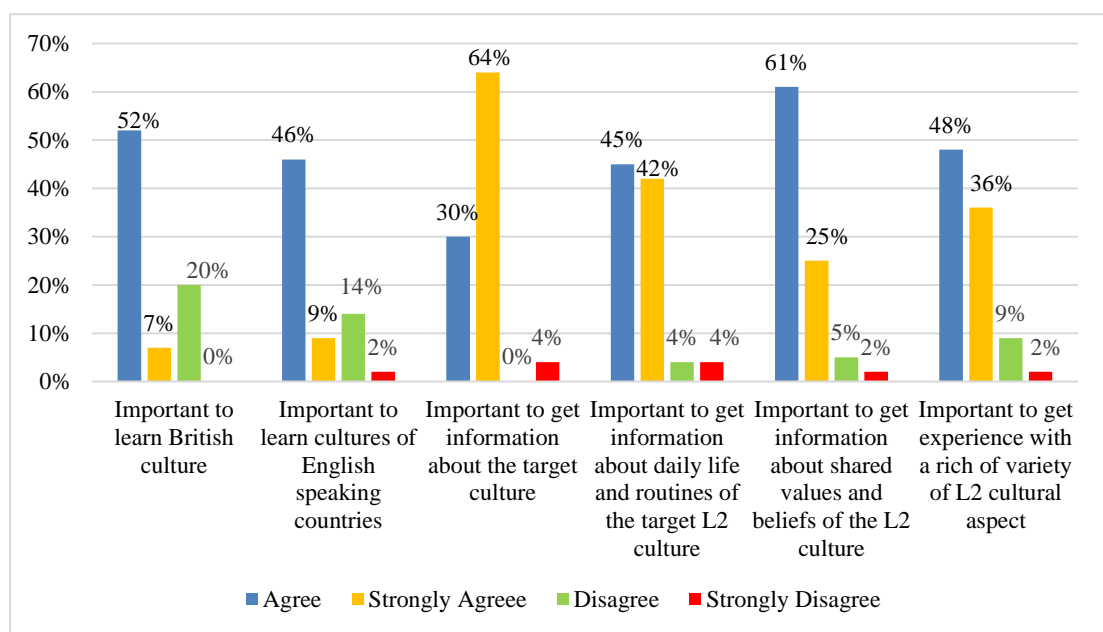
The aim of this research is to investigate teachers' and language learners' perceptions of culture and culture teaching / learning in Myanmar context. The research aims to unearth the idiosyncratic (personal) views of teachers and learners with regard to learning culture and figure out how far these views are in line or mismatch. This is important since these perceptions may directly affect their teaching / learning in the long run and additionally teachers' current practices in the English classroom can



the method of analysis is statistical analysis. Then, the data were analyzed with % step by step before drawing objective conclusions.

### 3.4 Data Analysis

In this research, the perceptions on the importance of culture and culture learning in Myanmar ELT classrooms are investigated to see whether there is a significant difference in teachers and student perceptions. According to the data, there is no significant difference between the views of teachers and learners on the importance of culture. (see Figure (1) and (2) below)



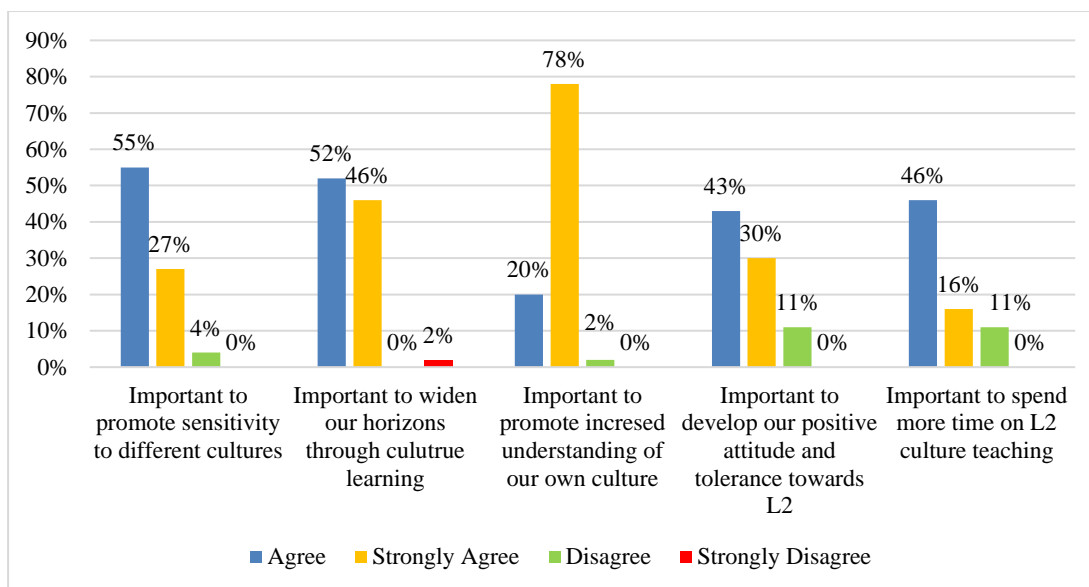
**Figure 1** Learners' perceptions on the importance of culture

## 4. Results

Regarding the student's perceptions on the importance of culture, 64% of learners responded that getting information about the target culture is important for them. We also investigated learners' thoughts on the effects of culture class. A significant similarity between the learners' views and experts in the field was observed. Regarding the benefits of learning about culture, 61% of the learners responded that attending the culture class has raised cultural awareness and benefitted learning about shared value and beliefs of the L<sub>2</sub> culture. (Figure 1)

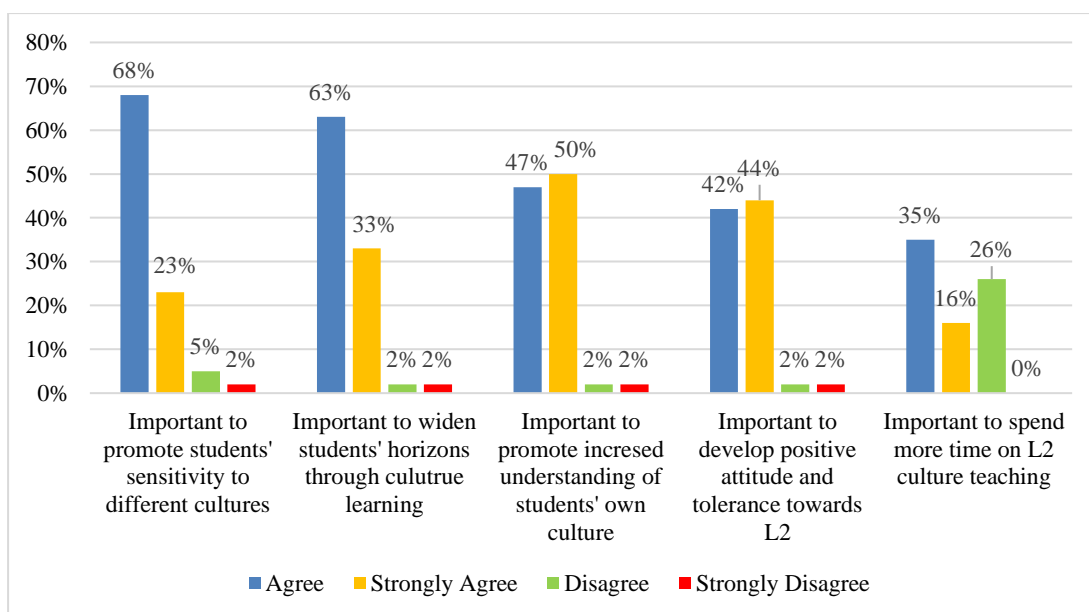
The data in general revealed that Myanmar foreign language learners were willing to try and attain culture learning objectives in foreign language education. We also aimed at describing an average foreign language-culture teacher in terms of





**Figure 3** Learners' perceptions on the importance of culture learning

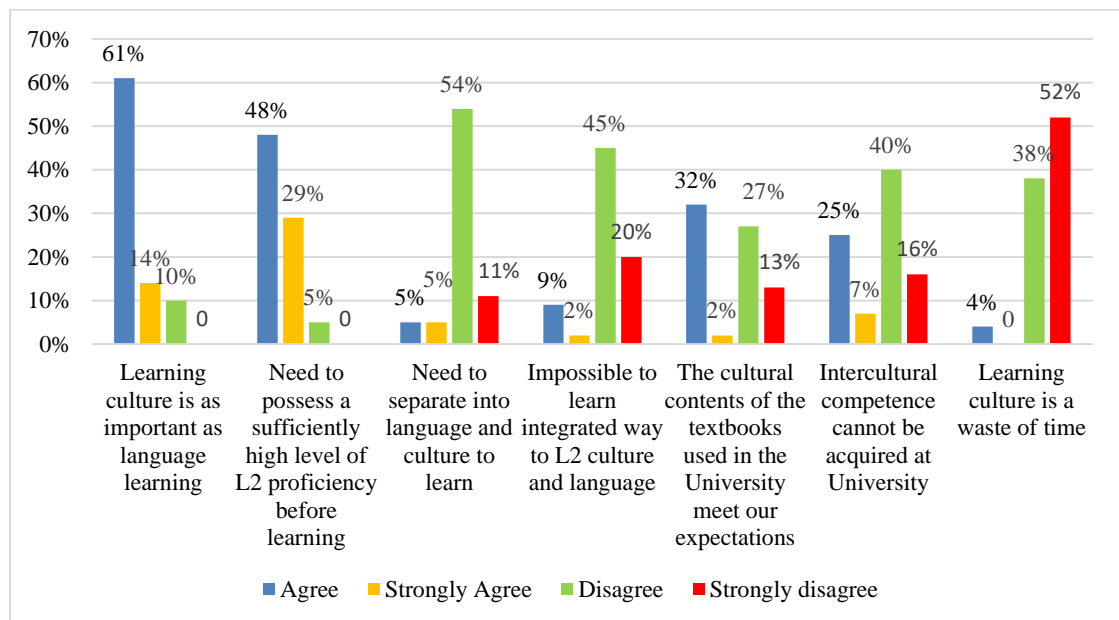
When we checked on the learners' perceptions on the importance of culture learning, it is clear that 78% of learners showed a high preference on their own culture. 55% of student participants wanted to expand their knowledge on different culture.



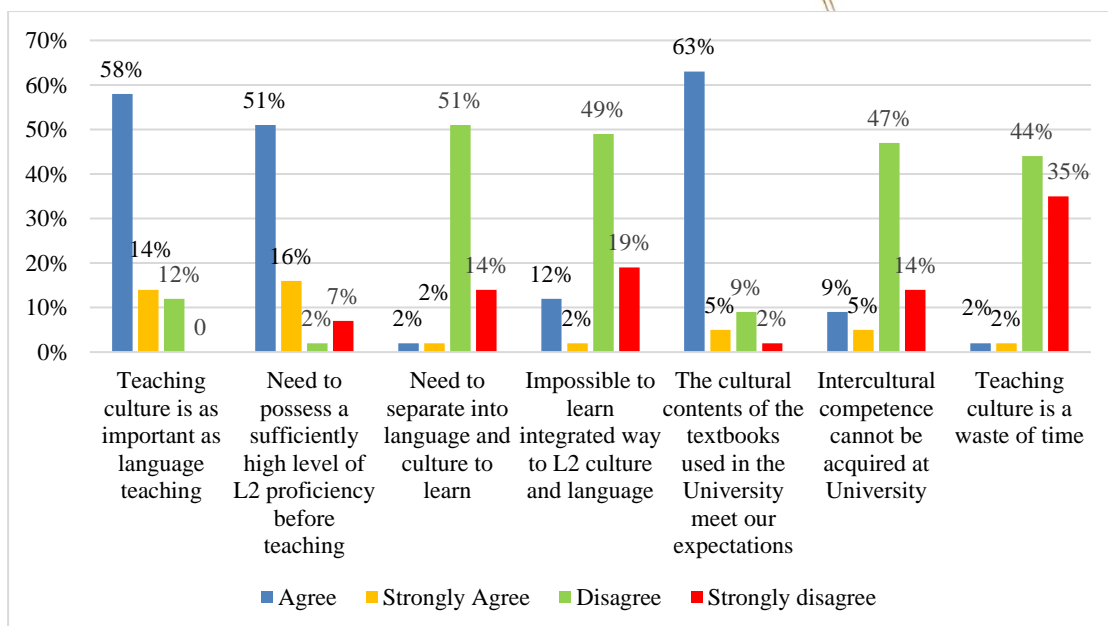
**Figure 4** Teachers' perceptions on the importance of culture teaching

It is noticeable that 68% of teacher participants favoured to promote learners' sensitivity to different cultures. When we compared to the learners concerning with the fact of to promote increased understanding of our own culture, 47% of teachers agreed with this. Instead of that 63% of teachers enthused to widen learners' horizons through culture learning. When we compared both results, most learners want to promote increased understanding of their own culture but most of the teachers want to promote their students' sensitivity to different cultures.

Moreover, we aimed to investigate the opinions of Myanmar learners and teachers of English on intercultural competence teaching and to see how and to what extent these opinions are reflected in their classroom applications.



**Figure 5** Learners' perceptions on place of culture and intercultural competence

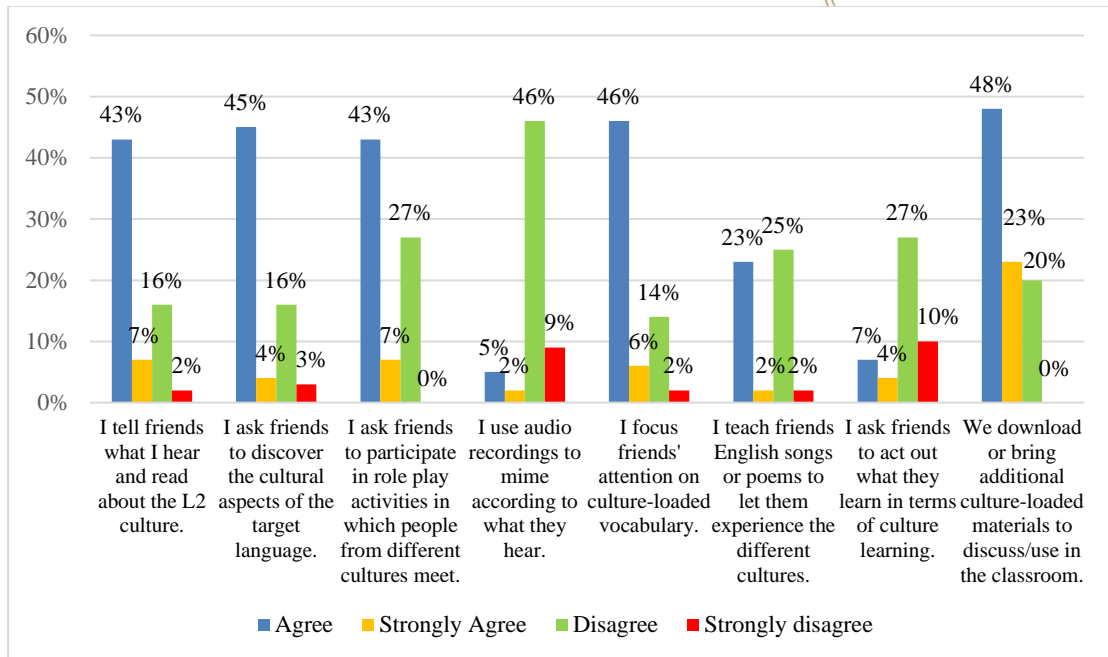


**Figure 6** Teachers' perceptions on place of culture and intercultural competence

Data were collected from 86 learners and the findings of Figure 5 revealed that 61% of them agree with the statement of learning culture is as important as language learning and 54% of participants thought that language and culture can be learned in an integrated way and no need to separate the two. 52% learners responded to the statement of learning culture is a waste of time as strongly disagree.

According to the responses of 52 English teachers, the views of 63% teachers responded that the cultural contents of the textbooks used in the University meet their expectations. And 53% of teachers thought that teaching culture is as important as language teaching. But 51% of them suggested that language and culture can be learned in an integrated way and before teaching L2 culture, learners have to possess a sufficiently high level of L2 proficiency. The findings revealed that most of the learners and the teachers did not seem to be aware of the role of the culture in foreign language education and they do not often integrate culture into their teaching in order to develop intercultural competence.

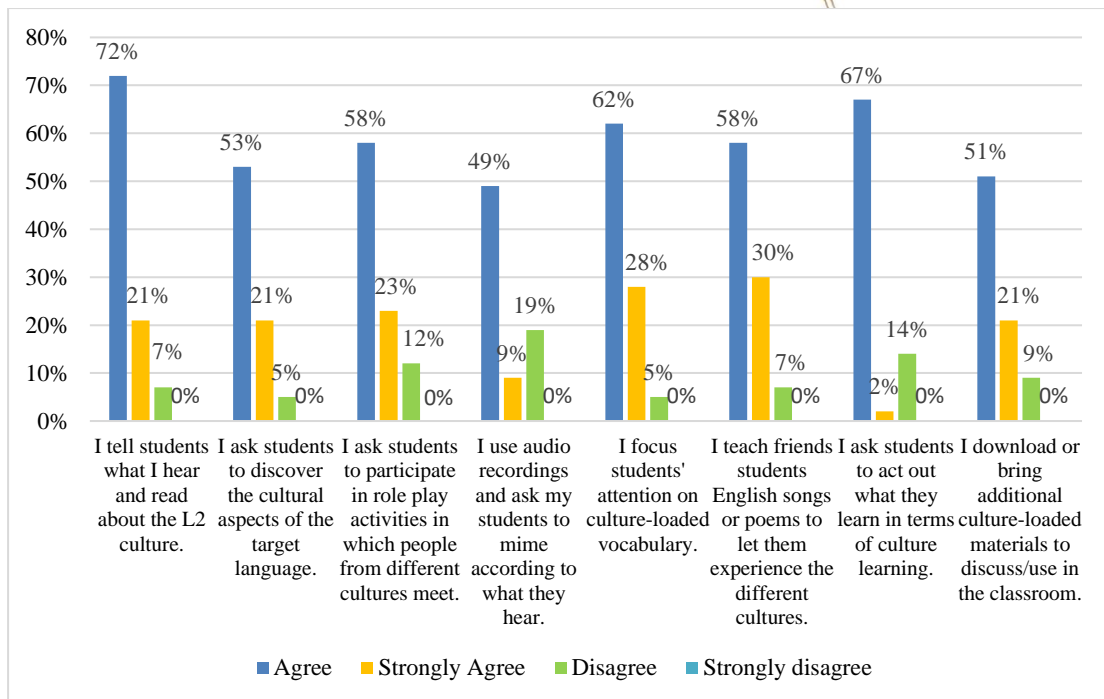
We also aimed at investigating the types of cultural activities which Myanmar university learners wanted to take during their study of the target language and the level at which learners preferred to see those cultural components in language classrooms.



**Figure 7** Learners' perceptions on how to pass culture

The findings of the research clearly showed the types of cultural activities learners would enjoy in language classrooms, at which level they would like to do them, their attitudes towards the target culture, the level of importance learners attach to the target culture and their understanding of “culture”. 48% of learners want to download or bring additional culture-loaded materials to discuss or use in their classroom. But 46% of learners don't want to use audio recordings to mime according to what they hear.





**Figure 8** Teachers' perceptions on how to pass culture

When we investigate the teachers' perceptions, we found that 72% of English teachers want to tell students what they hear and read about the L2 culture which they teach. And 67% of them would like to ask learners to act out what they learn in terms of culture learning. From the results it can be seen that most of the learners (48%) and teachers (72%) who took part in the research had positive attitudes towards the inclusion of cultural components during their study of the English language by bringing additional culture-loaded materials through technology and telling the learners what they hear and read about the L<sub>2</sub> culture. (Figure 7 & 8)

## 5. Discussion

An understanding of the relationship between language and culture is important for language learners, users, and for all those involved in language education. For language teachers and learners in general, an appreciation for the differences in opinion regarding the relationship between language and culture can help to illuminate the diversity of views held toward the use of language. According to the data, it is generally agreed that language and culture are closely related. In this research, the teachers and learners had positive attitude towards the culture and culture learning. They all preferred to the intercultural communicative competence. And the teachers and

learners are actively involved in cultural activities in language classrooms and had the positive attitudes to the cultural activities.

## 6. Conclusion

In conclusion, understanding the relationship between languages and cultures can be a good starting point for any approach to language education. This relationship can help policy makers to design programs in order to teach language learners about the target cultures in order to achieve real competency in the languages they are expected to learn. Learning language through culture has good impact on language learning. It draws learners' attention to cultural diversity thus enhancing tolerance, understanding and cooperation between people with different cultural backgrounds.

## 7. Recommendation

This present study investigated the interest of students and teachers towards cultural learning in their classroom. The findings revealed that the respondents were in favor of learning mostly about their own culture, followed by target and international target culture. On the basis of the research findings, teachers can look at different ways to motivate students to be curious to explore various cultural themes. Therefore, the study suggests that teachers should provide supplementary authentic teaching materials about cultural themes from diverse cultural sources in order to motivate students and expose them to more varied cultures. They can also use documentaries, video, or film to illustrate appropriate nonverbal communication in both international and target cultures in order to help students identify the meaning of gestures from different cultures. For students with advanced language skills, presentations and discussions/debates can be used for cultural knowledge learning. For example, students can discuss the similarities and differences between cultures. Finally, role-plays are another activity which can be used for skills and attitudes training to motivate students and to strengthen cultural knowledge learning. Some of the issues remaining to be investigated include the following. First, further research needs to be drawn from a larger sample size. Second, reasons why students prefer a particular source of culture over another, and a particular cultural theme over another should be investigated. Finally, teachers' perceptions as well as how to teach culture need further research.

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## Perceptions on Parental Involvement and Autonomy Support by Basic Education High School Teachers and Parents in Myanmar

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### Abstract

This research examined perceptions of parental involvement and autonomy support towards adolescents by Basic Education High School teachers and parents in Myanmar. Basic Education High school teachers and school administrators provided information about students' academic performance. This research examined how parental involvement and parental autonomy support are related to these three psychosocial outcomes in adolescence, i.e., academic performance, disruptive behavior and substance use. Parental involvement is the extent to which parents are interested in, knowledgeable about, and willing to take an active role in the day-to-day activities of their children. Parental autonomy support is the extent to which parents value and use techniques that facilitate independent problem solving, choice, and self-determination in their children. Specifically, perception of greater parental involvement is associated with higher standardized achievement scores, higher teacher rated competence, and better school grades. Perception of greater parental autonomy support is related to higher grade point average, higher teacher-rated competence, more active job search behavior, and a strong vocational identity (Vansteenkiste, 2005). This research examined the perceived parental involvement and autonomy support on academic performance, classroom disruptive behavior and substance use in adolescence. Classroom disruptive behavior and substance use are two important psychosocial outcomes that have not been studied in previous research on perceived parental involvement and autonomy support (Vansteenkiste, 2005). The present research examines whether perception of parental involvement and parental autonomy support related to academic performance of adolescents in the context of Myanmar. This

research has shown that perceived parental involvement and autonomy support are associated with good outcomes among students in Myanmar.

**Key words** : Basic Education High School teachers, perception, parental involvement, autonomy support, adolescent, Myanmar

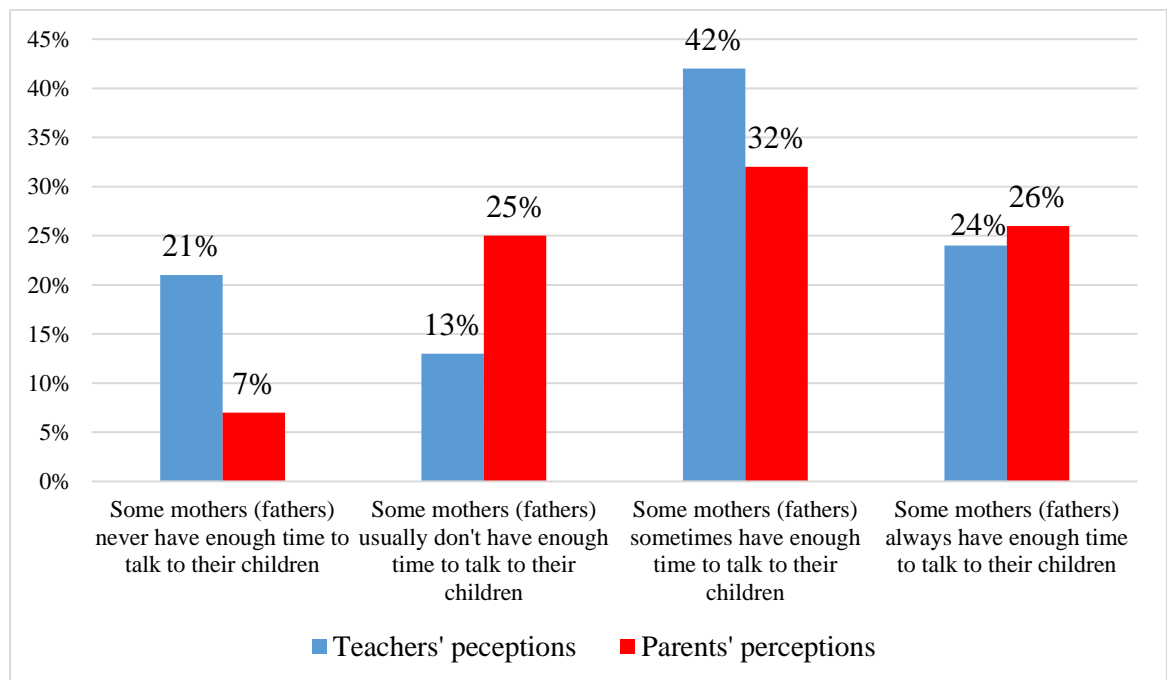
## 1. Introduction

Parents are significant others who exert strong influence on young adolescents. This research explores and examines the relationships between parental involvement and autonomy support towards adolescents. One hundred and thirty two Basic Education High school teachers (n=93) and parents (n=39) (21 males and 111 females) responded to the questionnaires. Both parents' and teachers' perceived parental involvement and autonomy support to students explored in this research. The results from the analyses show that student with high perceived parental involvement, autonomy support and warmth reported that their basic psychological needs are highly met, when compared to the others, had significantly higher autonomous motivation, higher self-perceptions, and rated the importance of, and the likelihood of achieving, intrinsic aspirations higher. Three important developmental tasks for adolescents are doing reasonably well in schools, behaving in a manner that does not disrupt others, and resisting the urge to use alcohol and other drugs (Reed, 2002). This research examined how parental involvement and parental autonomy support were related to these three psychosocial outcomes in adolescence, i.e., academic performance, disruptive behavior and substance use. Parenting practices and characteristics of parent-child interactions have been linked to behavioral problems, substance use (Miller, 1995) and resilience (Reed, 2002). Factors such as parents' permissiveness, inconsistent and unclear behavioral limits, unrealistic parental expectations, negative communication patterns, and lack of parental monitoring were associated with earlier initiation and higher rates of drug use (Anthony, 1996). Effortful control and identified regulation mediated the effect of both parental involvement and autonomy support on academic performance and classroom disruptive behavior for students. Thus perceived parental involvement and autonomy support, effortful control and academic identified regulation could be regarded as important protective factors for high risk adolescents, increasing their chance to do well in spite of the challenging circumstances they were in.

In this research, parental autonomy support was related to greater academic achievement, autonomous motivation, and psychological health. An autonomy



Parents' perceptions towards questionnaire items for parental involvement is (i) Some mothers (fathers) never have enough time to talk to their children (7%). (ii) Some mothers (fathers) usually don't have enough time to talk to their children (25%). (iii) Some mothers (fathers) sometimes have enough time to talk to their children (32%). (iv) Some mothers (fathers) always have enough time to talk to their children (26%).



**Figure 9** Perceptions of teachers and parents towards questionnaire items for parental involvement

According to the data, first, greater parental involvement was associated with more effortful control, which predicted less classroom disruptive behavior. Effortful control was a significant mediator of the relationship between parental involvement and disruptive behavior. Second, parental involvement had a direct relationship with disruptive behavior – high parental involvement was associated with more disruptive behavior. This indicates that the relations among parenting characteristics, effortful control, identified regulation and disruptive behavior were similar among the students. Substance Use Disruptive behavior was included because analyses show that it had a strong relation with substance use.

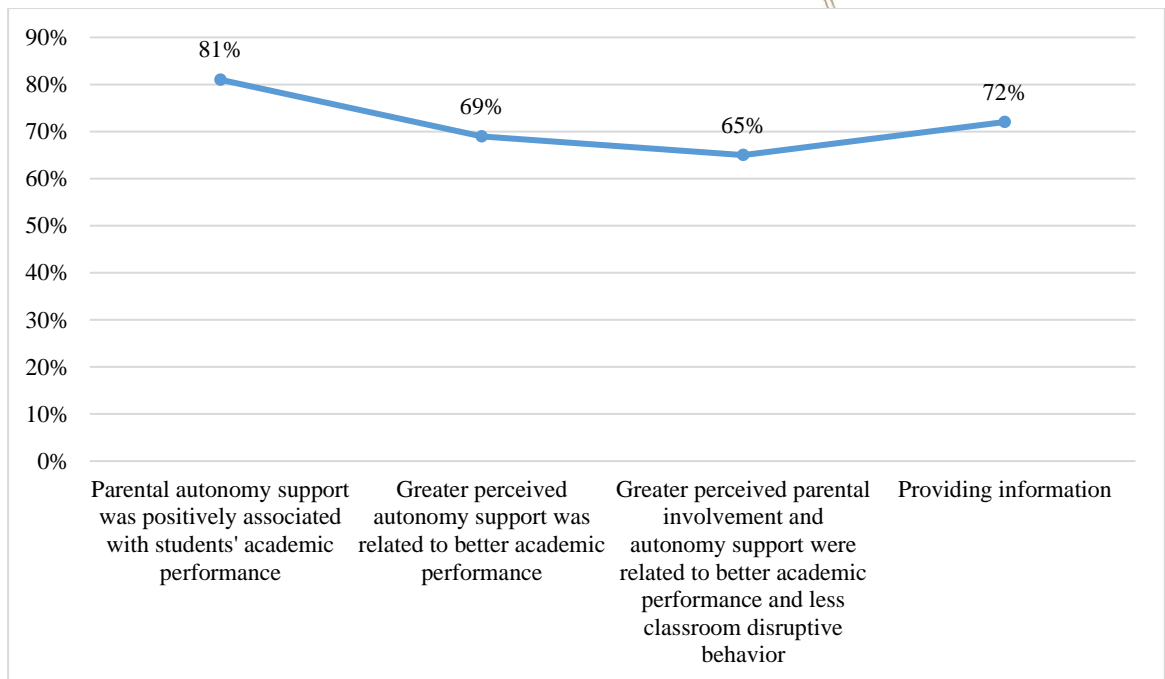
According to the data, parents who are high on involvement are interested in, knowledgeable about, and willing to take an active role in their children's day-to-day activities. They are probably more able to provide opportunities for their children to

practice self-control. For instance, without parental supervision, some adolescents may choose to play video games as opposed to doing homework. However, parents who are highly involved are more likely to be aware of such behavior and to be in a position to do something about it. They could demand that adolescents finish their homework first before playing video games. They could also help their children focus on homework by eliminating distractions in the immediate environment, e.g., taking the video game outside of the adolescent's room while he or she does homework. Identified regulation (i.e., believing that school work was important) significantly mediated the relation between parental autonomy support and adolescent outcomes.

We examined whether the academic performance was the same among the students. Information about Basic Education High School students' academic performance was collected from both the students and the teachers. Students were asked to indicate their performance in four areas: Math, Science, English, and Social Studies. In each area, they were asked to indicate their grade from monthly tests in each subject (A = 4, B = 3, C = 2, D = 1, F = 0). Additionally, teachers provided grade information in the four subjects.

Most of the participants (81%) responded that parental autonomy support was positively associated with students' academic performance, which was negatively associated with disruptive behavior. Less disruptive behavior was associated with less substance use. Identified regulation and effortful control did not have a direct relationship with substance use independent of their relationship with disruptive behavior. According to the data, 69% of the participants responded that greater perceived autonomy support was related to better academic performance. This research also shows that greater perceived parental involvement and autonomy support were related to more effortful control and identified regulation, which in turn predicted better academic performance and less classroom disruptive behavior (65%). To motivate their children to work hard, these parents are less likely to rely on pressure or punishment. Instead they may provide information on why schoolwork is important and encourage their children to develop their own opinion toward schoolwork. 72% of the participants responded that such practice might have helped adolescents focus less on the controlling aspects of schoolwork and more on how it could be important and meaningful to them.





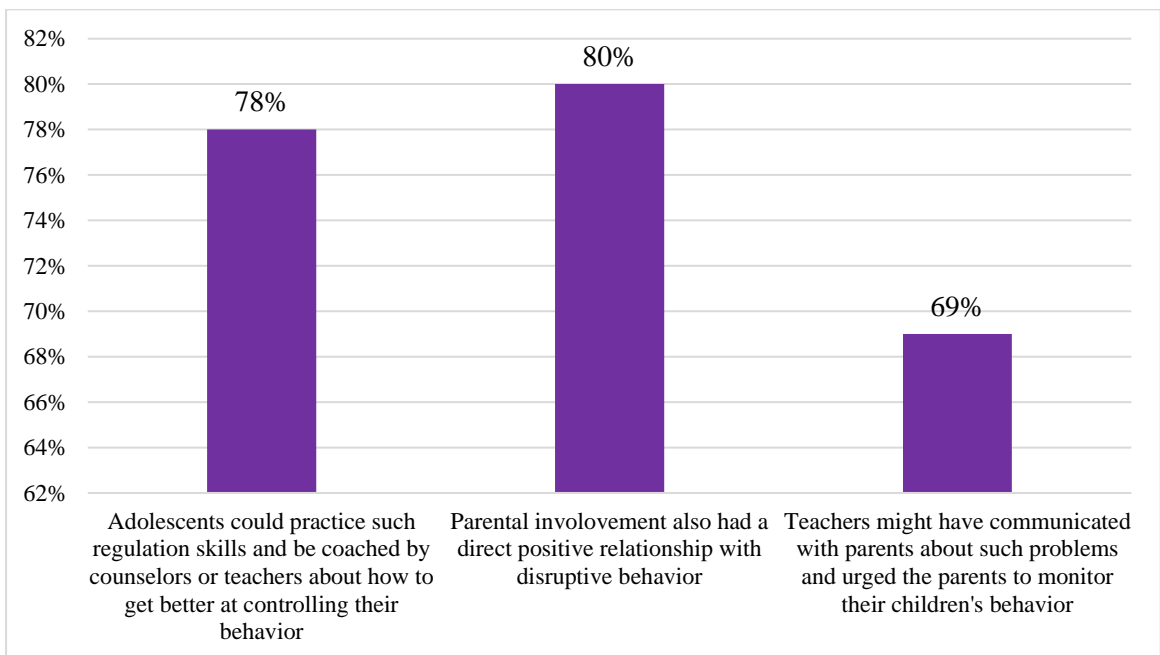
**Figure 10** Perceptions of teachers and parents towards parental autonomy support

To summarize, perceived parental involvement and autonomy support were positively related to three developmental outcomes in adolescence. Effortful control and identified regulation mediated the effects of perceived parental involvement and autonomy support on academic performance and classroom disruptive behavior for all students.

#### 4. Research Results

This research added to the existing literature by showing perceived parental involvement and autonomy support are associated with good outcomes among students in Myanmar. It may be relatively difficult to change parental involvement and autonomy support. For instance, some parents may not recognize the need to change; some adolescents may not have a caring parent or guardian who is willing to be involved or support their autonomy. However, teachers, counselors, or other adults can help adolescents develop self-regulation skills. Adolescents may learn valuable information such as how to decrease distractions while doing homework, avoid procrastinations to study before an exam and inhibit the impulses to use drugs and alcohol. More importantly, 78% of the participants think that adolescents could practice such skills and be coached by counselors or teachers about how to get better at controlling their behavior. Identified regulation involves taking a positive attitude toward schoolwork and

holding a firm belief that it is important. Such attitude and belief can also be cultivated among adolescents, especially when they are in a caring and non-judgmental environment. 54% of the participants suggested that parents and teachers need to be aware of the potential relation between classroom disruptive behavior and substance use. Prevention programs of adolescent substance use may want to recruit adolescents who disrupt classes frequently. Some of them may benefit from these programs. Earlier we stated that greater parental involvement is related to more effortful control, which in turn predicted less classroom disruptive behavior. 80% of the participants responded that parental involvement also had a direct positive relationship with disruptive behavior. Some parents might have become more involved in their children’s lives as a result of their children’s trouble at school. 69% of them think that teachers might have communicated with parents about such problems and urged the parents to monitor their children’s behavior. The findings underscore the importance of parental involvement, operationalized as responsibility for diabetes tasks, and parenting style, specifically coercion and autonomy support, for adherence in pediatric chronic illness management. Longitudinal research is needed to better understand how and why dimensions of involvement (e.g., responsibility, monitoring, support) vary over time and whether they impact outcomes differentially.



**Figure 11** Participants' responses on how perceived parental involvement and autonomy support are associated with good outcomes among students

## 5. Discussion

This research examined the perceptions of parental involvement and autonomy support towards adolescents by Basic Education High School teachers and parents in Myanmar. Moreover, the research examined whether the relations among perception of parenting characteristics, self-regulation and outcomes variables were similar among the students. However, this research has several limitations. First, the cross-sectional nature of the data makes it difficult to determine the causal relations among variables. It is important to obtain longitudinal data so that different causal relations among parenting characteristics, self-regulation, and adolescent outcomes can be systematically tested. Moreover, longitudinal data also allow researchers to ascertain the long-term effects of parental involvement and autonomy support on adolescent functioning. Second, except for teacher ratings of academic performance, all other variables were measured by self-report. It is important to gather data from different sources such as parents and teachers, especially on variables such as effortful control and classroom disruptive behavior. Third, this research focused only on two dimensions of parenting, i.e., parental involvement and parental autonomy. Future research could explore how these two dimensions are related to other parenting characteristics such as responsiveness, demand and expectation, and provision of structure (Baumrind, 1991; Grolnick et al., 1997). Last but not least, the method also has many limitations. Although we reported excellent fit indices in most analyses, the results do not allow us to rule out alternative models that may fit the data equally well.

## 6. Conclusion

This research aimed to investigate the perceptions of parental involvement, students' basic psychological needs. Parental involvement was addressed with four dimensions: parents' educational aspiration, parental communication, parents' participation, and parental autonomy support. Analysis results show that parent educational aspiration, parental communication, parent participation, and parent autonomy support were statistically significantly and positively related to basic psychological needs. Parents should be made aware of parental educational involvement practices that will ensure smooth academic functioning of adolescents. Parent/teacher training programs must incorporate findings from similar studies.

## 7. Recommendations

The results of the research have significant implications in parenting and teaching as well. Parental practices such as discussing future, talking of school activities, and school involvement must be free from traces of psychological control to have positive, buffering impact on the educational stress levels of adolescents.

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## The Use of Lecture-related ICTs and Technology-related Pedagogical Practices of University Teachers in Myanmar

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### Abstract

The use of ICT in Higher Education is considered a pre-requisite for adaptation to the Higher Education Area. According to Voogt and Pareja Roblin (2012), information and communication technology (ICT) is at the core of these 21<sup>st</sup> Century frameworks. Additionally, these frameworks promote the idea that ICT skills should be developed alongside other 21<sup>st</sup> Century competencies such as critical thinking, problem solving, communication, and collaboration. In this research 31 University teachers deemed by their students to be excellent in their use of technology in their teaching were interviewed. We obtained our interviewees by first surveying 74 students about their ICT likes, dislikes, suggestions and teacher nominations. Highlights of the student survey indicate that a majority of students liked it when their teachers used ICTs in their teaching and were able to specify their views. Finally, the results show that many students wanted to use technology in the classroom and they felt that the following ICTs worked well for them. It has been also found that students engaged in more on-task behaviors, such as note-taking and other academic tasks, when University teachers used a structured approach to laptops in the classroom. These include online materials (i.e., attendance records, tests), a variety of ICT tools used in class (i.e., grammar tools, language learning software) and online tools (i.e., wikis, portfolios and podcasts). As for the exemplary teachers, they mostly learned to use technology on their own or had previous experience with technology. Their most common challenges were technical and institutional problems. The technologies most frequently used by the teachers were: Facebook, e-mail, Power points, Course Notes, Tutorials / Practice Exercises and Web links available online, Presentation Software and Videos. The least frequently used technologies were Web Conferencing, Twitter, Chat Rooms, Podcasts, Blogs and Wiki sites.

**Key words :** Lecture-related ICTs, Technology-related Pedagogical Practices, University Teachers, Myanmar

## 1. Introduction

Our Universities must fulfil the expectations of a new society, which is characterized by being more open, flexible, and competitive, and they must promote the use of Information and Communication Technologies (ICT). They must respond to students' needs, begin to think globally and to create new alliances, design new programmes, restructure their conceptions on the characteristics of learning environments, rebuild their conceptions on the value of knowledge, and develop internal policies to encourage innovation, experimentation, and University teachers' creativity. The setting in motion of this vision presupposes the considering of the potential of ICT to the benefit of education and the strengthening of its administration and financing. The new functions and competences required of teachers lead us to consider their formative needs. Teachers point out their need for being trained in the use of ICT in new teaching methods and in the assessment of learning (Pablos Pons, 2007). In Myanmar, some university teachers use diverse information and communication technologies (ICTs) in their teaching. This research showed that students are more satisfied with teaching where lecture-related ICTs are used (e.g., PowerPoint, videos), whereas university teachers felt that constructivist uses of ICTs (e.g., blogs, wikis) were more effective.

## 2. Research Objectives

The proposed objectives of this research are as follows:

2.1 Exploring university students' beliefs and attitudes concerning teachers' use of ICT in higher education.

2.2 Identifying conceptual and organizational difficulties encountered by teachers of the selected universities when making use of ICT as teaching tools.

## 3. Methodology

### 3.1 Sample

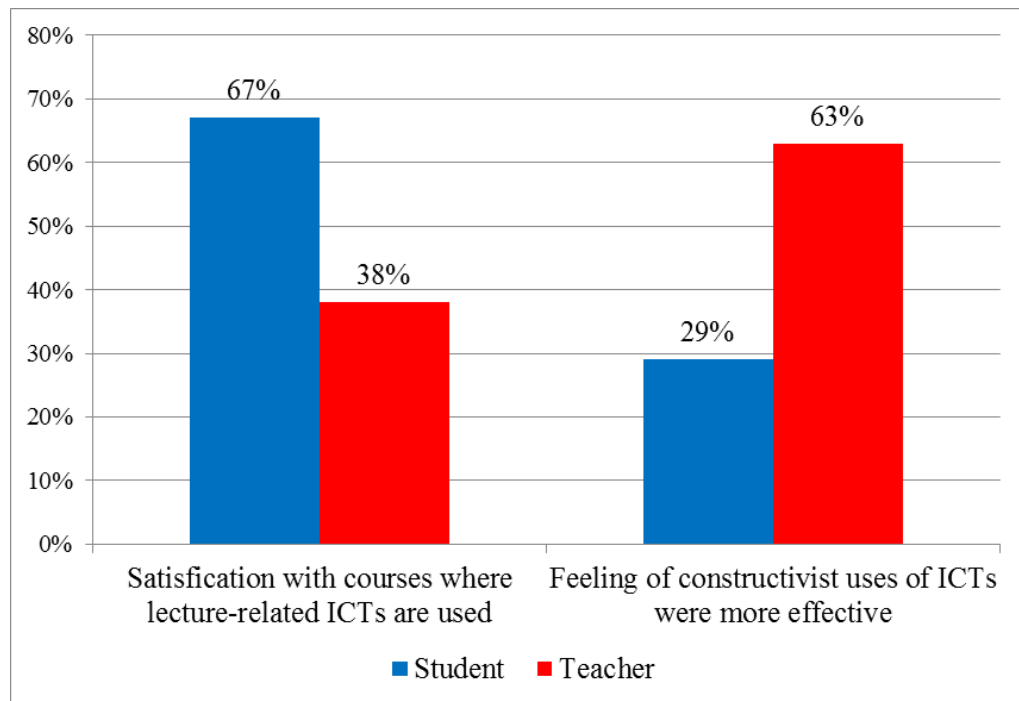
The researchers surveyed 74 students to see if their ICT preferences differed and also interviewed 31 university teachers nominated by their students as exemplary in their use of ICTs in teaching to find out about their ICT best practices and challenges. We interviewed university teachers deemed by their students to be excellent in use of technology. We identified them by surveying university students about their ICT likes, dislikes, suggestions and teacher nominations. We targeted students and teachers from different university types in Myanmar.

### 3.2 Instrument

Questionnaire (includes 23 technology related questions and the 37 item checklist of technology used by teachers) is used because there were few significant differences between the universities they attended. Items included statements like ‘I like courses where my professors use technology’ and ‘I am comfortable using technology’.

### 3.3 Data Collection

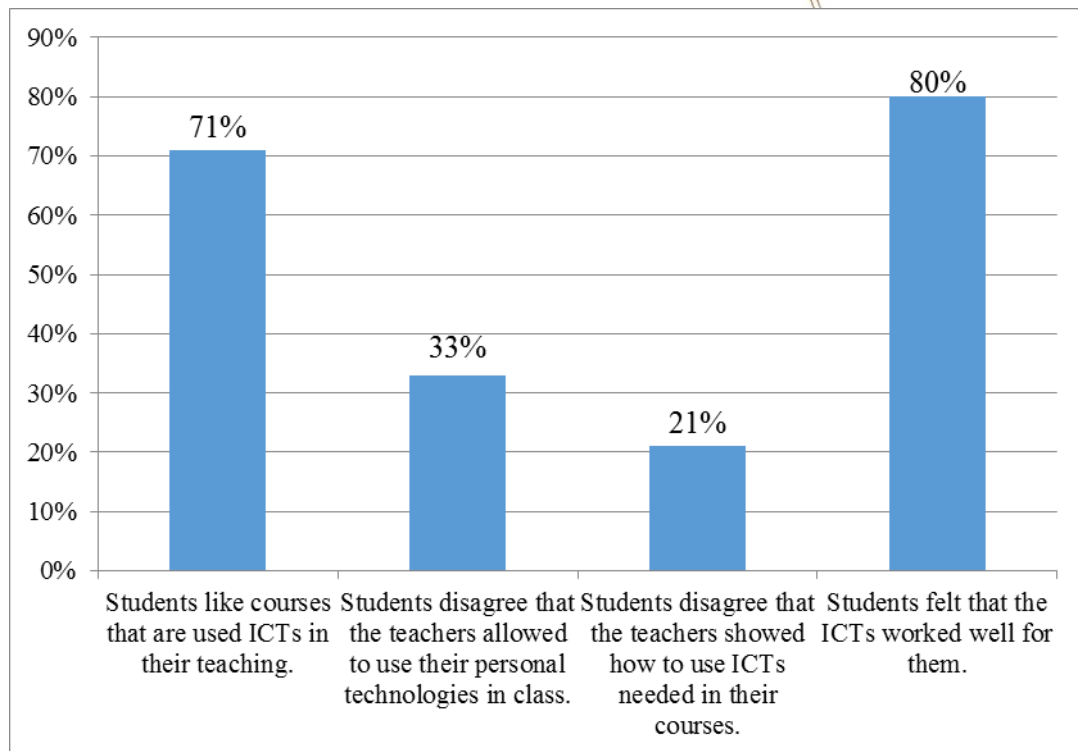
In the academic year 2017 we distributed paper and pencil surveys (Questionnaire for University Students) in general-education courses at selected universities. Students completed our questionnaire (E-Learning Questionnaire), which included a checklist (Computer Technology Checklist). After that, University teachers nominated by their students for excellent use of ICTs met with one interviewer and one note taker. A checklist of Computer Technology and interview questions for university teachers were used. Then, student and teacher data were analyzed. In fact, today’s university teachers reflect a powerful trend in tertiary education, which is to use diverse ICTs. Questions such as, “Does more extensive use of ICTs by University teachers ensure better learning?” and “Is teaching using ICTs seen as more or less effective by students and teachers?” have been asked and, yet, these have been shown to be overly simplistic. In this research, we explore the views, experiences and technology-related pedagogical practices of university teachers deemed by students to be excellent in their use of technology in teaching. According to the data, it has been found that some of the students engaged in more on-task behaviors, such as note-taking and other academic tasks, when university teachers used a structured approach to laptops in the classroom. Likewise, students spent less time on off-task behaviors, such as messaging and sending personal emails, when a structured approach was used. This study showed that, 67% of the students and 38% of the teachers are satisfied with courses where lecture-related ICTs are used (i.e., PowerPoint, videos), whereas 29% of the students and 63% of the university teachers felt that constructivist uses of ICTs (i.e., blogs, wikis) were more effective.



**Figure 1** Exploring university students' satisfaction and feeling concerning teachers' use of ICT in higher education

According to the data, the findings indicate that 71% of students like courses where their teachers used ICTs in their teaching. However, 33% of students disagree with the statement that teachers allowed them to use technologies in class and 21% of students disagreed with the statement that teachers showed them how to use ICTs needed in their courses. Over 80% of students felt that the following ICTs worked well for them: Course outlines and course notes / PowerPoint for lectures as well as the online submission of assignments, emails and presentation software. Many types of infrequently used ICTs by teachers were identified by students as working well for them. These include online materials (i.e., attendance records, tests), a variety of ICT tools used in class (i.e., grammar tools, language learning software), online tools (i.e., wikis, portfolios and podcasts) and virtual office hours.

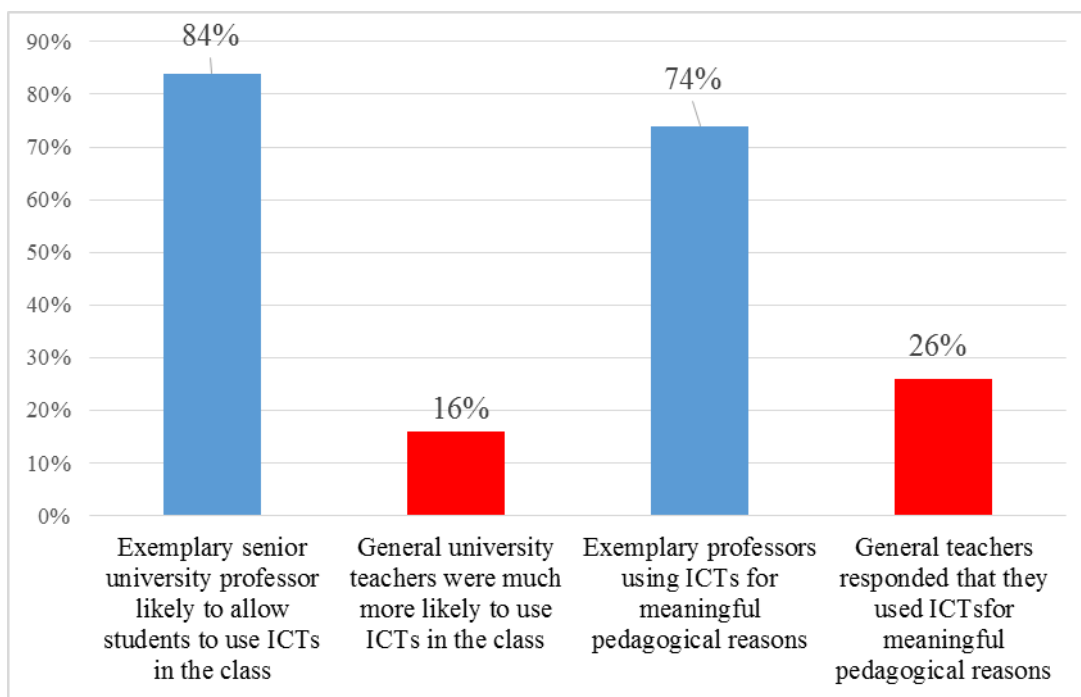




**Figure 2** Students' beliefs and attitudes concerning teachers' use of ICT in higher education of Myanmar

As for the exemplary teachers, they mostly learned to use technology on their own or had previous experience with technology. Their most common challenges were technical and institutional problems. The ten technologies most frequently used were: Facebook, e-mail, assignments, PowerPoints, course notes, tutorials / practice exercises and web links available online, presentation software and videos. The least frequently used technologies were web conferencing, Twitter, chat rooms, podcasts, LinkedIn, blogs and Wiki sites. To communicate with students, most teachers used e-mail, although some used other e-mail systems such as Gmail. A few teachers also used messaging, Facebook and virtual office hours. There were no significant differences between female and male teachers regarding comfort or proficiency using technology. Most of the exemplary teachers allowed their students to use technology in class. Thus, it is indeed worthwhile to invest in supporting teachers' use of technology and, more importantly, using it well. Most students liked it when their teachers used simple technology (e.g., email, teaching with PowerPoint); however, these ICTs had to be used well (i.e., quick response time, engaging visual support). It has been also found that 84% of exemplary senior university professors were much more likely to allow students

to use technology in the classroom than teachers in general. 74% of the exemplary professors responded that they used ICTs for meaningful pedagogical reasons.



**Figure 3** Responses towards the use technology in the classroom by exemplary senior university Professors

## 4. Results

### 4.1 Student Perspective

Many types of infrequently used ICTs were identified as working well for students. These include online materials such as attendance records and tests/quizzes; a variety of ICT tools used in class (i.e., grammar tools and checkers, language learning software). Students also offered ICT-related suggestions. Figure (3) shows the top four with examples, in rank order of frequency.

#### 4.1.1 Use and availability of technology at university

91% of the students make sure that each and every university should have better access to computer labs to work on their assignments or research related works and more accessible areas for Wi-Fi for phones and tablets.

#### 4.1.2 Instructors' knowledge and use of technology

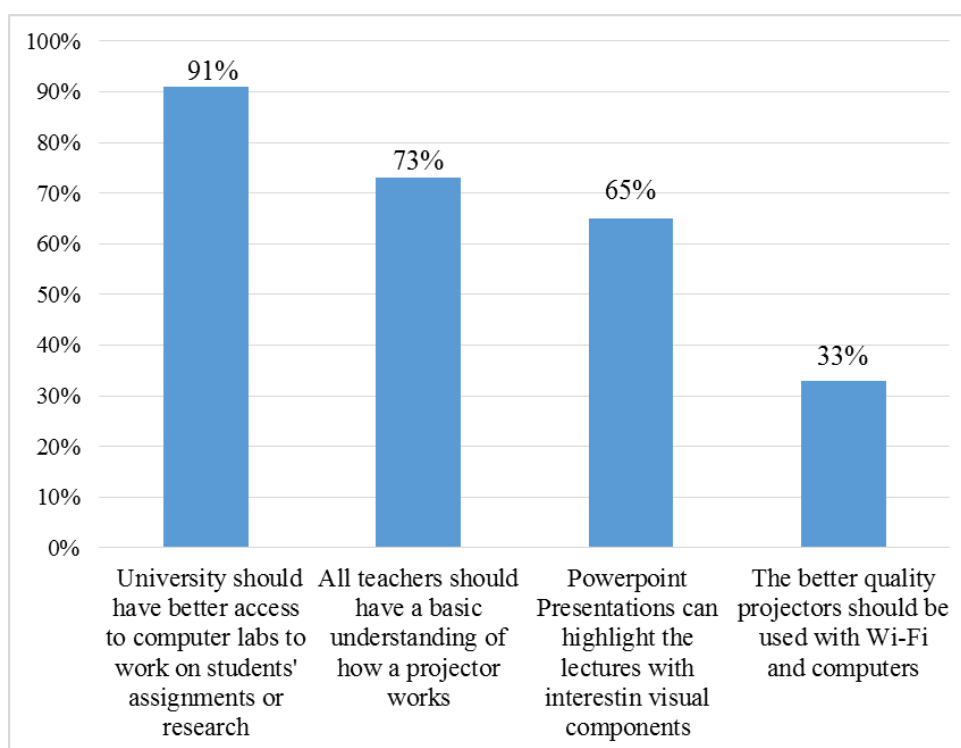
73% of the students make sure that all teachers should have a basic understanding of how a projector works; completed a basic course for teachers who are not used to practising a computer given by the university support.

#### 4.1.3 Presentation software: PowerPoint

65% of the students responded that PowerPoint presentations can highlight the lectures with interesting visual components like photos rather than just text.

#### 4.1.4 Performance of technology at university

33% of the students suggested that better quality projectors should be used since there are often some problems with Wi-Fi and computers are very slow in labs and classrooms.

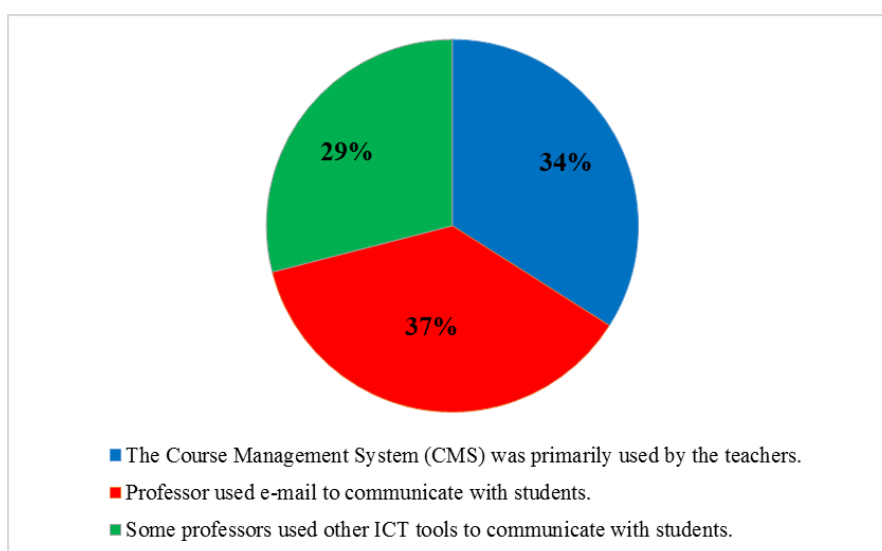


**Figure 4** Top four suggestions ICT-Related Solutions Given by Students

## 4.2 Teacher Perspective

Exemplary professors, nominated by their students for excellence in the use of ICTs in their teaching, mostly learned to use technology on their own or had previous experience with technology. Their most common challenges were technical and institutional problems; they mainly dealt with these problems on their own. The technologies most frequently used were facebook, email, assignments available online, computer labs, presentation software, web links available online, online submission of assignments, course notes / PowerPoints available online, videos, and tutorials / practice exercises available online. The technologies least frequently used were web conferencing, Twitter, chat rooms, mind mapping, podcasts, LinkedIn, blogs and Wiki

sites. In terms of the Course Management System (CMS), this was primarily used by the 34% of the teachers to post course notes and PowerPoint, and assignments online, web link and reading. For communicating with their students, 37% professors used e-mail, although some used other e-mail systems such as Gmail or a college e-mail. Some of them (29%) also used other means to communicate with students, including messaging, online chats and Facebook. Only a few teachers used Facebook to communicate with their students.



**Figure 5** Responses towards the use technology in the classroom by teachers in terms of the Course Management System (CMS)

## 5. Discussion

What makes this investigation unique is that ICT related pedagogical practice has been determined by the students and then operationalized by their teachers. The researchers were interested in the diversity of the student participants because different ICT-related pedagogical practices may be beneficial for one group of students but not for another. The results can be used to guide decisions about which ICTs should be used by teachers to meet specific learning objectives in diverse pedagogical contexts. Studying the experience of teachers use of ICTs, including the facilitators and obstacles they experience, has allowed us to gather information concerning “best practices”; something many faculties want to know about when designing courses which incorporate ICTs to ensure that these promote student engagement and motivation. This further emphasizes the need for understanding ICT “best practices” from the students’ perspective.

## 6. Conclusion

New points could be put into place which include guidelines for how face-to-face teaching environments could include students' personal technologies, where appropriate. Using a needs-analysis framework to survey students on a regular basis about their ICT likes and dislikes in the postsecondary environment would allow professors to target the ICTs most likely to increase student engagement and motivation. We need to hear from exemplary professors on a more regular basis as this is essential for identifying facilitators and barriers. Finally, asking students and professors identical questions provides a framework for comparative analysis which, in turn, allows professors to get the 'right fit' when choosing and effectively using ICTs in their teaching.

## 7. Recommendation

This research contributes to the firmly established field of ICTs and tertiary level pedagogy and less common research on ICTs in higher education. Practically speaking; it allows administrators, professionals and practitioners to learn and apply best practices. Below is a breakdown of these contributions:

7.1 An overwhelming majority of students like it when their professors use technology in their teaching.

7.2 Most students liked it when their professors used simple forms of technology (i.e., emails to communicate, posting grades online, PowerPoint); however, these ICTs had to be used well (i.e., a quick response time, clear and engaging visual support).

7.3 Exemplary professors are more likely to allow students to use technology in the classroom than professors in general.

7.4 Exemplary professors use ICTs for meaningful pedagogical reasons – as opposed to using an ICT for the sole purpose of using technology in teaching.

7.5 When student and teacher results are compared, there are still discrepancies in a variety of ICT areas.

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## Optimizing Students Writing Proficiency using Metalinguistic Corrective Feedback

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### Abstract

This study determined the effect of metalinguistic corrective feedback on the writing proficiency of the 30 second year Bachelor in Secondary Education major in English students at the College of Teacher Education, University of Northern Philippines, Vigan City during the Second Semester, School Year 2015-2016. It likewise looked into the students' level of writing proficiency before and after the use of the corrective feedback.

Data gathered using the writing outputs of students and a writing rubric were treated using mean and t-test.

Based on the results, it is concluded that the overall writing proficiency of the students improved from "Good" to "Very Good" after the use of metalinguistic corrective feedback. Likewise, their proficiency along the specific writing indicators improved from "Good" to "Very Good" after their exposure to the treatment. Thus, metalinguistic corrective feedback is effective in enhancing the writing proficiency of the students.

Since the use metalinguistic corrective feedback resulted in significant writing improvement among students, it is recommended that writing teachers use it in their classes. This will enable the students to monitor and become more responsible of their errors and be able to do self-repair. Also, teachers may want to try other written corrective feedback types to be able to vary their strategies in helping the students improve their writing proficiency.

**Keywords :** Writing Proficiency, Metalinguistic Corrective Feedback, College Students

## K to 12 Deliverance: Basis for the Generation of 21<sup>st</sup> Century Instruction

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### Abstract

The K to 12 Curriculum was a recent change in the Philippine educational system seen as critical in giving Filipino students a higher quality of education that prepares them for the 21<sup>st</sup> Century instruction. This study aimed to evaluate the K to 12 Training Program of the University of Northern Philippines (UNP) in terms of delivery of the program, knowledge and understanding of the curriculum's contents, learning satisfaction of participants and problems encountered related to the training. It also determined the teachers' performance as influenced by the training program factors. The descriptive-evaluation research design was employed with the use of questionnaires. The teacher trainees and administrators of secondary schools in the three Divisions of Ilocos Sur served as respondents of this study. The mean and Multiple Linear Regression analysis were used to treat the data. The results of the study are as follows: The respondents rated attainment of goals/objectives of the training program highly attained; the program planning management and preparation was highly implemented; the conveyance of learning outcomes, trainers performance, usefulness of the training, provision of support materials and equipment, suitability of training venues, laboratories and facilities and program management team were evaluated high. In terms of the knowledge and understanding on the contents of the BEC, the respondents rated high the following: benefits, goals and features, standards and competencies of the 21<sup>st</sup> century, pedagogical approaches, qualities of the 21<sup>st</sup> century teachers and assessment of learning outcomes. Satisfaction of the participants on the learning of the contents was rated with high satisfaction. The performance of the teachers were rated by the administrators and the teachers themselves and the over-all results was high performance. This was rated based on the following components of teachers' performance: Core behavioral like self-management, professionalism and ethics, results focus, teamwork, service orientation innovation, core skills competencies such as



achievement, managing diversity and accountability. The Regression Analysis showed the teachers performance significantly influenced by the -input factors of the K to 12 training delivery program, knowledge and understanding on the BEC Contents and satisfaction of the participants. These contributed almost 50 percent variance of the performance of the teachers after the training. The other 50 percent is explained by other factors not considered in this study. Knowledge and understanding on the BEC has the greatest contribution on the teachers' performance followed by training delivery program and satisfaction of the participants on the learning outcomes each of which yielded significant result. In conclusion, UNP as a training venue provided the necessary and needed preparation in the roll out of the program. Therefore, as a seat of excellence and knowledge provider, it must generate more to address 21<sup>st</sup> century needs in instruction.

**Keywords :** K to 12 Curriculum, Deliverance, 21<sup>st</sup> Century Instruction, Teacher Training



## Humanities and Social Sciences (Oral Presentation)

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## Ethos, Logos and Pathos in Patient-Doctor Communication at a Nepali Hospital

Eak Prasad Duwadi

Research Assistants: Sindhu Rijal, Sujan Nepal, Sweta Shrestha, Sushilata Sapkota and Sadikshya Dahal

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### Abstract

This research studies the quality of patient-doctor communication in a Nepali hospital. It is conjectured that a problem exists in doctor-patient communication in Nepali hospitals. The primary objective of this research is to determine the status of patient-doctor communication in a Nepali hospital. In this research, Aristotle's ideas of ethos, logos, and pathos are used as a framework to better understand / interpret the communicative findings of the research. Because of the lack of data, an empirically based survey is adopted for generating data. Finally, the data are categorized in terms of ethos, logos and pathos. Findings suggest that all emotional appeals, logical appeals and emotional appeals are satisfactory in patient-doctor communication in a Nepali hospital.

**Key Words :** Patient-Doctor Communication, Ethos, Logos, Pathos

### 1. Introduction

This research studies the quality of patient-doctor communication in a Nepali hospital. Although rarely studied, physician-patient interactions immediately following diagnostic tests are significant medical events because during these encounters the physician and patient often make decisions about major and sometimes invasive treatment (Gordan et. al. 2005: 1). This is the university hospital of Kathmandu University for all medical programs. A Nepali hospital is located in Dhulikhel (in Kavre), is famous for its stunning scenic beauty and pleasant weather. It serves millions of people in neighboring districts.

Patient-doctor communication is important as no proper diagnosis or treatment occurs without a proper communication, but big data on this topic are lacking as enough studies on this issues have not taken place until now in Nepal.

Big data is a recent phenomenon, and given its rapid implementation and deployment there are ongoing debates as to what constitutes big data and its associated characteristics. Some definitions, such as that big data are any dataset too large to fit in an Excel spreadsheet or be stored on a single machine (Strom 2012), are quite trite and unhelpful, reducing big data to merely volume. (Kitchin. 2014: 2)

Therefore, this study analyzes whether doctors and patients interact with each other to make sense of the illnesses and to position themselves in a wider medical and social reality, and also examines if the importance is seen in this hospital.

### 1.1. Research Questions

a. What is the condition of doctor-patient communication at a Nepali hospital?

b. Which aspects affect the quality of doctor-patient communication at a Nepali hospital?

### 1.2. Significance of Study

In the twenty first century, Nepal also has well informed society, where patients expect to be treated as gods. But, many hospitals in Nepal are not driven by this axiom, and services that patients receive in these institutions are an area that demands attention throughout the country. Neither most of doctors do thoroughly listen to what patient have to say, nor they show proper empathy, so they often miss very important history of their sickness.

This is the reason why many hospitals are sometimes vandalized (Rai & Rai. 2018: 3), and patients seem to have stopped trusting these institutions, and attracted to health care centers abroad. Several of such incidents of doctor-patient communication in Nepal usually are reported in local newspapers. However, these reports also fail to cover the width and depth of the range of doctor-patient relations.

## 2. Methodology

This research is guided primarily by Aristotle's rhetoric: Ethos, logos and pathos. An empirical method (survey) is adopted for generating data. Finally, the data are categorized in terms of ethos, logos and pathos. Before the surveys, the researchers develop good pathos with the doctors to create satisfying contexts.

Age, race, ethnicity, socioeconomic background, believes, attitudes, and interests determine our perceptions towards other fellows. Besides education level, there is a gap in language proficiency between the patients and doctors.

## 2.1 Participants and sampling

The study utilized purposive sample. The researchers interviewed and surveyed patients and doctors at a Nepali hospital in Kavre, Nepal. Sampling involved approaching those persons who are willing to be surveyed, and inviting them to respond to the questions.

The survey was designed by researcher to examine the perceptions of doctors and patients regarding communication between them. 50 doctors and 300 patients receiving outpatient services were surveyed mainly diabetes, epilepsy, vitiligo, high pressure and heart problems.

With prior information, the researchers went to the hospital and waited until the doctors were free. Then, they met the doctors at their own department privately. However, as scheduled before, all participants were not present due to some unavoidable reasons. Therefore, the researchers had to go to the hospital at least five times to complete the survey. Similar method was adopted to survey the patients. Only the difference was that in majority cases, the patients' relatives filled in the survey form. Moreover, many patients refused to take part in that survey. This approach, thus, influenced positively to accomplish the objectives of this study.

In order for the study to be replicated, the procedures for data collection and analysis are sufficiently detailed. Data-analysis procedures conform to the research design, hypotheses, models, or theory drives the data analyses. Rhetorical triangle is essential to persuasion. Ethos, logo, and pathos are the key elements of the triangle. Data are analyzed by examining how much pathos, ethos and logos are expressed. The above framework is used to extract the degree of persuasion in their conversations.

**Table 1** Data analysis plan

Patient		Doctor	
Gender:	Age:	Gender:	Age:
Education:		Specialty:	
Duration of the disease (months):		Years from graduation:	
Duration of the medical observations (in months):		Years from Becoming Specialist:	
		Professional Status:	

**Table 1** (Continue)

Patient	Doctor		
Transcripts of Doctor and Patient Conservation	Rational Appeals (Logos) Facts Logical reasoning Authority voices	Emotional Appeals (Pathos) Friendliness Love Sympathy Greed/Lust Revenge	Ethical Appeals (Ethos) Trustworthiness Credibility Reliability Expert proof Reliable sources

Source: Author

### 3. Results

According to Judy Segal (2009) health and the rhetoric of medicine explores persistent health conditions that resist conventional medical solutions. The findings of this research also echo the same. The results of the analysis are grouped into three main categories: ethical appeals, logical appeals, and emotional appeals.

#### 3.1 Ethical appeals

From the first section (patients' questionnaires), according to the scales (i. Strongly Agree ii. Agree iii. Disagree iv. Strongly Disagree), ninety seven percentage patients indicated they trust the doctor, but 3percentage disagreed about trusting the doctor. Sixty percentage of patients agreed upon the procedure they follow for the best outcome of their problem, thirty seven percentage strongly agree, but three percentage disagree. Sixty seven percentage patient disagrees about the secret hope not to see the doctor again. Thirty percentage agree, but three percentage strongly disagree. Seventy seven percentage patient disagree that they feel angry sometimes when doctor ask them some questions. Thirteen percentage strongly disagree, but percentage agree. Ninety percentage disagree that they feel the doctor is not totally honest about their feelings toward them. Seven percentage agree, but three percentage strongly disagree. Eighty seven percentage patients agreed that the doctor speaks their mother tongue, thirteen percentage disagreed to that.

In the second section (doctors' questionnaire), according to the survey, twenty percentage strongly agreed, but eighty percentage doctors strongly agreed that doctors and patients trust each other. Twenty percentage strongly agreed and eighty percentage agreed doctors can help patients according to the patients' expectation. Sixty percentage doctors strongly agreed that they are clear why the patient come to visit and forty percentage agreed that they are almost clear to what the patients want them to do in these visit. Fifty percentage doctors agreed that they did not want to see the same patients again. Whereas thirty percentage strongly disagreed, and twenty percentage disagreed those they secretly do not want to see the patients again. Sixty percentage of the doctors agreed that their patience used to exhaust with the patient, but other forty percentage disagreed that they have strong patience with the patients. Fifty percentage of the doctors agreed that they were criticized by the patients about their treatment.

Nonetheless, forty percentage of the doctors did not agree that they were criticized by the patients about their treatment, but other ten percentage of the doctors strongly disagreed about it. On the basis of these responses, we tried to analyze the doctors' honesty of overall patient-doctor communication in a Nepali hospital.

### **3.2 Logical Appeals**

In the first section (patients' questionnaire), according to the survey, eighty seven percentage patients agreed that the doctors perceive accurately what their problems are, but thirteen percentage disagreed. Ninety seven percentage patients agreed that the results of the meeting with the doctor are very important, but three percentage disagreed. As per the survey, eighty seven percentage patient disagree that the thing the doctor was asking them, did not make sense. Ten percentage agreed, but three percentage strongly agreed. Eighty three percentage patients disagree that they understand what the doctor wrote in prescriptions, but seventeen percentage agreed. According to the survey, Ninety seven percentage patients agreed that they like the way the doctor explained them about their treatment procedure, but three percentage disagreed.

In the second section (doctors' questionnaire), forty percentage strongly agreed and 60 percentage agreed that their sessions were very important. However, none strongly disagreed or disagreed to it. It means almost all achieved the goals of the sessions with the patients. Ten percentage strongly agreed and ninety percentage agreed that their sessions were very important. However, none strongly disagreed or disagreed to it. It means almost all doctors believed patients understood the language

they used, and there was better communication. Ten percentage strongly agreed and twenty percentage agreed doctors understand what they were trying to do. None strongly disagreed, however, seventy percentage disagreed to it. Twenty percentage strongly agreed and eighty percentage agreed that patients perceived doctors' goals accurately. With the question of their procedure they followed for the best outcome, fifty percentage doctors strongly agreed and fifty percentage agreed whereas there is not any negative answer of disagreement. Eighty percentage of the doctors agreed that the thing the patients were asking them had complete sense where as other twenty percentage disagreed to the claim.

It means most of doctors believed that they were following for the best outcome. Fifty percentage of the doctors agreed that they used online resources to diagnose and treat the patient's diseases whereas thirty percentage of the doctors strongly agreed about it. But twenty percentage of the doctors disagreed about using online recourses while treating patients. The patients thought that the results of the meeting were very important in patient-doctor communication in a Nepali hospital.

### **3.3 Emotional appeals**

In the first section (patients' questionnaire), according to survey, seventy seven percentage patients agreed that their last visit with the doctor was satisfying whereas seventeen percentage disagreed and three percentage strongly agreed and strongly disagreed respectively. Eighty five percentage patients said that doctor understood them and their problem, but thirteen percentage disagreed to that. And two percentage strongly agreed that doctors understood them. Eighty three percentage patients disagreed that the doctors did not show any patience with them, fourteen percentage agreed, but three percentage strongly disagreed. Hundred percentage patients agreed that doctor-patient relationship was very important. Fifty seven percentage patients were found to disagree having sympathy for the doctors, and forty three percentage agreed. Seventy percentage disagreed about feeling uncomfortable with the doctors, but thirty percentage agreed.

In the second section (doctors' questionnaire), according to the survey, twenty percentage doctors agreed that their recent case was very satisfying for them. Similarly, sixty percentage strongly agreed to it. However, three percentage disagreed, and none strongly disagreed. Thirty percentage strongly agreed and seventy percentage agreed that the patients' and doctors' relationship was very important. Forty percentage strongly agreed and fifty percentage agreed that patients perceived doctors' goals accurately. Ten percentage strongly disagreed, but none disagreed to it. Eighty





Most of the people agree with the things the doctors ask them to do. On the basis of these responses, we analyzed the trust of overall patient-doctor communication in a Nepali hospital. It is found that all emotional appeals, logical appeals and emotional appeals separately are good in patient-doctor communication in a Nepali hospital. However, the balance among ethos, logos and pathos lacks even in that hospital.

## 5. Limitations to This Study and Its Approach

This study was done in a university hospital that is comparatively a better one. Moreover, in other aspects of healthcare institutions like nurses, patients' relatives and the doctors' social backgrounds, can impact differently on doctor patient communication in Nepali hospitals. However, this study has analyzed the ethos, logos and pathos on the basis of surveys only.

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## The Impact of Short Academic Programs in Entrepreneurship Education on Self-confidence and Entrepreneurial Intentions in Students

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### Abstract

The need for entrepreneurial thinking and acting is a common feature in business environments, both for entrepreneurs and intrapreneurs. The desire to become an entrepreneur demands for better entrepreneurial skills and entrepreneurship education and raises the question how to increase both. This empirical study explores the value of an International Summer University in entrepreneurship education, a short academic program of three weeks with transferable credits: Can entrepreneurship be triggered by studying at a summer school in entrepreneurship? How is the impact of serendipitous experiences of students on their interest in further entrepreneurship studies, their confidence levels, and how they eventually perform towards their entrepreneurial outcome with entrepreneurial intentions? Our findings show that a diverse summer school program can be a learning environment that contributes to the decision to become an entrepreneur. In addition, this program can instill the desire for further entrepreneurship education in female students, nurtured by the experience of increased self-confidence through the short academic program; and entrepreneurial intentions for male and female students are significantly impacted through an academic short program with serendipitous elements, especially for students with family business background.

**Keywords :** Entrepreneurship Education, entrepreneurial intention, serendipitous entrepreneurship, self-confidence, short academic programs

## 1. Introduction

The need for entrepreneurial thinking and acting is a common feature in business environments, both for entrepreneurs and intrapreneurs. The desire to become an entrepreneur demands for better entrepreneurial skills and entrepreneurship education and raises the question how to increase both. This empirical study explores the value of an International Summer University in entrepreneurship education, a short academic program of three weeks with transferable credits: Can entrepreneurship be triggered by studying at a summer school in entrepreneurship? What are incubating and accelerating components, using serendipitous concepts in a multi-dimensional program structure with a combination of lectures, company visits and “meet the entrepreneur” sessions, bridging academics and practice? Despite the knowledge that entrepreneurial activities of women are an important way to achieve leadership roles, women entrepreneurs are underrepresented in nearly every economy. As a result, a short academic program for female students with a specifically designed portfolio including culture shock elements can result in higher interest in entrepreneurship and contribute to higher rates of women entering entrepreneurship education and in series to increased women entrepreneurship rates.

Entrepreneurs and their talents drive innovation, technological change and economic achievements, crucial for economic growth, higher income of the population and societal well-being (Yanya, Abdul-Hakim, & Abdul-Razak, 2013) by transforming needs of achievements into economic growth (Landstrm, Harirchi, & strm, 2012). Half of the entrepreneurial talents in an ecosystem are female, and very often this resource is utilized less despite the existing knowledge of the importance of entrepreneurial activities of women, for example to achieve leadership roles (Bullough, De Luque, Abdelzاهر, & Heim, 2015) or to enhance their societies (Kelley, Brush, Greene, & Litovsky, 2011). Differing women entrepreneurship rates mirror their differing impact on innovation and job creation (Kelley et al., 2015). Educated women are more likely to invest in health and education of their children than their male counterparts, thus creating a positive societal cycle. In addition to economic enhancements, women empowerment and increased gender equality is regarded as a tool to combat poverty, hunger and disease and to stimulate sustainable developments in economies (Neimanis & Tortisyn, 2003). However, economies are lagging behind due to rapidly increasing economic globalization and its effects on societies, and vulnerable employment and gender disparity prevail (Pea-Lpez, 2015).

Our study tries to explore the impact of serendipitous experiences of students on their interest in further entrepreneurship studies, their confidence levels, and how they eventually perform towards their entrepreneurial outcome with entrepreneurial intentions.

### **1.1 Entrepreneurship education**

Evaluating entrepreneurship education proves to be a more complex process and one of seven main categories centers around program leadership, the commitment of involved professors and entrepreneurs as role models, university administrators and student engagement (Vesper & Gartner, 1997). Evaluation of entrepreneurship programs is limited and –if conducted- usually aims to understand students’ attitudes at the end of a specific program (Kailer, 2007; Karlsson & Moberg, 2013). Previous research indicates that regular assessments of study courses do not lead to an evaluation of their entrepreneurial skills and abilities (Kailer, 2007; Moberg, 2011). There is a research gap if specific courses can support the development of entrepreneurial skills and capabilities. Despite an increasing number of programs directed towards women and their leadership skills, there is also little research on effective education or training for women entrepreneurs and how the course design may contribute to sustainable success in entrepreneurship education programs (Bullough et al., 2015).

Previous research indicates that there is a small yet significant correlation between entrepreneurship education and entrepreneurial intention (Bae, Qian, Miao, & Fiet, 2014; Martin, McNally, & Kay, 2013). Action-based and experiential approaches to developing entrepreneurial capabilities are an important tool in developing entrepreneurial skill sets (Erkkil, 2000; Gibb, 2008; Heinonen & Hytti, 2010). Objectives of entrepreneurship education intend to deliver broader perspectives, entrepreneurial knowledge base and skillset, and entrepreneurial behavior for future entrepreneurial activities to students (Blenker, Dreisler, & Kjeldsen, 2006; Ilozor, Sarki, Hodd, Heinonen, & Poikkijoki, 2006; Moberg, 2011). However, there is a gap in literature about when, how and why this learning environment contributes to the decision to become an entrepreneur which leaves this field open for individual assessments of individual courses (Moberg, 2011).

Wilson, Kickul, and Marlino (2007) suggest that entrepreneurship education is more important for females than for males by increasing self-efficacy as an important entrepreneurial trait. For potential women entrepreneurs, successful targeted entrepreneurship training can raise their levels of self-efficacy and increase their interest in starting a business. Matlay et al (2010) found that female students generally perceived

lower positive attitudes towards entrepreneurship after course completion compared to males whereas the course impact itself was perceived to be higher for female students. Results suggest that female students benefitted considerably from their learning experience in the entrepreneurship course in terms of perceptions of pursuing an entrepreneurial career.

### **1.2 Self-confidence and self-efficacy**

Minniti and Naud (2010) conclude that women in developing nations tend to be more self-confident about their abilities as compared with developed nations to start a business. Beliefs in the own capability produce direct impact on entrepreneurial action and a strong self-confidence about one's own capability in term of self-efficacy potentially drives an entrepreneur to accomplish a desired goal (Cassar & Friedman, 2009). There is growing literature emphasizing on the entrepreneurial self-efficacy in order to further understand the entrepreneurial success as well as its influences in entrepreneurial ventures (Boyd & Vozikis, 1994; Drnovsek, Wincent, & Cardon, 2010; Segal, Borgia, & Schoenfeld, 2005). Many scholars therefore opine that entrepreneurial self-efficacy is closely linked with business intentions (Krueger, Reilly, & Carsrud, 2000), new business growth and personal success (Drnovsek et al., 2010). Scholars conclude that self-efficacy with high risk preferences is especially strong in achieving entrepreneurial intentions (Barbosa, Gerhardt, & Kickul, 2007; Wilson et al, 2007). Despite different beliefs and feelings with respect to a challenging task, an individual with strong self-efficacy is more ready to excise control over negative thinking such as for example fear of failure in the process of entrepreneurial venturing (Ozer & Bandura, 1990).

### **1.3 Serendipity and Culture Shock**

Serendipitous entrepreneurship includes elements of “Culture Shock” or “Out of Comfort Zone” with the intention to challenge the students. Serendipity may be quite prevalent in entrepreneurship (Rasmussen & Srheim, 2006) and “can be the result of chance, good timing, or simply being in the right place at the right time” (Wennberg, 2010, p.11). Entrepreneurship is not always a streamlined planning process and is frequently not completely intentional. For many entrepreneurs, start-up intentions tend to stay “wishful thinking” and do not take place, whereas others discover sudden entrepreneurial opportunities, triggered through activities or events. Serendipity in entrepreneurship can be described as an exploration while suddenly stumbling over a potential idea, a new concept, an unintended discovery; something that gets the person started into entrepreneurial activities. To make serendipity part of the summer course, several success factors have to come together: the location and the host educator, the





4=average, 5=below average and 6=failed. The statistics used to assess the quantitative survey were percentages and the significance of the answers to the research question was tested by using regression. The international program with transferable credits included cross-cultural experiences, unexpected elements, sending the students on a roller-coaster of cultural differences, travel, company visits and meetings with entrepreneurs in several regions in Thailand. In addition, the students completed reflective essays on their experiences, which are integrated in the analysis as qualitative data.

### 3.3 Data Collection

The data collection by quantitative survey was done on the last day of the international summer program and includes 82 variables which assess both overall experience and students' self-assessment as the rating of individual program points in the three weeks and the overall program to see the impact of the serendipitous events on the students' self-confidence and entrepreneurial intentions.

### 3.4 Data Analysis

Dependent variables were used according to our research objectives: (1) further studies in entrepreneurship education, (2) self-confidence levels and (2) entrepreneurial intentions. The results of our frequency and our regression analysis show gender related differences in entrepreneurship education through short academic programs. Of those students with a family business background 81.3 percent of the male and 63.6 percent of the female students were more interested in entrepreneurship after the three week program, whereas especially the female students who did not come from family businesses were significantly more interested (91.7 percent) in entrepreneurship than before, compared to only 75 percent of their male counterparts.

Overall, 81 percent of the female and 78 percent of the male students were more interested in entrepreneurship after the course. 70.8 percent of the male students and 48.7 percent of the female students intend to start their own business three years after completion of their studies. Whereas male students tend to have better or very much better entrepreneurial skills after the three weeks (male: 64.3 percent; female 57.9 percent), female students perceive better and very much better confidence levels (male: 63.4 percent; female: 74.2 percent). In addition, no significance was found for male students with regard to studying an entrepreneurship master program and to more interest in entrepreneurship, whereas both variables were significant for female students.

Family business background proved not to be significant to further studies in the master program for female students. Regression analysis showed the highest

significance for those female students who had increased their confidence level during the program (.000), to age (.012), an increase in their interest in entrepreneurship (.015) and a perceived increase in their entrepreneurial skillset (.022) after the program. An increase in self-confidence proved significant for the 100 students (.014) and was solely influenced by an increase in their entrepreneurial skill set, which they acquired during the three week program. The program also showed significant influence on entrepreneurial intent with intentions to start a business in the next three years (.015) as does family business background (.006).

#### 4. Research Results

The results are presented according to the research objectives as follows:

4.1 The impact of serendipitous experiences of students on their interest in further entrepreneurship studies: The R Square values show that 35% variance is accounted for female students for further entrepreneurship studies as dependent variable. The significant results for female students to further their studies with an entrepreneurship master program (ANOVA for female .016; for male .525) are shown in Table 1.

**Table 1** Increased interest in further entrepreneurship studies of female students

Independent Variables	Beta	Sig.
age	.282	.038
family business background (father, mother, close relatives)	-.155	.273
first time in Thailand	-.264	.081
first time in Asia	.014	.927
overall summer school program	-.237	.074
increase in entrepreneurial interest	-.048	.800
increase in confidence	.596	.004
increase in entrepreneurial skills	-.240	.140
entrepreneurial intentions	.233	.095

As shown in Table 1, the increase in interest in further entrepreneurship studies of the 58 female students was significantly influenced by their age (.038) and their perceived increase in their confidence levels (.004). Interestingly, increase in entrepreneurial interest in general and increase in entrepreneurial skills as well as

stemming from a family business background were not relevant as the overall program failed to deliver the expected result.

4.2 The impact of serendipitous experiences of the 100 students on their confidence levels proved significant in ANOVA with .000. The R Square values show that 35% variance is accounted for the overall model with self-confidence as dependent variable. The results for increased confidence level after the three week course are shown in Table 2.

**Table 2** Increased self-confidence level in students

Independent Variables	Beta	Sig.
age	-.084	.379
gender	-.075	.429
family business background (father, mother, close relatives)	.075	.436
first time in Thailand	-.014	.891
first time in Asia	.026	.810
overall summer school program	.042	.666
increase in entrepreneurial interest	.398	.000
increase in entrepreneurial skills	.275	.009
entrepreneurial intentions	.126	.208

As shown in Table 2, the increase in students' self-confidence levels was significantly influenced by their increase in entrepreneurial interest (.000) and entrepreneurial skills they gained in the three week program (.009). Serendipitous elements by first time visits to Thailand or Asia and the overall program were not significant for their increase in confidence.

4.3 The impact of the structured serendipitous program on students' entrepreneurial intentions to start a business in the next three years were significant (.008) and the R Square values show that 22.6% variance is accounted for the students for entrepreneurial intent. The results for entrepreneurial intentions after the three week course are shown in Table 3.

**Table 3** Entrepreneurial intentions of students

Independent Variables	Beta	Sig.
age	.082	.431
gender	-.097	.346
family business background (father, mother, close relatives)	.278	.007
first time in Thailand	.005	.968
first time in Asia	-.091	.437
overall summer school program	.244	.018
increase in entrepreneurial interest	-.215	.079
increase in confidence	.150	.208
increase in entrepreneurial skills	.078	.506

As shown in Table 3, entrepreneurial intentions of students were significantly influenced by their family business background (.007) and by the overall summer school program (.018) with its serendipitous elements in the three weeks. Other elements were not significant for their entrepreneurial intentions to start an own business within the next three years.

## 5. Discussion

Our findings suggest that female students can benefit from short academic programs in entrepreneurship with an increased interest in entrepreneurial education depending on increased confidence levels and on their age. The regression results also show that the short academic program significantly and positively influenced the students' self-confidence levels of both genders due to an increase in a general interest in entrepreneurship and an increase in their entrepreneurial skills' perceptions. Finally, concrete start-up intentions were triggered by the overall summer school program and for those students who come from a family business background.

Our study confirms previous studies that there is a small yet significant correlation between entrepreneurship education and entrepreneurial intentions (Bae, et al., 2014; Martin, et al., 2013) and that this is not only prevalent for general entrepreneurship education, but also for short academic programs. The suggestion of Wilson et al (2007) that entrepreneurship education is more important for female students than males to increase self-efficacy as an entrepreneurial trait is supported in the findings, that only the female students show a significant increase in entrepreneurial

interest for future studies, supported by their increased confidence levels. In addition, higher confidence levels for both female and male students are significantly influenced by a gain of higher entrepreneurial interest and entrepreneurial skills' perceptions.

Challenging students to go beyond their comfort zone seems to trigger entrepreneurial intentions in a combination with giving them the possibility to network with entrepreneurs. General entrepreneurship education –experienced in a culturally new environment with culture shock elements are additional supporting elements in increased entrepreneurial intent. Family business background in combination with this specific summer school program finally leads to entrepreneurial intentions, wanting to start a business within the next three years.

## **6. Conclusion**

Our study shows that a diverse summer school program, including confrontation of students with serendipitous and culture shock elements, forms a learning environment that contributes to the decision to become an entrepreneur, confirming Moberg (2011). These findings, despite the need for further studies, can be a first answer to the research gap and existing limitations in entrepreneurship course evaluations, if courses can actually support the development of an entrepreneurial skillset and entrepreneurial capabilities and abilities (Kailer, 2007; Moberg, 2011) and –even more important- lead to entrepreneurial intentions.

Bridging the gap of female inclusion in entrepreneurship, this study shows that the desire for further entrepreneurship education can be instilled in female students, nurtured by the experience of increased self-confidence through the short academic program. Entrepreneurial intentions can be triggered through an academic short program with serendipitous elements, especially significant if there is a family business background.

## **7. Recommendations**

Our study shows, that entrepreneurship education in form of short academic programs can influence self-confidence and entrepreneurial intent in students, however further studies need to explore, which elements in a short academic program and which combinations of program points might be relevant for these findings. Further research should more deeply address key elements of the serendipitous program points and culture shock elements in the setting of international students coming to another culture

in Asia for entrepreneurship education. In addition, future research in different context is needed to be able to more generalize these findings.

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the clay area is protected by the government. However, the pottery businesses in Andong Reusey had been constrained by internal weaknesses and external threats. The weaknesses include low productivity due to technology issue, insufficient capital, lack of market strategies, and poor logistics. The threats are in relation to product quality, the increase of substitute and replacement products, lack of network and training, and the effect of climate in rainy season.

**Keywords :** pottery business, development guidelines, promote community economy, Andong Reusey Village

## 1. Introduction

Pottery has a very close relation with daily life of Cambodian people since prehistory, particularly 5200 years before century (Stark, 2003). They have creative wisdom in producing pottery for the purposes of cooking and storing food, and for containing water and other small articles. The techniques in producing pottery may be developed from time to time and slightly differently from one community to another. The pattern of design and decoration may also be different according to the ability of the potter and the local resources they used. The craft art of producing pottery became the main business or career of people in many communities until nowadays.

The present Cambodia is a small and poor country in Southeast Asia. Community development is the priority issue for the kingdom. According to UNDP, 35 percent of Cambodian, especially rural people, are living under poverty (Dara, 2018). In order to promote community economy and be self-sufficient, the community should develop their business or create products more independently on utilizing local resources including local wisdom, culture, tradition, natural resources, and even the advantage of geography (Samneang, 2018).

Andong Reusey Village of Kampong Chhnang Province is famously known as the hub of pottery producers in Cambodia since the ancient time. The village is located in Srae Thmei Commune, Rolear B'er District, Kampong Chhnang Province, Kingdom of Cambodia. Almost everyone in the village has pottery wisdom which has contributed a lot to sustain the economy of the village since almost every family in the village live on pottery business. Their products include, but not limited to, water vessel, penny bank, vase, flower pot, lamp cover, soup pot, and cooking stove.

However, as the effect of globalization for instance modern technology, and open economy, their pottery business becomes very fragile and vulnerable since their

potteries have to compete with imported products (Robertson and Oudom, 2014). On the other hand, those potters still apply traditional method of business operation. On account of the open economy and the inflow of capitalism, they are not ready for the competitive market. Though pottery is counted as their main business, they still lived in poverty. Many have left their motherland to find wage job at other places (Wright and Moun, 2016). Hence, the guidelines to improve their pottery business are very crucial and in need as means to strengthen their business as well as to promote community economy.

## **2. Research Objectives**

This research consisted of two objectives

1. To identify the state of pottery business at Andong Reusey village, Kampong Chhnang province, Kingdom of Cambodia.
2. To propose pottery business by developing guidelines for promoting community economy in Andong Reusey village, Kampong Chhnang province, Kingdom of Cambodia.

## **3. Research Methodology**

### **3.1 Sample**

The samples were pottery producers and workers, government official, tourist, and consumers. The sample was purposively selected due to the fact that 1) They produce pottery as their main business in Andong Reusey Village; 2) They involve in pottery business in Andong Reusey Village.

### **3.2 Research Instrument**

The research was conducted through qualitative research method. Hence, the research instruments consisted of observation, and in-depth interview.

### **3.3. Data Collection**

The following were the stages of data collection:

The method of developing research tools were described as follows:

3.3.1 For observation, the researcher focused on the general context of the village, including geographical context, land used, clay collection areas, roads, tourism, and the economic activity. Then, the researcher directly visited the pottery producing places inside the village to observe the method of producing pottery.

3.3.2 For the in-depth interview, the pottery producers and pottery workers were invited to in-depth interview about their methods of producing pottery, raw

materials, tools, labors, financial sources, and the consumers of their pottery products. The government official was invited for the in-depth interview for the general information and the government policy in supporting pottery business in Andong Reusey Village. Consumers were also invited for the in-depth interview to understand the market of the pottery business.

#### 3.4 Data Analysis

The data from observation and in depth interview were collected and analyzed through qualitative research method. The qualitative data such as the general context of Andong Reusey Village, method of producing pottery, raw material, tools, labor, financial sources, and the consumers of their pottery products were examined and analyzed using content analysis subordinated by key themes and sub themes. The strengths, weaknesses, opportunity, and threats of pottery business at Andong Reusey Village were identified by SWOT Analysis method. Interpretation was conducted through descriptive method.

### 4. Research Results

#### 1. Andong Reusey Village Context

Andong Reusey was the pottery village located in Srae hmei Commune, Rolear B'er District, Kampong Chhnang Province, Kingdom of Cambodia. The village lied besides Krang Dei Meas Mountain, which is 4 kilometers away from Kampong Chhnang City, 8 kilometers from Tonle Sap, and about 100 kilometers from Phnom Penh City by national road number 5. The distances of the village from Kampong Chhnang Airport and the train station are 15 kilometers and 35 kilometers, respectively.

The total land area is 569 hectares and divided into 5 areas composed of a primary school named Sophorn Kiri, a Buddhist temple named Kiri Sovannavonn, forest area, agricultural area, and residential area. According to the village chief, there were 404 families which equaled to 1676 people, 51 percent of whom were female which is equivalent to 850 people is. 69 percent of the total population, which equaled to 1155 people including 605 women are 18 years old or older and were active workforce.

The community is rich in earthenware clay, which could be found almost anywhere in the village. As usual, people enjoy to dig clay at the Krang Dei Meas Mountain due to the fact that the clay layer was just less than 1 meter beneath the surface layer, while the clay layer at the rest of the village was at least 4 meters beneath the surface layer.

The most common and important business to generate income for living was pottery since people produced it for the entire years, however not all families were producing pottery. The occupation of the villagers besides pottery were, producing palm sugar and palm juice, construction, raising poultry, and agriculture - particularly growing paddy rice, vegetable, and fruit tree.

Andong Reusey Village was also named as the tourism spot in Kampong Chhnang Province. Dozens of tourist both Cambodian nationals and foreigners came to visit the village daily. The most tourist-attracting factors were the culture of producing pottery and producing palm sugar and palm juice.

## 2. Pottery Production Input

### 2.1. Clay Soil

Clay soil was the most important raw material for pottery production. The clay soils that the villagers collected to produce pottery were earthenware clay. The sources to dig the clay were in the village. The villagers mostly dug and collected clay at the area besides the Krang Dei Meas Mountain. However, it was life risky to dig the clay during rainy season since the soil was soaked by rain water, thus it turned very slippery and landslide accident could happen anytime.

### 2.2. Water

Water was used to soak and mix the clay in preparation, shaping and design steps. Though the village was not very far from Tonle Sap River, there was no irrigation system to exploit the natural water. Moreover, piper water system was not accessible yet. The villagers, thus, installed hand pump to extract underground water instead to supply pottery production and daily consumption. However, it was not sufficient for the entire year.

### 2.3. Sunlight

Sunlight was also important for potters in Andong Reusey Villager. They obviously needed an open space with enough sunlight so as to dry the wet shaped pottery for at least three hours before firing.

### 2.4. Paint

Paint was used to apply additional decoration after the pottery was fired in the kiln. It helped make the pottery colorful and shiny. Usually, the potters bought the paint from Kampong Chhnag market, 4 kilometers away from the village.

### 2.5. Wood, Rice Straw, and Rice Husk

Wood, straw and rice were the material in need to use in firing step. Wood could be collected from the forest area besides the mountain foot. However, it was not



future investment and business expansion was very little, less than 5 percent of the monthly net revenue.

Another group of potters raised their capital by borrowing from friends and relatives. They normally had to be trustful and very close to the lenders. On the other hand, it was risky since the borrowing process was done verbally rather than by document. Thus, in case any partner broke the promise, they could not take legal action.

Tontine System was also popular to potters in Andong Reusey village. Tontine was a joint financial annuity to raise capital, whereby the participating members paid daily equally to the sum of the annuity. The annuity then was awarded entirely to the member who survives all the others.

Very few potters dared to borrow capital from the bank. They personally believed that the interest rate was high and very risky since the bank's condition required them to legally keep their real estate document at bank, which could confiscate the property of the borrower anytime in case they failed to pay the interest and the debt. Those who borrowed from the bank were normally running bigger pottery firm and had clear plan for future investment.

### 3. Pottery Production Procedure

#### 3.1 Clay Collection Step

Clay collection was the initial step of producing pottery. Early in the morning clay collectors traveled to the clay source areas besides the Krang Dei Meas Mountain foot or sometimes on the mountain. They used steel digging bar to break the surface of harden soil and rock and kept digging until reaching the clay layer, which is normally 1 meter beneath the top layer. The clay then was cut by using the hoes and spade and temporarily store in the clay containers until full. The clay collectors then carried the all the clay containers to fill in the cart then stepped down to collect the clay again. The activities kept repeating until the cart drawn by oxen or hand tractor on the land surface was full. The next task was to carry and store at home.

#### 3.2 Clay Preparation Step

In this stage, potters purified the raw clay. Basically, the clay that was dug from earth was still wet and needed to dry under sunlight for one day before it could be grinded into tiny pieces. The impurities were removed by filtering with net. The grinded and filtered clay was then mixed with appropriate amount of water for one or two days before it could be squeezed to use according to potter's purposes. After that, potters wedged and kneaded the clay as to get rid of air pockets or air bubbles inside



the clay, so that the potteries were very solid after firing. After wedged and kneaded, the clay could be surely used to form the shape.

### 3.3. Forming Step

Potters in Andong Reusey Village used different techniques in forming and shaping according to the kind of potteries they made. Hand building, slip casting, and wheel throwing were common methods practiced in the community.

**Hand Building:** This primitive technique was practiced by potters who produced water vessel. Initially, they formed the hand rolled coil clay and slapped around until the round and hallow shape was fully appeared by using a Kleng (round stone object) and a flat wood to press both internally and externally. At the same time, potters used ball and rope of clay and liquid clay to add more and more continuously until it was perfectly done. By this method, potter used their bare hand from the beginning to the end, but the finished product is very unique.

**Slip Casting:** This method was used by potters who produced complex shape pottery such as animal shape penny bank and clay stove. It was the most commonly used due to its easiness and swift productivity. To form and shape, potters poured the liquid clay or put wet soft clay slip into plaster molds. After several minutes, the outer clay layer that was close the internal layer of the molds was harder enough to take out and the remaining liquid clay was poured out and kept in specific container to use again. Next, the pair of plaster molds was adjoined together as to combine and form the hardened clay layers into the desired shape. The shaped clay, after taken out of plaster mold, needed to be dried by air for some minutes before trimming and cleaning.

**Wheel Throwing:** This method was practiced by potters who produced round-shape potteries such as round-shape penny bank, vase, lamp holder, water jar, soup pot, and mosquito coil holder. They were all seen owning pottery wheel. By this method, potters firstly put a ball clay right on the center surface of the upper wheel of potter wheel and started to kick the below wheel to make both wheels spine. While the wheel was revolving, potters could squeeze, press, and pull the clay gently into any shape they want.

### 3.4 Design

In this step, potters enjoyed doing the most since they could apply their distinguished creativity by their own design. They used needle tool to draw the picture of flower, animal, houses, mountain, cloud or other artistic styles especially on pottery neck according to their imagination. Sometimes, the pictures reflected their society too.

They also used small knife as cutting tool to cut rectangular, round, square, or diamond holes on the surfaces of potteries, particularly lamp holder and mosquito coil holder. Potters believed that design could make their pottery more beautiful and attractive to customers. However, all potteries that made by potters in the community were not glazed.

### 3.5 Sun Dry

After designing, the designed products were lay under sunlight for approximately 3 hours before firing in the kiln. The designed potteries were laid on a large mat, ensuring the unbaked clay did not touch the normal soil. It also needed to make sure that there were no tree branches or disturbing article falling on them and distorting the shape and the design.

### 3.6. Firing Step

There were two types of firings that were practicing such as open firing and kiln firing. In open firing method, potters mounded a big pile of pottery fully covered by rice straw and some little wood to burn. The firing temperature of this method was below 200 degree Celsius, but it was costless although the quality of the pottery was limited. The kiln was burnt by wood or rice husk. There was no present of modern kiln such as electric kiln and gas kiln. Not every potter in the village had their own kiln. Thus, those who did not have one, had to rent their neighbor's kiln but they also had to used their own wood to fire. The woods were collected from the forest inside the community or bought from the market. Potters who used rice husk kiln said the kiln was more economized and helped the environment by reducing deforestation. The firing temperature was up to 850 degree Celsius. None of the potters in the community had gas kiln or gas kiln that could fire higher temperature and able to make the potteries shinier and high quality.

### 3.7. Painting

After firing, all potteries were collected and kept in the vacant space under their house. Then, potters used the paintbrush and the paints bought from the market to apply the colors on the outer surface of the pottery according to their imagination or their method of decoration.

## 4. Market

After their pottery products were finished, they stored them besides or under their house. The consumers could be wholesalers, vendors, and tourists. Their most important consumer was wholesalers since they came to buy and collect every pottery product directly from producer's house. Potters did not deliver their products to sell

anywhere. They just phoned to the wholesaler, and then the wholesaler drove their truck to collect everything. The process of delivering had to be careful the most, or the potteries could be accidentally broken or scratched. The way of setting price was based on the result of the negotiation between one another. Not often did the vendor come to buy directly from the pottery producer since could not meet their demand. It would waste their time to buy and collect from house to house of the producer due to the fact that they were normally hurried to deliver to other provinces on time. They however provided higher price than wholesalers. The consumer who offered the highest price was tourists who visited Andong Reusey Village. They loved to buy animal shape pottery as souvenir and sometimes offered four times of normal price. However, they did not buy a lot and not often did they come to buy.

## 5. SWOT Analysis of Pottery Business at Andong Reusey Village

**Table 2** Strengths weakness opportunities and threats of pottery business at Andong Reusey Village

Strengths	Weakness
<ul style="list-style-type: none"> <li>– availability of active labor forces</li> <li>– good access to clay sources</li> <li>– pottery wisdom</li> <li>– available raw material</li> <li>– identity of the province</li> <li>– faith in conservation of pottery business</li> </ul>	<ul style="list-style-type: none"> <li>– lack of skilled labor</li> <li>– inefficient technology in production</li> <li>– low productivity</li> <li>– low quality pottery</li> <li>– lack of capital</li> <li>– lack of market strategies</li> <li>– poor logistics (delivering and packaging)</li> </ul>
Opportunities	Threat
<ul style="list-style-type: none"> <li>– accessible to highway and water way</li> <li>– daily life activities attractive to tourist</li> <li>– popularity</li> <li>– government protection on clay collection areas</li> <li>– government policy of tax exempt</li> </ul>	<ul style="list-style-type: none"> <li>– increasing substitute and replacement products</li> <li>– climate effect on clay collection areas</li> <li>– lack of network</li> <li>– lack of training</li> <li>– far from railway station</li> <li>– lack of home stay for tourist</li> </ul>



7.5 To improve the pottery skill, the government should arrange training program by inviting the experts in pottery production. Study tour to other pottery places inside the country or abroad should be organized to exchange and absorb new skills and experiences.

7.6 To promote community economy, pottery business of Andong Reusey Village should be linked with tourism. Strategically, they should create interesting folktale of the pottery business of the village for tourist. Homestay and traditional food serving infrastructure should be built and served for tourist on purpose to encourage their stay and joyfulness, involving daily life activities. The villagers, in addition to selling pottery, could earn more income from the service.

In order to make the implementation of the 7 recommendation to practical and beneficial to the community, the government agencies, the private sector and the community should work closely and collaboratively.

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## Modernization and Modernity as Represented in Uthis Haemamool's *The Brotherhood of Kaeng Khoi* in the Characters: Dreams and Aspirations

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### Abstract

This study aims to explore the impact of modernization and modernity in Thai society from the 1970s to the 1990s as represented in Uthis Haemamool's *The Brotherhood of Kaeng Khoi* in the selected major characters: Pii-mai, Urai, and Sert. Specifically, the novel depicts the impact of modernization in Thailand during which period Thais pursued economic dreams and aspirations. One of the major impacts of modernization is manifested in the main characters' drive towards economic success and their active involvement in trade, industry, and business enterprises in the hope of fulfilling their materialistic dreams and aspirations. This paper utilizes the conceptual framework of modernization theory to analyze how modernization and modernity have profoundly impacted on these characters in the novel. The analysis also examines the socio-cultural contexts of Thailand during the modernizing period of Thailand as presented in the novel. The novel reveals that these characters are highly motivated to climb the social ladder and pursue their economic dreams and aspirations. Some characters can be viewed as representations of those who successfully profited from the new opportunities offered to them by the forces of modernization. Yet, for some characters their dreams and aspirations could not always be fulfilled in the dark side of modernization as also portrayed in the novel.

**Keywords :** Modernization, modernity, *The Brotherhood of Kaeng Khoi*, dream, aspiration

## 1. Introduction

It has been widely acknowledged that a number of renowned authors of literary works have used their works as a means to reflect upon problematic social issues and changes in society as well as to convey social commentary. Modern Thai fiction in particular displays a vibrant tradition of representing social problems, social changes, and their impact on the lives of ordinary people. More particularly, Thailand itself and many Thais have fully embraced modernization and modernity in many aspects and it is not surprising that many fictional works written by Thai authors also reflect the theme of the impact of modernization and modernity. A representative and notable example is Uthis Haemamool's 2009 S.E.A. (South East Asian) Write Award-winning novel, *Lab Lae Kaeng Khoi* (in Thai). The novel was translated into an English version by a Bangkok-based US writer Peter Montalbano in 2012 and the novel's title was translated as *The Brotherhood of Kaeng Khoi*. In addition to the prestigious S.E.A. Write Award, the novel also won the Seven Books Award in 2009. The narrative voice is that of a young man whose name is Lab Lae. He recounts the traumatic story of his life and relationships with his family members while at the same time offering his account of the socio-political contexts of his life and those of his parents and grandparents. As the novel is mostly set during the modernizing period of Thailand (1970s to the 1990s), the impact of modernization is visible through the trajectories, disruptions, and changes in the lives of Lab Lae, his family members, other villagers and their community. The most visible effects of modernization and modernity are depicted in the main characters' dreams of and aspirations for financial success and their concern with prosperity in industry and business. For example, Lab Lae's father, Pii-mai does not receive a proper primary education since he has to make a living at a very young age and take care of his brothers because of poverty. When he becomes a teenager. Pii-mai realizes the necessity of striving for economic success and class mobility by applying for a job at a local cement factory in the hope of improving his financial and social status. However, he later dies from lung cancer caused by the poor working conditions in the cement factory (Haemamool, 2012, p.385). Unlike Pii-mai, his friend, Sert and his wife, Urai, can be seen as a representation of those who successfully make use of the new opportunities offered to them by the forces of modernization. Urai changes her occupation from being a food seller in a cement factory to a real-estate broker, since there is a high demand for land in Kaeng Khoi district, Saraburi province during the industrialization period in Thailand (Haemamool, 2012, pp.190-195). Furthermore, Urai can also make use of the

patronage system aided by the local government to ensure her family's financial success by establishing connections with those in power.

Although there have been a number of previous academic studies of *The Brotherhood of Kaeng Khoi*, those studies do not specifically focus on the reflections of modernization and modernity in the novel. They focus on a linguistic investigation of the English translation of the novel from the source language (SL) into the target language (TL). For example, "A Study of Translation Strategies Used in the Target Text *The Brotherhood of Kaeng Khoi* with Focus on Thai Cultural Expressions and their Lexical Meanings" (2014), by Pattamawadee Tansakul, and "A Study of Simile Translation in Uthis Haemamool's *The Brotherhood of Kaeng Khoi* by Peter Montalbano" (2012) by Kamolchanok Prasertsom aim to study the accuracy of translation of meaning from the source language (SL), Thai, to the target language (TL), English, by applying translation theories and approaches as the theoretical approaches. However, Isaraporn Pissa-ard's article, "Uthis Haemamool's *The Brotherhood of Kaeng Khoi*: A Gramscian Reading" (2016), briefly touches upon modernization in Thailand in her analysis with a major focus on the concept of hegemony which is associated with the process of class-stratification, in which subaltern groups are willing to transform themselves from being passive and inferior into authoritative and superior groups in society (Pissa-ard, 2016, pp.4-7). However, Isaraporn's analysis does not take account of the various aspects of the impact of modernization nor does she examine modernity within Thai society during the period of Americanization in Thailand.

As there is a lack of analysis of the impact of modernization and modernity represented in the novel *The Brotherhood of Kaeng Khoi*, this paper will examine these aspects in fuller detail by employing the conceptual framework of modernization and modernity derived from classical modernization theory as expounded by Alberto Martinelli. Martinelli's theory will be utilized to analyze how modernization and modernity have profoundly impacted on characters, particularly Pii-mai, Urai, and Sert in terms of their dreams and aspirations. Importantly, in doing so, the analysis will also be based on the socio-cultural historical contexts of Thailand in the past during period of the 1960s-1990s as presented in *The Brotherhood of Kaeng Khoi*.

This paper is based on the more comprehensive master's degree thesis entitled "Modernization and Modernity as Represented in Uthis Haemamool's *The Brotherhood of Kaeng Khoi*" in which the full thesis explores aspects of impact of modernization and modernity in three main facets, including dreams/aspirations and political consciousness, gender and sexuality, and the persistence of Buddhist and traditional beliefs in Thai



society as portrayed in the novel. The master's degree thesis is financially supported by the Thailand Research Fund's Master Research Grants (TRF-MAG) in the fields of Humanities and Social Sciences.

## 2. Research Objectives

2.1 To study modernization and modernity as reflected in Uthis Haemamool's *The Brotherhood of Kaeng Khoi* in terms of their impact on the main characters' dreams and aspirations by applying a theoretical discussion to modernization and modernity as depicted in the novel with regard to modernization theory and socio-cultural context analysis.

2.2 To offer insights about the impacts of modernization and modernity in Thai society, specifically as represented in the Thai novel *The Brotherhood of Kaeng Khoi*.

## 3. Research Methodology

This research aims to examine modernization and modernity as portrayed in Uthis Haemamool's *The Brotherhood of Kaeng Khoi*, a 523-page novel printed by Amarin Publishing and translated by Peter Montalbano, a Bangkok-based US writer, in 2012. The conceptual framework for this research is synthesized from the theoretical discussions of modernization and modernity derived from classical modernization theories. Additionally, the Thai socio-cultural historical context during the years 1960s-1990s as depicted in the novel will also be used for the contextual analysis. The aforementioned approaches will be utilized to analyze the main characters, including Pii-mai, Urai, and Sert since these characters are significant representatives of the impact of modernization and modernity. In order to understand modernization and modernity, modernization theory derived from the classical modernization theory of Alberto Martinelli will be discussed in terms of its definitions and features in the next section.

### 3.1 Modernization and Modernity

Martinelli refers to modernization as the process of massive change and development in specific societies (Martinelli, 2005, p.28). In the twentieth century, modernization was viewed as a development process postulated by the Western world that the non-Western world would be able to follow. The term modernization is correlated with the term industrialization, both of which bring massive changes to societies in terms of social, cultural, and traditional consequences. Martinelli (2005) rejects the idea of a single model of modernity because he believes that some essential aspects of modernization, developed by classical theorists of modernization, should also

be taken into account. This is because modernizing societies do share some important aspects, especially those of economic and socio-cultural dimensions.

The economic aspect of modernization is generally involved with industrialization that applies technological inventions, replacing human labor or animals by mechanical energy to produce commodities for vast and mass consumption in global markets (Martinelli, 2005, p.14). This economic organization is primarily focused on rational principles and the adequacy of ways in which to produce products and achieve objectives efficiently. The development of science and technology will play a prominent role in industry, which greatly brings about an increase in the capacity of the production and exchange of goods, especially in terms of both quality and quantity (Martinelli, 2005 p.10). Furthermore, there is an alternative view of the same process in Marx's historical-materialistic theory of social change. Marx's theory focuses on "the contradiction between transformation of the 'structure' of society and the 'superstructure' of society" (Martinelli, 2005, p.12). The 'structure' of society means the evolution of social class relations, while the 'superstructure' of society means massive changes regarding cultural, political, and legal institutions. Specifically, changes in the division and in the hierarchy of labor can generate social inequalities and conflicts between social classes (Martinelli, 2005, p.12). However, current modern society is characterized by inequalities in relation to class, gender, race, ethnicity, state structure, and region (Martinelli, 2005, p.17).

In addition, the socio-cultural dimension of modernization is correlated with human change, urbanization, and shifts in gender and class relations. To begin with, millions of uprooted people from rural areas will move to settle in urban areas for economic purposes in order to be laborers in industrialization. The divisions of labor develop enormously in a plurality of occupational roles and professions that require specialized training, skills, and abilities. Furthermore, economic development will be concerned with social transformation, especially in terms of class mobility systems in which the expansion of the bourgeoisie, or middle-class, will encompass the majority of the national population. Moreover, the status of women in general will be changed because of the shifting opportunities in education, career, and newly independent work roles. The percentage of women in the workforce has tended to increase. As a result, the role of women in patriarchal society under patriarchal authority will be altered (Martinelli, 2005, p.13). Particularly, Thailand during 1990s, women in the new middle class of working families went out to work and the numbers of male and females in labor market were roughly equal (Baker & Phongpaichit, 2014, p.208).



as national policies to promote social and economic changes (Chaloentiarana IX). The country's economy of 1960s was based primarily on agriculture, forestry, mining, and manufacturing which were mainly for export (Wyatt, 2004, pp.272-282). Moreover, in the Sarit era his slogan of "work is money, money is work, this brings happiness" was popularized to encourage in the people sentiments favorable to development and improved living conditions undertaken under his economic plans (Baker & Phongpaichit, 2014, p.149). According to Martinelli's modernization theory, the economic aspects of modernization are generally involved with industrialization that applies technological inventions, replacing human labor or animal by mechanical energy to produce commodities for vast and mass consumption in the global market (Martinelli, 2005, p.14). Correspondingly in Thailand in that era, traditional agricultural techniques were increasingly replaced by mechanical techniques for the purpose of mass production and export. This is in line with Pii-mai's dreams of and aspirations for a better economic status for his family during the period of industrialization in Thailand starting in the 1960s. Pii-mai fully embraces the by-products of modernization that appears in the form of economic development and expansion of Sohng's business. In line with Sarit's slogan of hard work and his endeavors in fulfilling assigned job tasks, Pii-mai works extremely hard and gains enough money from his jobs. He could think of owning his own land and a house for his mother and brothers. Hence, Pii-mai is able to take advantage of the opportunity and he makes uses of the modernization which affects him in that he earns a higher income and better living conditions for his family members.

Later, Pii-mai moves from Lab Lae to Kaeng Khoi district to pursue a successful career at the *Nakhorn Luang* cement company. Pii-mai is officially accepted to work as a repair and maintenance worker in the heavy equipment division and this makes him very proud of himself. Pii-mai is very much aware that his career at this cement company will bring him stability in life, financial prosperity, and social acceptance among the surrounding people. As a part of the company, Pii-mai considers that he is financially and economically stable and prosperous. In addition, Pii-mai is assisted by Sert and Urai, who are real estate agents, in negotiations to purchase a piece of land and they attend to the legally matters necessary for Pi-mai's ownership. Not so long, Pii-mai's house is equipped and rises elegantly above his own land on which his large house can well represent his projected social image. However, other details of the house are not paid attention to. In fact, the house is not fully finished yet since Pii-mai lacks enough money for the interior decoration. Essentially, Pii-mai is a person who seems to care for his social image and the outward manifestation of prosperity in the eyes of the

surrounding villagers. He finds every possible way to secure his social status by making his house outstanding to the neighboring area and desires to elevate his social status into that of the upper middle-class. This is in line with an essential aspect of modernization in that the economic development caused by the industrialization affects the dream and aspiration of social transformation, especially the growth of middle-class people in the society. Stereotypically, Pii-mai is represented as a product of the process of modernization which can be considered as a middle-class person because of the economic development and industrialization (Martinelli, 2005, p.11). At the beginning of the story, Pii-mai is not portrayed as a victim of modernization but instead tries to gain profit and control over the fate and destiny of himself and other persons close to him. For the purposes of favorable comparison, he proudly displays the realization of his dreams and aspirations through his gigantic wooden house. His wooden house represents his social status and the financial wealth that he fully embraces from economic development, in which he is accepted to work in a newly founded and reputable cement company in Kaeng Khoi district. Pii-mai confidently believes that his working role at this cement company during this period of modernizing will secure for him financial stability and success and pave the way for the members of his family to live in better conditions in the future. However, Pii-mai's apparent financial stability and success is like his big wooden house that is not completely finished and is waiting to deteriorate in the near future because of its unfinished construction. This also reminds the reader of the economic boom in the country before 1997, when Thailand was regarded as a newly industrialized country in the 1980s because there were flows of foreign capital circulating within the country. Thus, the economic boom during the 1980s came from the outside, not from the inside, just as in the case Pii-mai's house whose structure is hollow on the inside. Pii-mai chooses to secure his social image by borrowing money from Urai to complete his house. Unfortunately, Pii-mai cannot clear up all his debts before his death and this financial burden is left to his wife and son. Accordingly, Pii-mai can be regarded as a victim of modernization because he has big dreams of economic expansion and development but it turns into the destruction of his financial status. In fact, his dreams for economic stability are shattered. What he seems to gain at the beginning is just an illusion. In this way, the novel implicitly suggests that modernization not only can bring prosperity, but it can also bring destruction to the lives of the common people.

Besides having dreams and aspirations for himself, Pii-mai imparts all his hopes, dreams, and aspirations for educational and career success to his two sons, Lab

Lae and Kaeng Khoi. Pii-mai fervently hopes that Kaeng Khoi can become a mechanic in a high-level position which Pii-mai never reaches because of his lack of a higher educational degree and Lab Lae can be an electrician in service to another branch of the cement business in producing roofing, tiles, and bathroom fixtures (Haemamool, 2012, pp.161-164). Pii-mai firmly believes that what he is doing will assure that his sons live securely in better conditions. At the time, Kaeng Khoi district is economically flourishing and about to experience an influx of factories to the area for goods production, investment, and industrialization. There are many employment opportunities and job openings which attract skilled and non-skilled laborers in search of prosperity. In particular, the cement company at that time is increasingly engaged in expanding its production capacity. Similarly, in *Value Conflicts in Thai Society*, the analysis of selected short stories also depicts social changes occurring in the transition from a traditional to an industrialized society during the massive economic development in the years 1950s-1980s. The book suggests that education might be a mean for impoverished people to transform their lives so as to achieve a better social and economic status (Kriengkraipetch & Larry, 1992, p.95). It is a traditionally typical saying or blessing of Thai elders given to children that “be smart, learn more, and be the master” (Kriengkraipetch & Larry, 1992, p.96). With this notion, it can be assumed that being a master or in a higher position can bring about improvement in social status and economic prosperity. Furthermore, the development of education also plays an important role in increase of social mobility in which specialized skills and knowledge are required for the specialized job market (Martinelli, 2005, p. 49). This is in line with university education in Thailand during 1970s-1980s in that there were many open universities and colleges. The students who graduate from the universities mostly preferred to work for private companies rather than for government organizations because the salaries were much higher than those offered by government service. Thus, the expansion in government or bureaucratic employment slowed down in the 1980s (Baker & Phongpaichit, 2014, p.207). Pii-mai places his hopeful dreams and aspirations on his two sons. He strongly hopes that one of his sons fulfil his aspirations since Pii-mai never had the opportunity to reach higher education at the graduate level and thereby be eligible for a high position career. Significantly, Pii-mai seeks to enable Kaeng Khoi, his oldest son, to learn technical skills and gain scientific knowledge at a technical college. However, his dreams and aspirations are not fulfilled because Kaeng Khoi suddenly runs away from home without notice.

#### 4.2 Urai and Sert

Two characters portrayed in *The Brotherhood of Kaeng Khoi* who are representative of how modernization and modernity affect people's way of life in the modernizing period of Thailand are the couple Urai and Sert, especially in terms of their own dreams and aspirations. Urai and Sert's lives are introduced accordingly in order to show how they start their lives and work until they are financially and socially well-off by making use of the modernization and modernity developing in Kaeng Khoi district. Additionally, I will seek to show how Urai and Sert are depicted as persons who are successful in taking advantage of the benefits of modernization and modernity in terms of various aspects, including promptly embracing modernization, making profit from it, and developing relationships with persons in the patronage system to secure their wealth. It is evident that Urai fully embraces modernization and modernity in which she takes advantage of the economic boom caused by the impact of modernization during the 1970s by transforming herself from an ordinary food vendor in the cafeteria into a wealthy real estate dealer. As a real estate dealer she can ensure the prosperity and financial status of herself, Sert, and their daughters and enable them to live in comfort with full facilities in their house because Urai is able to gain considerable financial profit from buying and selling land to entrepreneurs who at that time would like to set up factories in Kaeng Khoi district. Urai is particularly depicted as keen and skillful as a real estate dealer. She uses her talents to negotiate with previous land owners to sell her a piece of their land at a very low price. Afterwards, Urai sells this land to Pii-mai at a higher price so that she can earn an additional commission from selling this land, although Pii-mai and her husband are good friends. Considering Urai's skills in negotiating in buying and selling land, Urai wisely indicates and specifies the disadvantages of land that can cause trouble for the next owner. This means that the land could be bargained down to a low price. As a result, Urai can come out ahead in the negotiations and is able to buy the land at a price that satisfies her. In this way, Urai profits from buying and selling land in such a way that she is skilled sufficiently to adapt herself to the economic boom and to advance during the time of modernization in Thailand.

Being a real estate broker means that Urai frequently coordinates and negotiates with government officials in local sections. This position provides her with good connections and relationships with high-ranking persons and those in positions of authority and enhances her real estate business. Apart from the support and the authority provided by these bureaucrats, Urai and Sert, are appropriately viewed as

‘civilized,’ ‘stable,’ and ‘cultured’ as their family’s reputation is good, fortunate, and secure and this makes ordinary locals have trust in this family. For example, the excellent image of his family regarding financial stability and good connections with authoritative persons helps Sert to become the next village headman because the villagers believe he can lead the community forward if there is new policy and instruction from the government. Sert gains a lot of trust and recognition from both villagers and persons in high positions since Urai uses her skills as a real estate broker to establish good relationships with them (Haemamool, 2012, pp.321-322). Considering Thailand in the 1970s, the local businesspeople grew rapidly, they were rich and powerful since they enjoyed good connections with the local government officials in the provinces. Having close connections with officialdom and patronage persons could help secure and smooth the way for their business interests. Those official governments could offer them privileges over the competition and protection from legal difficulties. As a result, they could share in the financial profits from businesses (Baker & Phongpaichit, 2014, pp.244-245). Thus, Sert is appointed as a village headman instead of Pii-mai as his social and financial stability is viewed as superior to that of Pii-mai all of which result from the patronage system and the relationships established by his wife.

## 5. Discussion and Conclusion

Pii-mai’s dreams of and aspirations for a better economic status for his family reflect the idea of modernization in that technological and mechanical inventions would facilitate the productions of commodities for vast and mass consumption in global markets (Martinelli, 2005, p.14). In particular, Songh’s business and Pii-mai’s role in the cement company as portrayed in the novel illustrates how Pii-mai fully embraces the impact of modernization in terms of the economic development which is related to the expansion of his boss’s business. One main impact of modernization, from the viewpoint of modernization theory, is that the economic advancement triggered by industrialization definitely moves forward the social transformation, especially the increase in the number of middle-class people in the society (Martinelli, 2005, p.11). As a stereotype, Pii-mai is depicted as a product of the modernization process which is centered in the middle-class because of the economic development brought about by industrialization. Additionally, he genuinely trusts that his working role at this cement company during the modernizing period will provide him financial stability, success, and enable the members of his family to live in better conditions in the future. Pii-mai may not be totally portrayed as a victim of modernization because he tries to exert control over his



fate and destiny and that of other persons close to him. However, before his death, he is still financially indebted with Urai and Sert. Accordingly, this demonstrates as well that Pii-mai is a victim of modernization while Urai and Sert profit from it.

On the other hand, Urai and Sert are good examples of those who are better at adapting and adjusting to modernization and modernity. In particular, Urai, is in a position to profit considerably from the economic boom caused by the impact of modernization in the 1970s by transforming herself into a wealthy real estate dealer since there was a high demand of land for the setting up of factories. In addition, this is of benefit to her since Urai has good connections and relationships with government officials in local sections and high-ranking persons in authoritative positions. These people are in a position to help her real estate business be successful and prevent any difficulties in her business. Considering the social context of Thailand in the 1970s, the number businesspeople in provincial localities increased rapidly. They were financially stable and powerful since they maintained good relationships with the local government officials in the provinces. Having good friendship with officialdom and persons in positions of patronage enabled business to function smoothly. Government officials in positions of power were able to ensure the profits of favored businesspeople over the competition and could provide protection from any legal difficulties for businesses in which they shared the financial profits (Baker & Phongpaichit, 2014, pp.244).

In conclusion, Sert and Urai are two characters who clearly demonstrate the ability to both climb the social ladder into the upper middle class and to pursue their economic dreams and aspirations successfully by profiting from modernization and modernity. On the other hand, a character such as Pii-mai can be seen as representing those who their economic dreams and aspirations are not always achieved because modernization does not benefit all who are affected.

## 6. Recommendations

Due to the page limitation of this paper, the study is unable to demonstrate adequately other aspects of life affected by modernization and modernity portrayed in the novel, including political consciousness, gender and sexuality, and the persistence of Buddhist and traditional beliefs. These aspects are also of considerable interest and are worthwhile to discuss in this paper. Hopefully, this study can be of guidance for other researchers who are interested in studying representations relevant to modernization theory and other theoretical approaches in Thai novels.

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## The Development of English for Selling Product Pocket Book for OTOP Entrepreneurs in Phetchabun Province

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### Abstract

English has become important global language, especially, in business area. This study aims to develop English for Selling Product Pocket Book for OTOP entrepreneurs and to evaluate the use of English for Selling Product Pocket Book of OTOP entrepreneurs in Phetchabun province. Twenty OTOP entrepreneurs were selected to be experimental group for English for Selling Product Pocket Book by using purposive random sampling method. Data was collected by questionnaire, interview and testing. The statistics used to analyze the data were percentage, mean, standard deviation and t-test. The finding revealed that the English for selling product pocket book had the effectiveness as committee criteria at 80/80. Moreover, when the pocket book was used by the participants, it was found that the OTOP entrepreneurs' posttest score was higher than pretest at the statistical significance level of .05. Moreover, the OTOP entrepreneurs had the satisfaction towards the pocket book at high level ( $\bar{x}$  =4.28; S.D. = 0.54). Furthermore, in the focus group, it was showed that most of them found the pocket book was convenient to use in the real situations because of the easy sentences and Thai subtitle. However, they had some suggestions about the contents of each OTOP product; it should be separated, as well as they need to be trained about product advertising and describing the product stories in English version.

**Keywords :** Pocket Book, English for Selling Product, OTOP Entrepreneurs

### 1. Introduction

One Tambon One Product (OTOP) was established in 2001 in order to solve the economic problem. The project was designed to support local communities to be

stronger in terms of becoming self-reliant and job creation, as well as to increase incomes at the grassroots level with their local wisdom and resources to produce the quality products and services. At the same time as maintaining the Thai culture and way of life, the goods also meet the needs of the domestic and international markets

Moreover, this project was regarding to as adopting a holistic approach or “people centered development” by the Eighth National Plan (1997-2001) to the Tenth National Plan (2007-2011). The National OTOP Administrative Committee have set three basic principles; local yet global, self-reliance and creativity, and Human Resource Development (HRD), in order to provide a guideline for improving each community’s economy, including training the local people to be self-reliant, and for helping them to take part in the sustainable process of regional development.

OTOP products have currently become the main business which make a revenue for Thai local people in every part of country including Phetchabun province. In addition, the Four Provincial Development Plan (2018 – 2021) has determined the issue of trades and services connection among other provinces, regions and neighbor country following the North-South Economic Corridor and East-West Economic Corridor including logistics to promote trade and service activities as well as create the value of local product.

In the present days, people use English a international language by focusing on meaning more than form to meet their success of communication whether in daily life, education, especially, in business context. English has become part of the daily life of many people from various linguistic and cultural backgrounds such as road and signs, several products with English names, band name song lyrics, etc. English is also the language of international communication and play the import role as official working language in the most major political integration. (Galloway and Heath, 2015). Consequently, enhancing English language skills is also important for OTOP entrepreneurs because the aim of OTOP project reflects the wisdom and the way of life to both domestics and international market. The previous study indicated that the OTOP operators face problems of using English to communicate with the foreigners in the insufficient vocabularies, lack of the knowledge to construct English sentences, and lack of understanding in foreigners’ accent. They needed English training course organized by private and government sectors (Meunchong, 2018). Thus, English skills development will help the OTOP entrepreneurs to obtain an increasing income and enable to promote their products because the comprehension of communication. English for Specific Purpose (ESP) is one of several subjects which can promote English language skills of

the learners in the professional area. Hutchinson and Waters (1989: 18 – 19) claimed that ESP is the curriculum which focuses on the different needs of learners. Normally, the learners study English “not because they are interested in the English Language or English culture as such, but also because they need English for study or work purposes” (Robinson, 1991: 2).

The English for Selling Product pocket book which was designed following problems and needs of OTOP entrepreneurs would help to promote English language skills of the OTOP entrepreneurs in Phetchabun province. Furthermore, the finding of the study would be advantageous for the organization related to OTOP operation area such as Community Development Department to design the course training for their personnel’s English competence. In addition, the pocket book could be applied as a teaching material to promote English language skills of the students in ESP area.

## **2. Research Objectives**

2.1 To develop English for Selling Product Pocket Book for OTOP entrepreneurs in Phetchabun province.

2.2 To evaluate the use of English for Selling Product Pocket Book of OTOP entrepreneurs in Phetchabun province.

## **3. Research Methodology**

### **3.1 Participants**

The sample of fifty OTOP entrepreneurs were selected from three district in Phetchabun province; Muang, Lomkao, Lomsak to provide the general information about problems in using English for selling product and twenty people were selected to be experimental group for English for Selling Product Pocket Book by using purposive sampling method.

### **3.2 Research Instruments**

In order to obtain the data, mixed method research (quantitative and qualitative) was employed in this study to collect data by using triangulation design. The instruments used in this study were questionnaire, English for Selling Product pocket book, pre – test and post – test, and group interview. The statistics used to analyze the data were percentage, mean, standard deviation, t-test and content analysis.

### **3.3 Data Collection**

The data collection of this study was implemented as follows:

3.2.1 All questionnaires were employed with fifty participants were in order to obtain data of their English problems and needs. The form of questionnaire was divided into three parts: 1) participants' general information, 2) ten items of their opinions about problems and needs of English for selling OTOP products and 3) other suggestions.

3.2.2 Regarding pretest and posttest, they consisted of twenty questions; multichoice, for testing the participants about English language skills using for selling OTOP products.

3.2.3 The pocket book was designed following the problems and the needs of OTOP entrepreneurs in Phetchabun province. It consisted of three main topics: Greeting, Product Presentation, and Negotiation & Payment. After that, it was employed with twenty participants.

3.2.4 The satisfaction form was divided into three parts: 1) participants' general information, 2) ten items of their opinions about satisfaction towards English for selling product pocket book and 3) other suggestions. The form had the content validity examined and approved by three experts.

3.2.5 The focus group interview was taken place to find the OTOP entrepreneurs' attitude and satisfaction on English for selling product pocket book.

### **3.4 Data Analysis**

1. The questionnaire was analyzed by using descriptive statistics; percentage, mean, standard deviation.

2. The English for Selling Product pocket book was analyzed by using E1/E2 Development Testing Formula (Chaiyong Promwong, 2013). And then evaluate the learners' language competence after using the pocket book with referential statistics; t-test. The focus group interview will be reported in the content analysis.

## **4. Research Results**

The results were presented according to the research objectives as follows:

4.1 The efficiency of English for Selling Product pocket book of OTOP entrepreneurs in Phetchabun province were shown as follows:

**Table1** The efficiency of English for Selling Product pocket book of try out group (1:1)

Try out group of OTOP entrepreneurs (1:1)	E1	E2
First participant (excellent)	90.00	95.00
Second participant (fair)	80.00	85.00
Third participant (poor)	70.00	72.00
<b>Total</b>	<b>80.00</b>	<b>84.16.</b>

As shown in table 1, it was found that the pocket book had the participants' posttest (E2) score was higher than pretest (E1) at 80.00/84.16 which was higher than the criteria of 80/80

**Table 2** The efficiency of English for Selling Product pocket book of try out group (1:10), two people per group

Try out group of OTOP entrepreneurs (1:1)	E1	E2
First group (excellent)	86.66	95.00
Second group (fair)	85.00	92.50
Third group (poor)	73.33	77.50
<b>Total</b>	<b>81.66</b>	<b>88.133</b>

As demonstrated in table 2, it was found that the pocket book had the participants' posttest (E2) score was higher than pretest (E1) at 81.66/88.33 which was higher than the criteria of 80/80

4.2 The result of OTOP entrepreneur's development after using English for Selling Product pocket book was shown as follows:

**Table 3** The score of pre-test and posttest after using English for Selling Product pocket book of OTOP entrepreneurs in Phetchabun province

Group testing	$\bar{x}$	S.D.	D	SD $\bar{b}$	t	Sig
Pre-test	12.95	4.67	-4.20	3.81	-	0.00
Posttest	17.15	2.11			4.94	

\* The statistical significance was determined at level of .05.

As shown in table 3, it was found that the OTOP entrepreneurs' posttest score was higher than pretest at the statistical significance level of .05.

4.3 The result of the pocket book assessment by using satisfaction form and group interview was shown as follows:

**Table 4** The satisfaction of the OTOP entrepreneurs towards English for Selling Product pocket book.

Items	$\bar{x}$	S.D.	Level of satisfaction
1. The interesting of the pocket book.	4.30	0.66	high
2. The language in the pocket book was easy to understand	4.45	0.60	high
3. The Thai subtitle help the learners to understand easily.	4.30	0.57	high
4. The picture was related to the content in the pocket book.	4.10	0.72	high
5. The content responded to the need of the learners.	4.45	0.60	high
6. The content consistent with the context and easy to understand.	4.25	0.55	high
7. The pocket book was easy to use.	4.25	0.55	high
8. After using the pocket book, you had confidence to use language skills.	4.10	0.72	high
9. The pocket book could be applied in your daily life such as selling OTOP products.	4.20	0.70	high
10. Overall satisfaction towards the pocket book.	4.25	0.72	high
<b>Total</b>	<b>4.28</b>	<b>0.54</b>	<b>high</b>

As shown in table 4, as a whole, OTOP entrepreneurs had the satisfaction towards the pocket book at high level ( $\bar{x}$  =4.28; S.D. = 0.54). When considered in each item, they had satisfaction towards the pocket book at high level in every item.

Furthermore, the researcher also studied the attitude towards the pocket book by using focus group interview. Ten OTOP entrepreneurs was selected from all participants by purposive sampling by testing. The finding revealed that most of them found the pocket book was convenient to use in the real situations because of the easy sentences and Thai subtitle. However, they had some suggestions about the



contents of each OTOP product; it should be separated, as well as they need to be trained about product advertising and describing the product stories in English version.

## **5. Discussions (12 points, bold, left aligned)**

5.1 In the development of English for Selling Product pocket book phase, the finding revealed that the pocket book had the effectiveness as committee criteria at 80/80. Moreover, when the pocket book was used by the participants, it was found that the OTOP entrepreneurs' posttest score was higher than pretest at the statistical significance level of .05. The results correspond of the study of Sattra Sahatsathatsana (2017) which developed the effective and sustainable communicative English handbook on communication with foreign tourists. The populations were 50 peoples of the Ban Phon Phraewa silk weaving entrepreneur and 20 peoples there were selected from the simple random sampling method by drawing lottery. It was found that the communicative english handbook on communication with foreign tourists had the effectiveness as committed criteria at 80/80.

5.2 In the assessment of English for Selling Product pocket book phase, the OTOP entrepreneurs had the satisfaction towards the pocket book at high level ( $\bar{x}$  =4.28; S.D. = 0.54). Furthermore, in the focus group, it was showed that most of them found the pocket book was convenient to use in the real situations because of the easy sentences and Thai subtitle. However, they had some suggestions about the contents of each OTOP product; it should be separated, as well as they need to be trained about product advertising and describing the product stories in English version. This would be related to the study of Pawanrat Nikornkittikosol (2016) which developed Innovation of Tourism English communication and study the satisfaction towards such innovation of the participants. The target were 20 local vendors selling souvenirs, food and/or drink at Koh Kret, Nonthaburi Province. Overall the result of mean value derived from questionnaire for satisfaction went up to 4.33 and standard deviation was 0.73. This result indicated that such developed Innovation of Toursim English Communication was ranked at the level of Good and proved workable for local vendors at Koh Kret.

## **6. Conclusion (12 points, bold, left aligned)**

In sum up, the participants needed to improve their English language skills to promote OTOP products. Most of them found the pocket book was convenient to use in the real situations because of the easy sentences and Thai subtitle. Moreover, their posttest scores were significantly higher than the pretest scores. Lastly, their satisfaction

towards the English for Selling Product pocket book was found at the high level. However, they also had some suggestions about the contents of each OTOP product; it should be separated, as well as they need to be trained about product advertising and describing the product stories in English version.

## 7. Recommendations (12 points, bold, left aligned)

7.1 The recommendation about the English for Selling Product pocket book of OTOP entrepreneurs in Phetchabun province.

7.1.1 The research finding should be implemented with other OTOP entrepreneurs.

7.1.2 The English for Selling Product pocket book should be developed for further research to be an innovation for the new generations of OTOP entrepreneurs.

7.2 The recommendation for future studies.

7.2.1 The finding should be developed to be other innovation such as mobile application or E – learning.

7.2.2 In this study, the researcher developed only English for selling product. It should study in other topics for OTOP entrepreneurs in Phetchabun province, for example, English for OTOP story telling, English for OTOP advertisement, etc.

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## Comparison of Chinese Learning Motivation between Thai University Students and Overseas Students in China

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### Abstract

Motivation is an extensive and complex psychological phenomenon, and learning motivation can be used as a source of motivation to induce and maintain students' learning behavior. In the teaching process, Thai university students are generally less motivated to study than overseas students in China. Therefore, the author hopes to explore the differences and similarities between Thai university students and overseas students in China through questionnaire, data collection, data analysis and interview, so as to find out the reasons why Thai university students are having problems in learning Chinese.

**Keywords** : Chinese learning motivation; Thai university students; Overseas students in China

### 1. Introduction

During my teaching in Thailand, I found that some Thai university students would choose to escape or withdraw when they are facing problems in learning Chinese, and some students would give up learning Chinese. But overseas students in China will choose to solve the problem. So I want to analyze the differences and similarities between Thai university students and overseas students in China in Chinese learning motivation to find out reasons of this problem.

What is learning motivation? In psychology, motivation refers to some reasons that drive people or animals to produce various behaviors. According to a. e. woolfolk (2001), learning motivation is the tendency to seek the significance of learning activities and try to obtain benefits from them. That is to say, students should find pleasure during learning, acquire knowledge and skills that can improve their level in these meaningful learning activities.

### **1.1 Motivation Construction Theory**

Motivation is a complex and multifaceted factor. Gardner's motivation construction has two components: the interaction between integration motivation and the instrumental motivation. According to Gardner's theory, the integration motivation has a positive impact on second language learners. Integration motivation means learning a language, and more importantly, integrating into the environment and life of the target language. However, instrumental motivation tendency is that learners will set more realistic goals, thus Gardner and Lambert put forward relative to the instrumental motivation, the fusion of motivation is to better promote learners eventually master and master a foreign language, Cook for Gardner fusion type tool system in more detail, on the one hand, the fusion motivation reflects whether the learners or deny the target language cultural background: the appreciation of the target language culture of learners in learning the second language classroom gains more. On the other hand, instrumental motivation means something like passive learning a second language in order to pass a test.

### **1.2 Self-determination Theory**

The motivation is divided into internal motivation and external motivation from different angle. Pintrich and Schunk argued that internal motives are self-interested; External motivation is a means to achieve the ultimate goal. In addition, Eggen and Kauchak also made a statement: motivating students from the inside is to make them learn automatically and spontaneously. Motivating students from the outside, however, is a way to learn also a way to get high marks or praise for a test. Because of the essential difference between internal motivation and external motivation, the researchers represented by the second language teaching research expert Brown believed that external motivation is not the opposite of internal motivation. Autonomy is the key prerequisite for external motivation to combine with internal motivation and even guide internal motivation. Under correct guidance of teachers, and under independent consciousness of students themselves, internal motivation and external motivation will eventually combine into a continuous unity.

## **2. Research Methods**

This research is mainly based on questionnaire survey and supplemented by interview. In order to understand the situation of the respondents more intuitively, the respondents are classified as follows:

## 2.1 Regions

We have 41 Thai university students, 41 overseas students in China.

## 2.2 Chinese Learning Time

Thai university students (1 ~ 6 months: 1 person, 7 ~ 12 months: 1 person, 1 year ~ 1 year and a half: 3 person, 1 year and a half ~ 2 years: 2 person, 2 years and a half: 6 person, 2 years and a half: 5 person, 3 years and more: 32 person)

Overseas students in China (1 ~ 6 months: 3 persons, 7 ~ 12 months: 6 persons, 1 ~ 18 years: 5 persons, 1 1/2 years: 5 persons, 2 ~ 2 1/2 years: 6 persons, 2 1/2 ~ 3 years: 8 persons, 3 years + 8 persons)

## 2.3 Chinese Level Classification

Thai university students (freshman: 12 person, sophomore: 11 person, junior: 7 person, senior: 11 person)

Overseas students in China (junior: 9 person, intermediate: 6 person, intermediate: 21 person, senior: 5 person)

In order to make the collected data more concrete, I will use tables to present the data. When analyzing the survey data, the interview data will be supplemented.

## 3. Data Analysis

Why are you studying Chinese? (Mark all that apply);

### 3.1 Data and Analysis of Chinese Learning Motivation of Thai University Students

**Table 1** Chinese learning motivation of Thai university students

Options	The number of statistics
A.Interested in Chinese culture.	18
B.Interested in the Chinese language	26
C. In order to find a job	24
D.To be able to travel in China	27
E.Want to make Chinese friends	16
F. Friends are also studying Chinese	4
G. In order to satisfy parent or school requirements	4
H. Not quite sure why, but know there is a reason	1
I. Other reasons	2

From table 1, it can be seen that the motivation of Thai university students to learn Chinese basically focuses on the first five options. The specific analyses are as follow:

1. 18 people interested in Chinese culture, accounting for 44% of the total. Thai university students are interested in Chinese traditional culture, but only a few universities in Thailand offer opportunities to learn Chinese traditional culture, mainly because there are few teachers. In addition to their love for traditional Chinese culture, Thai university students are also interested in Chinese TV series, variety shows, music groups and other modern cultures. Compared with traditional Chinese culture, the access to such new culture is easier.

2. 26 people interested in Chinese itself, accounting for 63% of the total. Since the government of China and Thailand vigorously promoted Chinese learning in Thailand. Included Chinese teaching became a part of teaching plan which issued by ministry of education of Thailand. Thai students can have access to Chinese earlier than foreign students from other countries, and it is easier to cultivate student's interest in Chinese.

3. 24 people, 39% of the total, found it easy to find a job. Most of the students who chose this option were juniors and seniors. These students are faced with the problem of looking for a job after graduation, and have already carried out social practice in advance through school activities, short-term internship and other means. So in terms of planning for the future, they already have very clear goals.

4. 27 people, accounting for 66% of the total, are expected to travel in China. Thai university students have learned about famous Chinese historical sites and tourist attractions through various channels, especially online channels such as Facebook and YouTube. In addition, the low cost of traveling to China, diversified scenic spots and less time consumption, etc., make Thai university students want to travel to China more.

5. 16 people, 39% of the total, want to be friends with Chinese people. Thai university students want to make friends with Chinese people in the hope of practicing spoken Chinese. "If possible, I hope to teach my Chinese friends Thai." Students said.

6. 8 students with extrinsic motivation. Four people learn Chinese because of their friends, accounting for 10 percent of the total. Four people, 10 percent of the total, also learn Chinese at the request of their schools or parents. Thai university students enjoy spending time with their friends both in life and study. Thanks to the support of the Thai government, many comprehensive schools start learning Chinese from primary school. Some university students learn Chinese because their parents want

them to learn it. Some students just happen to be interested in by their own, also schools and parents have requirements at same time, so they learned Chinese.

7. "I think there is a reason, but I can't tell one of them", two students choose to learn Chinese for other reasons. After interview the students, they explained that they could not remember clearly.

### 3.2. Data and Analysis of Chinese Learning Motivation of Overseas Students in China

**Table 2** Chinese learning motivation of overseas students in China

Options	The number of statistics
A. Interested in Chinese culture.	22
B. Interested in the Chinese language	26
C. In order to find a job	19
D. To be able to travel in China	12
E. Want to make Chinese friends	12
F. Friends are also studying Chinese	1
G. In order to satisfy parent or school requirements	4
H. Not quite sure why, but know there is a reason	6
I. Other reasons	5

From table 2, it can be seen that the motivation of overseas students in China to learn Chinese basically focuses on the first five options, too. The specific analyses are as follow:

1. There were 22 people interested in Chinese culture, accounting for 53% of the total. Many foreign students find Chinese culture mysterious and fascinating. There are many overseas students who like Chinese traditional culture. Some of them are interested in Chinese martial arts and some are interested in Chinese music, so Chinese universities will offer some interesting courses about Chinese culture.

2. There were 26 people interested in Chinese, accounting for 63% of the total. Some foreign students think that Chinese sounds good even though it is difficult to pronounce. The foreign students believed that Chinese has a large vocabulary and many words have only slight differences. These differences are interesting and can help them express their feelings more accurately.



3. 19 people, or 46% of the total, study Chinese in order to find a job easier. It shows that with the rapid development of China's economy and the increase of companies engaging in economic trade with China, Chinese has become an important skill for some companies to recruit talents, and those who can use Chinese will get more opportunities.

4. 12 people, 29% of the total, learn Chinese in the hope of traveling in China. For overseas students, go to China not only to study, but also to experience Chinese culture. Tourism is the best choice for them. The students believed that learning Chinese will be easier on the road, easier to communicate with Chinese, and more accurate to obtain useful information.

5. 12 students studied Chinese for communicative purposes, accounting for 29% of the total. These overseas students hope that by learning Chinese, they can better chat with the Chinese friends they have already met, and find more Chinese friends to learn about the real life of Chinese people, so that they can understand their Chinese friend's country and life.

6. There are 5 students with extrinsic motivation for learning, for the following two reasons. One, 2%, learned Chinese because a good friend learned it. The other was learning Chinese at the request of the school or parents, with four students, or 10% of the total. Schools are required to learn Chinese, which may be required to obtain Chinese credits. Parents may ask to learn Chinese because they think it will have a big impact on their future, so they forcing their children to learn. Of course, some foreign students like Chinese or Chinese culture themselves, and the school or parents also require them to learn Chinese.

7. There were also 11 people who believed that they learned Chinese for a reason, but were not quite clear or had other reasons. Some of these overseas students forgot the reason why they started learning Chinese in the process of learning Chinese, but still insisted on learning Chinese. There are also overseas students studying Chinese for research and investigation in China, so they choose other reasons. During the interview, one American student said that learning Chinese was a challenge, while another American student wanted to learn Chinese to understand different cultures.

### 3.3 Comparative analysis

**Table 3** Comparison of Chinese learning motivation between Thai university students and overseas students in China

Options	Thai university students (%)	Overseas students in China (%)
A. Interested in Chinese culture.	44%	54%
B. Interested in the Chinese language	63%	63%
C. In order to find a job	39%	46%
D. To be able to travel in China	66%	29%
E. Want to make Chinese friends	39%	29%
F. Friends are also studying Chinese	10%	2%
G. In order to satisfy parent or school requirements	10%	10%
H. Not quite sure why, but know there is a reason	2%	15%
I. Other reasons	5%	12%

According to the data comparison and analysis in Table 3, we can see that:

1. Options with the same or similar data include:

1.1 The number of Thai university students is 44%, while that of students studying in China is 54%. Both Thai university students and overseas students in China are interested in Chinese traditional culture, but there are few resources, ways and opportunities to learn traditional culture in Thailand, and many Thai university students' interests are not timely supported. Compared with Thai university students, overseas students in China have better learning conditions. Most universities that accept overseas students offer Chinese culture courses, such as ethnic dance, ethnic Musical Instruments, tai chi, tea ceremony and so on.

1.2 The data of Thai university students and Chinese students in China are identical, both of which are 63%. This data shows that Chinese, as one of the oldest languages in the world, has great attraction for Chinese learners in terms of pronunciation, Chinese characters and vocabulary.

1.3 The data of Thai university students who learn Chinese at the request of their school or parents is identical with that of overseas students in China, accounting for 10% of the total.

2. The choices of data difference are as follow:

2.1 From the easy job hunting option, we can see that overseas students in China have a stronger purpose in learning Chinese than students in Thailand. The number of international students in China is 46%, and that of Thai students is 39%, a 7% difference. The social background of overseas students in China is different, so before they came to China to learn Chinese, most of them had a clear purpose, while Thai university students are all in school, so those who think Chinese plays an important role in their work are mainly the students in the third and fourth years.

2.2 The number of university students in Thailand is much higher than that of students studying in China, with 66% and 29% respectively, 37% difference. After the interview, since most of the Thai university students have never been to China, they will naturally become more interested in traveling to China by learning about China in Chinese classes and after class. But overseas students in China have more opportunities to travel, so fewer students choose this option.

2.3 When it comes to wanting to be friends with Chinese, the number of Thai university students is 39%, compared with 29% of students studying in China. In Thailand, many universities have begun to accept Chinese students, who live and study in Thailand, so Thai language has become a very useful language for Chinese students, also provides conditions for Thai students to find Chinese friends. Overseas students in China can see Chinese and hear Chinese everywhere in the Chinese-speaking environment, so their desire to be friends with Chinese people has been reduced.

2.4 About 10% of Thai university students study Chinese because of their friends. But there were 2% of students studying in China have this problem. This difference is related to the cultural customs of both sides. Thais prefer to be with friends in life, study and work rather than alone. This explains why Thai university students are more susceptible to friends when it comes to learning Chinese. Overseas students in China come from all over the world. Some are from European and American countries.

2.5 About unclear why and other reasons. Among the options, the proportion of overseas students in China is larger than that of Thai university students. This is because some overseas students in China have lost their motivation to learn Chinese for they have been learning it for a long time. There are also foreign students who come to China to study Chinese because they want to do research.

### 3.4 Advantages and Disadvantages of Thai University Students in Learning Chinese

From the analysis of the data, Thai university students have both advantages and disadvantages in learning Chinese. Now let's analyze these two aspects separately.

#### 1. Chinese learning advantage of Thai university students:

1.1 Many Thai students want to travel to China, so teachers can use this motivation as the basis to increase the proportion of Chinese culture in teaching, thus increasing the interest of Thai university students in Chinese culture. At the same time, it can also enhance the interest of Thai university students in learning Chinese, so that they can face up to the difficulties in learning Chinese more easily and will not give up easily. In addition, this motivation can also help Thai university students plan their future career and give them more career choices.

1.2 As the traditional culture of Thailand believes that teachers are inviolable, many students are so afraid of teachers that they are afraid to ask the teachers when they encounter difficulties in learning. According to the survey data, most Thai university students are willing to make friends with Chinese people, which can effectively solve the problem. With the help of Chinese friends, Thai university students can solve problems in Chinese learning, practice oral Chinese with Chinese friends and learn about the real life of Chinese people.

#### 2. Disadvantages of Thai university students in Chinese learning:

2.1 The motivation to make friends with Chinese people has both advantages and disadvantages. Most of the Chinese people I know in the language environment of Thailand are Chinese students who come to Thailand to study Thai. These students also make friends with Thais to practice their Thai language. In the face of such problems, coordination between the two sides is essential.

2.2 Due to the social and cultural customs of Thailand, some students learn Chinese because of their friends. Such motivation is a double-edged sword. If these students have strong self-control, they can practice together and make progress together. If the students are weak in self-control, the friends will only communicate in Thai, thus both of them lose a lot of opportunities to practice. Overall, this motive is doing more harm than good.

### 4. Conclusion

Based on the above data analysis, compared with the Chinese students in China, the advantage of Thai university students in learning Chinese is also obvious.

This requires teachers to take students primary learning motivation as a starting point in the process of organizing teaching, and use this major learning motivation as much as possible to enhance the influence of other favorable motivations on learning. Help students to solve the difficulties in learning and increase their confidence in learning Chinese. At the same time, we should also pay attention to the influence of negative learning motivation on learning. Under certain conditions, negative learning motivation can be transformed into favorable direction by some activities or methods.

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## 汉语学习动机调查问卷

### Learning Motivation Questionnaire

这份问卷需要您用几分钟来完成。您在问卷中的回答将会成为对我的研究的重要数据和资料，请您认真的回答每一个问题。谢谢您的合作和支持！

This questionnaire only needs a few minutes to complete. Your responses will become important data for my research. Please answer each question earnestly.

- 1、你的国籍是 / Nationality \_\_\_\_\_。
- 2、你的母语是 /Native Language \_\_\_\_\_。
- 3、你的年龄是 /Age \_\_\_\_\_。

- 4、你学习汉语多长时间了？ How long have you been studying Chinese?
- A、一~六个月 1.0-6.0 Months
  - B、七~十二个月 7.0-12.0 Months
  - C、一年~一年半 1.0-1.5 Years
  - D、一年半~两年 1.5-2.0 Years
  - E、两年~两年半 2.0-2.5 Years
  - F、两年半~三年 2.5-3.0 Years
  - G、三年以上 More than 3.0 Years
- 5、你为什么学习汉语。（多选） Why are you studying Chinese? (Mark all that apply)
- A、对中国文化感兴趣 Interested in Chinese Culture
  - B、对汉语感兴趣 Interested in the Chinese language
  - C、容易找工作 In order to find a job
  - D、希望能在中国旅游 To be able to travel in China
  - E、想和中国人做朋友 Want to make Chinese friends
  - F、自己的好朋友学习汉语 Friends are also studying Chinese
  - G、学校或者父母的要求 In order to satisfy parent or school requirements
  - H、有原因，但不太清楚 Not quite sure why, but know there is a reason
  - I、其他原因 Other reasons

## The Causal Model of Factors Affecting Continuance Intention to Taxi Application of the Generation-C in Bangkok

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### Abstract

The purpose of this paper were 1) to analyze factors affecting continuance intention to taxi application, and 2) to develop and empirically test a model that examines the relationship between quality of application, technology acceptance, attitude toward taxi application, application of customer satisfaction and continuance intention in the usage of taxi applications. This study was quantitative research that used questionnaire for collecting data. The samples were 400 people recruited from generation-c in Bangkok.

The results showed that 1) a model of continuance intention to the taxi application consisted of quality of application, technology acceptance, attitude toward taxi application, and application of customer satisfaction. They were found to be consistent with the empirical data. 2) The factors affecting continuance intention to taxi application consisted of application of customer satisfaction (TE= 0.483), technology acceptance (TE= 0.354), attitude toward taxi application (TE = 0.314), and quality of application (TE= 0.160), respectively. All factors could jointly predict 35.50 % of variable in the continuance intention ( $R^2 = 0.355$ ). And 3) the results supports all the posited hypothesis as postulated in a significant.

**Keywords :** Continuance intention, taxi applications, Generation-C

### 1. Introduction

The advancement of network communication technology and portable devices for travelers anytime you want because consumers can access directly and meet the needs of consumers as well. For example, consumers can shop, make financial transactions, listen to music, play games or communicate with friends in the social

media through mobile applications. (SME leader, 2018) It is also the first year that buying products and services online. Entered the top 5 list of activities that Thai people prefer to do online with a high number of applications, up to 51%, including a variety of activities over the past year both financial transactions, reading online, booking hotels, booking tickets, calling taxis, ordering food including various online classes shows that Thailand has begun to enter the digital society completely as the lifestyle of people's daily lives is becoming more digital in all aspects. (Brandbuffet, 2018)

Passenger cars or taxis play a huge role in providing passenger services in urban areas, especially in Bangkok. But from the news that appears in general users are also faced with many problems including: refusing passengers. Carelessness in driving as well as inappropriate behavior of taxi drivers is leading to questioning the quality of taxi drivers. The selecting and training taxi drivers are the duties and main obligations of business operators. (Thailand Development Research Institute, 2018)

This current digital technology facilitates vendors and buyers to interact with each other in real time and reduces restrictions on space and distance. It benefits the seller by increasing sales and buyers by accessing the information from online purchasing. Survey of internet user behavior in Thailand in 2018 by ETDA indicates that Thailand has moved to a full digital society. The average internet usage of Thai people is much higher it grown 3 times more than the previous year and has a average per persons total of 8 hours per day. Thus the current generation of digital is seriously attached to the internet they may called Generation-C (Brandbuffet, 2018)

For the above reasons, the researchers saw the benefits and importance of research on The causal model of factors affecting continuance intention to the taxi application of the generation-C in Bangkok. This is based on current knowledge and the need to develop an approach to e-commerce in Thailand both short and long term that will drive the digital economy further.

## **2. Research Objectives**

This research consisted of two objectives:

2.1 To analyze factors affecting the taxi applications continuance intention.

2.2 To develop and empirically test a model that examines the relationship between quality of application, technology acceptance, attitude toward taxi application, application satisfaction, and continuance intention in the usage of taxi applications.



### **3. Conceptual model and hypotheses**

All constructs are briefly explained in the following:

#### **3.1 Technology Acceptance**

This study the continuance intention to the taxi application based on theory of TAM Davis(1989) proposed the TAM to predict or elucidate the factors affecting information technology. TAM was extended and developed, and consisted of two beliefs: perceived ease of use and perceived usefulness. Perceived ease of use defining the level that users expect for the technology that is the target to use and it must be easy and does not require much effort to study and learn to use. Perceived usefulness defining the level at which people believe that the use of technology can increase performance .

#### **3.2 Quality of application**

Crosby (1979) defining the concept that adheres to the operation without defects and responds to the needs of the client as well as service providers can know the needs of the service recipients. Service quality is also defined as the degree or direction of discrepancy between perceived quality and the expectation (Parasuraman, 1988).

#### **3.3 Attitude toward using**

The term attitude towards used in our daily life. The attitude towards use is inclination. Psychological expressions by evaluating the liking level of technology (Eagly & Chaiken, 1993). Attitudes will affect the use of technology to influence intention to use technology (Ajzen, 1998)

#### **3.4 Application of customer satisfaction**

Delone and McLean (2003) refer to user satisfaction is the key to measuring the success of a computer system. Doll and Torkzadeh (1988) user satisfaction regardless of the user's attitude towards the operating system

#### **3.5 Continuance intention**

Anderson (2006) explained the success of the sale, that can be successful may be considered by the customer having repurchase intention which repeat can occur from customers having confidence in the product or service as a basis trust, reliability is a very important factor. The intention of repeating is that the consumer decides to buy in a product or service for a period of time. By continuously buying or using services from the same service provider to continuance intention. (Gounaris, Dimitriadis & Stathakopoulos, 2010)



## 4.2 Research Instruments

The researchers tested the quality of the measurement. The reliability of the content by using corrected item-total correlation and the objectives from 3 experts in marketing field and inspecting reliability of questionnaire before practice (n=30) and gathering the data from generation-c across the country (n=400 ) so that all latent constructs have Cronbach's Alpha coefficient more than 0.7 (Cortina, 1993) (as shown in Table 2).

All the measurement items were measured on a five-point Likert-type scales that was anchored by 1= strongly disagree to 5= strongly agree to express the degree of agreement.

## 4.3 Data Collection

In this survey based study the data was collected from generation-c located in Bangkok. The researchers used 400 samples and applied a two stage stratified sampling scheme to the research from Bangkok two areas the Phranakhon and Thonburi. In Bangkok, there are fifty districts. It was decided to select a sample by using simple random sampling, and samples were collect from six districts in Bangkok. The six major districts Dusit, Bangkhen, Suanluang, Huaykwang, Klongsan and Bangpat. All these six districts of Bangkok were considered as clusters and repondents were contacted on a random basis. The survey instrument was distributed through face to face meetings. Subjects were contacted at main shopping malls, educational institutes, metro railway stations, and organizational headquarters.

## 4.4 Data Analysis

The data collected were analyzed using basic statistical techniques: frequency, percentage, mean, standard deviation. The qualitative data were analyzed using content analysis. Structural equation modeling (SEM) approach using Smart PLS statistical software was used to test the research model. PLS is a component-based approach to structural equation modeling.

## 5. Research Results

Table 1 showed the profile of the participants that the major proportion of the respondents were females and aged between the ages of 18 – 25 years old. They were single with this education being a bachelor's degree for almost 75% of participants They had income 15,000-25,000 Baht, and had company employment.





**Table 4** The impact of Antecedents variable to dependent variable

Latent variable	R <sup>2</sup>	Effect	Antecedents			
			QA	TA	AT	AS
AT	0.489	DE	0.193	0.547	N/A	N/A
		IE	0.000	0.000	N/A	N/A
		TE	0.193	0.547	N/A	N/A
AS	0.690	DE	0.206	0.377	0.353	N/A
		IE	0.068	0.193	0.000	N/A
		TE	0.274	0.570	0.353	N/A
CI	0.355	DE	0.000	0.000	0.143	0.483
		IE	0.160	0.354	0.171	0.000
		TE	0.160	0.354	0.314	0.483

Remark : DE = Direct effect, IE = Indirect effect, TE = Total effect, N/A = not applicable

From Table 4, it was found that the factors with the highest total effect on the Continuance Intention were (1) Application of customer satisfaction (TE = 0.483), (2) Technology acceptance (TE = 0.354), (3) Attitude toward taxi application (TE = 0.291) and (4) Quality of application (TE = 0.160), respectively. All factors together could be used to predict the Continuance Intention to 35.50 percent (R<sup>2</sup> = 0.355). Overall, R<sup>2</sup> for attitude toward taxi application, application of customer satisfaction and continuance intention to taxi application in Figure 2, indicate that the research model explains 47.9%, 69% and 35.5% respectively of the variance in the endogenous variables. Following formulae provided by Tenenhaus, Vinzi, Chatelin & Lauro, (2005), The calculated global goodness of fit (GoF) is 0.66, which exceeds the threshold of GoF>0.36 suggested by Wetzels, Odekerken-Schroder & van Oppen (2009). Thus, this study concludes that the research model has a good overall fit.

## 5.2 Structural model

The results of the PLS analysis was shown in figure 2 and table 4 respectively. Standardized path coefficients were expected to be at least 0.2. The reliability of each coefficient was assessed from bootstrapping (400 resamples). Support was provided for all the seven hypotheses. All other path coefficients were above 0.2 and significant (pb0.001). As indicated in Figure 2 and Table 4, The path coefficients were 0.193, 0.206, 0.547, 0.377, 0.353, 0.483 and 0.143 for H1, H2, H3, H4, H5, H6 and H7, respectively.

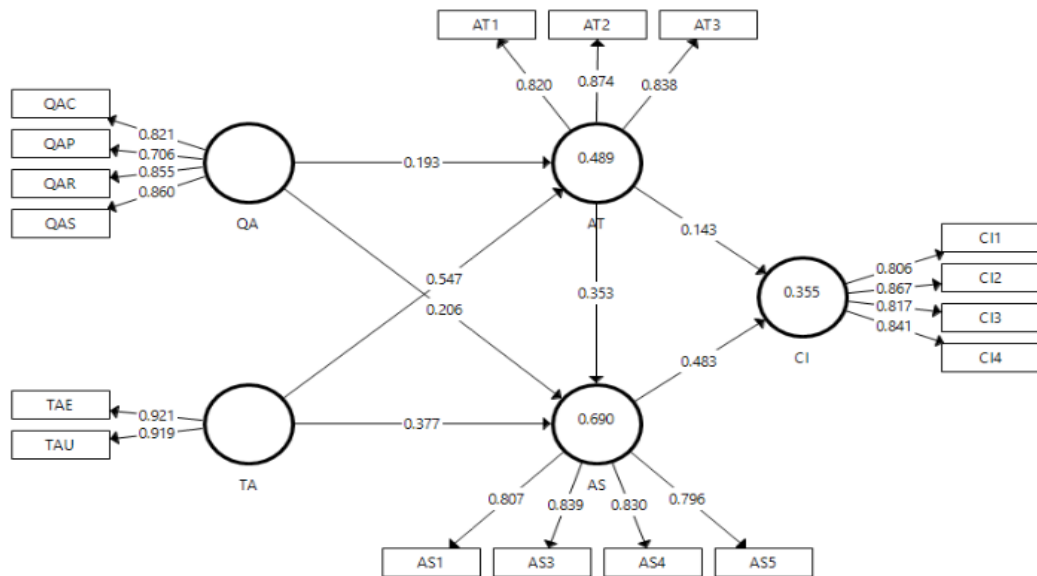


Figure 2 Research Model

Table 5 Results of structural Equation Model Analysis

Hypothesis	Path Coefficients	T-statistics	Results
H1: QA → AT	0.193	3.201**	Supported
H2: QA → AS	0.206	4.552**	Supported
H3: TA → AT	0.547	9.546**	Supported
H4: TA → AS	0.377	8.178**	Supported
H5: AT → AS	0.353	8.349**	Supported
H6: AT → IT	0.143	2.042**	Supported
H7: AS → IT	0.483	7.413**	Supported

Note : QA= Quality of Application, TA= Technology Acceptance

AT= Attitude toward Taxi applications, Attitude toward Taxi applications,

AS= Applications satisfaction , IT= Intention to use though taxi applications

Table 5 provides the T-statistics for the hypothesized relationships. The minimum T-statistics is 4.445 and, therefore, exceeds the recommended threshold of 2. This further confirms that all the hypothesized relationships are statistically significant and hence are supported.





## 7. Conclusion

The research attempts to identify the quality of application, technology acceptance, attitude toward taxi application and application satisfaction about continuance intention to the taxi application. It can help these taxi application businesses in planning their marketing strategies and expanding. The results show that customers are positive towards the continuance intention to taxi application.

## 8. Recommendations

Due to limited resources and time constraints this study involves respondents from Bangkok only; for that reason a comparative analysis of findings with other (e.g. Chaingmai or Phuket) respondents as well as a comparative study for different segments to increase the generalizability of the finding. In addition, there may be other factors affecting continuance intention to the taxi application (e.g. brand image and brand trust) and worth for future investigation.

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## Thai Secondary Students' Perceptions on Using Note-Taking Strategy to Enhance Vocabulary Learning

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### Abstract

This study is an attempt to investigate the perceptions of Thai secondary students on using note taking to enhance vocabulary learning. The participants were 30 Thai native students who were studying intermediate English course in upper secondary level at Surawiwat School Suranaree University, Nakhonratchasima, Thailand. The research instruments include questionnaire and semi structured interview. The participants have been instructed to apply note taking strategies adapted from Cornell Note taking method to enhance vocabulary learning. The lessons have been consisted note taking implementation on 21 target unknown words selected from students' needs. The words were divided into 3 different themes; crimes, problems, and money. After 3 weeks of the implement, the participants were asked to answer a set of questionnaire and semi structured interview questions in order to reveal their perceptions on using note taking to improve their vocabulary learning. The result presents no significant difference of satisfaction between male and female participants. The participants tends to realize the significant of applying note taking as vocabulary learning over the satisfaction of applying note taking strategies. The finding presents that note taking tends to effectively enhance the vocabulary learning in the aspect of word form, meaning and use due to participants' perception.

**Keywords :** note taking, vocabulary learning, perceptions

### 1. Introduction

Undeniably, vocabulary learning is considered as the foundation tool and has been focused in many counties around the world. According to Wilkins (1972), it is impossible to communicate without vocabulary. Nevertheless, vocabulary learning among Thai learners is still far beyond the proficiency levels and significantly needed

to be improved (Chomchaiya & Dunworth, 2008; Chomchaiya, 2014; Kasemsap & Lee, 2015; Sawangsamutchai & Rattanavich, 2016). The claim is supported by the result of the Common Europe Framework of Reference for Languages which also known as CEFR. The Thai Ministry of Education has been working on the additional kind of Education benchmark to evaluated Thai educational system. In recent year, the Common European Framework of Reference Languages (CEFR) has been introduced to be one of Thai educational standards. English language curriculum has been trying to develop English proficiency for the last twenty years, it still far beyond the expectation (Franz & Teo, 2017). The related result has shown through the report of O-NET, Ordinary National Education Test, from 2009 – 2014. The statistic supported the claim that the lack of English proficiency levels of ninth and twelfth graders in Thailand. The test result presented 28.98 as the average scores of English O-NET test since 2009 to 2014. In other words, the percent of English language proficiency levels of Thai learners are lower than fifty percent through the past six years. The result from the reports, therefore, raised the important questions to the English learning strategies and approaches in Thailand, especially what could be considered as the problems and how to solve them.

Indeed, learning language is required all four types of skills; listening, speaking, writing and reading. Knowing vocabulary significantly enhances the capability of all language skills (Nation, 2001). Therefore, a number of researchers shed the light on the vocabulary learning approaches and strategies. According to Hashemzadeh (2012), EFL vocabulary retention is significantly improved through the process of repeatedly taking a recognition exercises. As claimed by Nation (2001), the successful second or foreign language learning relies on how well students obtain and maintain vocabulary. Vocabulary learning strategies have been analyzed and demonstrated to active use of dictionary, unknown words guessing, and note-taking strategies. To deal with this learning challenge, many researchers suggest teacher to pay attention to note taking implementation in classroom (Ward & Tatsukawa, 2003; Kobayashi, 2006; Bui et al, 2013). Since note taking requires comprehension and the selection of written production processes. Its function has been reviewed to the relationship among abbreviation procedures, strategies, and working memory. Moreover, note taking occurs in frequent and various circumstances such as making order purchases, planning events and activities, studying for examinations, preparing for delivering a speech, recording minute of meeting. In other words, note taking is common used skill and plays an important role in students' daily and academic lives. Students' learning experience is likely to be fulfilled by adding the value of applying note taking skill through the way

they acquire new words, record, and process the information. In order to achieve the effective note taking skill, note takers have to naturally collect the information from one or several sources, try to understand, process the cognitive processes, and store the information in long-term memory by writing it down. Undoubtedly, the processes are similar to original composition. Unfortunately, the significant demands to activate note-taking skill as part of active learning are scarcely found in EFL contexts (Crawford et al., 2016). In order to achieve the efficiency of language learning, the importance of note taking skill should be considered under the spotlight and be emphasized in general and language classrooms.

Nation (1990) believes that vocabulary should not be left to develop itself. It should be enhanced by using systematic and principled approach. There are three reasons to support why it should be systematic approach. Therefore, teachers could design which is suitable from their students. The trends of research in the area of vocabulary learning have been increasing over twenty years since 1980 (Nation, 2008). In recent years, the researchers have been shading light on the vocabulary learning and developing for second language learners. There are many vocabulary-learning topics to be focused such as spelling rules, dictionary uses, guessing words, word parts, and note taking. The last one aims to solely increase vocabulary for future use. According to Peverly & Sumowski (2012), one of the common practice that students apply while they are listening to the lecture or reading the text is note taking. In order to adapt the effective teaching and learning vocabulary is to investigate how the learning process takes place.

#### 1.1 What is involved in learning a word?

According to Nation (2001), there are number of components of the information about word form, meaning and use of particular word, which the learner should acquire to complete the knowledge of a word. For instance, the process of learning new vocabulary starts after its meaning is introduced and connected with the form of the word. The process of storing the word knowledge could take many years of language exposure. Language learners are automatically required to have adequate number of words for written and communicative purposes. Normally, the vocabulary acquisition process is cumulative. Since it includes knowing other aspects of word knowledge such as meaning in other fields, usage, collocations, and association.

#### 1.2 Note taking as vocabulary learning strategies.

William and Eggert (2002) claim that note taking promotes students' deep understanding since it integrates several processes such as comprehension, selection,

and production. In addition, Gur et al., (2013) states that the ability to recall and learn are better when note taking are instructed. Since note-taking product provides the understandable version of the original text that students attempt to study. Therefore, it is important for the students to know how the keywords or significant information should be included and transformed in their note-taking product. Van Der Meer (2012) suggest the teachers to purposefully introduce the method of using note taking in the class as to improve learners' learning outcomes. In addition, the feedback from the students who use note taking strategies in their learning processes is positive (Cohen et al., 2013).

Vocabulary learning strategies are broadly used by second and foreign language learners (Ahmed, 1989; Gu & Johnson, 1996; Schmitt, 1997). Many studies have conducted the research to investigate the effective way to develop vocabulary learning in various topics such as memory-based strategies, inferencing strategies, incidental vocabulary learning strategies, and note taking. Takač (2008) presents that strategies for vocabulary learning are more popular than other language learning activities. Ahmed (1989) classifies vocabulary-learning strategies into two sets, which are macro-strategies and micro-strategies. Macro-strategies include memorization, practice, note taking, and using different data sources.

Gu & Johnson (1996) presents the lists of vocabulary strategies. They could be categorized into two main sessions which are, metacognitive strategies; selective attention, and self-initiation, and cognitive strategies; guessing strategies, dictionary strategies, note-taking strategies, rehearsal memory strategies, encoding memory strategies and activation strategies. On the other hand, note taking concerns with the process of encoding skills. Learners have to link the receiving information to their cognitive structure. The important of note taking product is its meaning (Di Vesta & Gray, 1972).

According to Barnett et al., (1981), note taking enhance the processes of the matter recalling. It happens when learners are taking note, not the note studying afterward. The statement is supported by the study of Bohey (2011). The learners who take note are actively engaging during a lecture or when reading a text. They tend to pay greater attention and constantly be determining the ideas to write down. The finding of implementing note taking strategies on 97 college students presents that the note takers significantly outperformed the other group of students who did not apply note taking strategies. The note taking effects are presented on the higher level thinking questions on their exam.

Acquiring vocabulary concern with various keywords; vocabulary, phrases, recalling, learning, remembering. On the other hand, note taking is associated with paying attention, organization, recording and making understandable note (Bui & Myerson, 2014). Hence using note taking is the stimulate process which is generated by the note takers while they are taking note. Note taking could refer to the cognitive processes that take place during taking note. Moreover, it enhances the chance of memorizing and developing comprehension ability since note taking allows the learners to divide information into small sections. In other words, pieces of information could be effectively acquired and remembered by learners after they retrieve information (Barnett et al. 1981). In the similar vein, well-organized note-taking skill encourages the capability of recalling, and comprehension of target matter (Ayer & Milson, 1993; Kobayashi, 2005). Moreover, note-taking advantages have been supported by several studies (Bonner & Holliday, 2006; Davis & Hult, 1997; Einstein, 1985). Consequently, applying note-taking skill in the process of learning vocabulary is demanding since note-taking skill is likely to enable cognitively demanding. In addition, the process of expanding the existing information is better than receiving the well-written notes from the instructor (Russell et al., 1983).

Note taking could be considered as a complex activity which demands the writing production processes, information selection, and comprehension. Selecting the crucial information to take note is challenging with the processes of selecting and structuring the information, abbreviating operations, syntactical short-cuts, context paraphrasing, and working memory under time constrains. Accordingly, one could conclude that note taking relates with dual- and triple-task processes; heard, observed, or thought. Since note taking activates the effort of reading comprehension, verbal learning, and writing composition. It is considered as both passive and active learning; comprehension and production processes. Even though, note taking requires less effort than the creativity of original writing composition it is still considered as a challenging due to its complexity (Piolat, 2001). According to Nation (2008), note-taking could be used a vocabulary learning feature that encourages learners to enhance their vocabulary learning. Moreover, notetaking in itself could function as aid memory which concern with two main parts. Firstly, notetaking could be used to store information for later use. Secondly, the significant role is to increase and retrieve learners' attention. In addition, notetaking encourages learners' critical thinking process by interacting with the receiving information. On the other word, learners could be facilitated with notetaking by processing information transfer of reading text to taking note, captioning main idea



or key word, and summarizing while listening or reading. Therefore, it is important to provide learners effective training in how to take notes using heading, sub-heading, including concept diagrams.

Language learners are encouraged to use note taking strategies as tools for vocabulary development. The great obstacles of language learning is supposed to be lighten after applying the effective tools. Since there is none related research has been conducted in the area of using note taking to enhance vocabulary learning in Thai context. Therefore, this study aims to review the relationship between these features. A better understanding of using note taking to develop vocabulary learning might help to reach an effective learning method for general English as a foreign language learner. In conclusion, note taking is a skill that is extended through proper instructions and continuous practice. However, there is limited number of research to investigate the perceptions and effect of note taking in the area of language learning. Furthermore, most of the research in this area has been focusing on university students and little is known about upper secondary school. In this sense, the present study focuses on answering the research questions in the field.

## **2. Research Objective**

This research consisted of one objective:

To investigate perceptions of students on using note taking to enhance vocabulary learning.

## **3. Research Methodology**

### **3.1 Samples**

This present study is included a sample of thirty students of Surawiwat School aging from fifteen to sixteen in Nakhonratchasima province, Thailand. They are studying intermediate English, but from 3 different classes. All of them are Thai native speakers who study English as foreign language. The participants come from various English learning backgrounds, but currently share the same learning and living environment since all of them are dormitory resident at Surawiwat School. Thirty participants were randomly selected from a total population of 73 students who are currently studying grade 10.

### **3.2 Research Instruments**

In order the achieve the in-depth data about how note taking strategies affects the vocabulary learning among participants, 24 questions in questionnaire related to the

using of note taking and 12 interview questions were applied after the note taking implementation. They were asked to rate the level of their attitudes on the Likert Scale (Likert, 1932). The score for reliability was 3.51. The quantitative data was analyzed and presented in percentage, mean, standard deviation. In addition, the answers of interviewed question were analyzed via content analysis.

### **3.3 Data Collection**

The study started the note taking treatment at the beginning of second semester of academic year 2018. In order to answer the research question, the set of questionnaire was adopted after the implementation of note taking which were introduced to the students for 3 units within 3 weeks.

3.3.1 The questionnaire was constructed in three main parts; general information, attitudes towards using note taking to enhance vocabulary learning, and additional comment.

3.3.2 After the participants complete the questionnaire, they were asked to participate the interview in order to gain in depth information about their perceptions towards using note taking. The questions from semi-structure interviews were questioned. The face- to- face conversations were audio- recorded to allow for transcription and analysis. The data were gathered to answer the research question.

### **3.4 Data Analysis**

3.4.1 This present study will use Mean ( $\bar{x}$ ) and Standard Deviation (S.D.) to present the collected data of the questionnaires. The results from these questionnaires will be presented to investigate the perceptions of using note taking to develop vocabulary learning.

3.4.2 The answers from the interview were transcribed and the contents were analyzed. The written data of the interview was presented.

## **4. Research Results**

The perceptions of using note taking among 30 participants were statically presented below.

4.1 The perceptions of Thai students towards using note taking to enhance vocabulary learning:

The descriptive statistics of samples' personal information were shown in Table 1 below:

**Table 1** Personal information of the samples

No.	Personal information	Frequency (n= 30)	Percentage (%)
1.	Sex		
	Female	19	63.33
	Male	11	36.67

Data from table 1 show the number of participants which could be divided into two main groups; male and female. The number of female participants are higher than male participants.

The obtained mean of perceptions of using note taking to learn vocabulary form were presented in Table 2 below:

**Table 2** Perceptions of students of using note taking to learn vocabulary form

No.	Items	Frequency (n= 30)	Df	Mean	SD	$\alpha = 0.05$
1	recognition	30	29	3.73	0.78	3.51
2	spelling	30	29	3.93	0.78	>3.51
3	pronunciation	30	29	2.90	0.84	>2.51
4	part of speech	30	29	3.70	0.88	3.51

Table 2 represents that mean score of students' perception on note taking could be ranked as followed; spelling (mean = 3.93), recognition (mean = 3.73), part of speech (mean = 3.70), and pronunciation (mean = 2.90). According to the number, it could be considered that note taking enhance the word spelling the most and pronunciation the least.

The perceptions of using note taking to learn vocabulary meaning were presented in Table 3 below:

**Table 3** Perceptions of students of using note taking to learn vocabulary meaning

No.	Items	Frequency (n= 30)	Df	Mean	SD	$\alpha = 0.05$
1	general meaning	30	29	4.07	0.52	>3.51
2	meaning in context	30	29	4.17	0.65	>3.51
3	word concept	30	29	3.83	0.79	>3.51
4	related word	30	29	3.60	0.89	3.51

According to information from tale 3, students' perceptions on using note taking to learn meaning of target vocabulary could be considered as effective tool. Mean score shows that note taking significantly affects vocabulary learning in the aspects of meaning; meaning in context (mean = 4.17), general meaning (mean = 4.07), word concept (mean = 3.83), and related word (mean = 3.60).

The perceptions of using note taking to learn vocabulary use were presented in Table 4 below:

**Table 4** Perceptions of students of using note taking to learn vocabulary use

No.	Items	Frequency (n= 30)	Df	Mean	SD	$\alpha = 0.05$
1	general use	30	29	3.87	0.68	>3.51
2	use in sentence	30	29	3.73	0.69	>3.51
3	use with collocation	30	29	3.60	0.67	3.51
4	use in different context	30	29	3.80	0.96	3.51

In the succeeding table it is obvious that highest mean score among the perceptions towards learning vocabulary use is general use (mean = 3.87). In contrast, the lowest is vocabulary and its collocation (mean = 3.60).

The descriptive statistics of perceptions of students' satisfaction using note taking to learn vocabulary in general were presented in Table 5 below:

**Table 5** Perceptions of students of students' satisfaction using note taking to learn vocabulary in general

No.	Items	Frequency (n= 30)	Df	Mean	SD	$\alpha = 0.05$
1	enjoy using	30	29	3.50	0.82	3.51
2	enhance vocabulary learning	30	29	4.20	0.76	>3.51
3	not enhancing vocabulary learning	30	29	3.57	1.10	3.51
4	consider note taking as important tool	30	29	3.93	0.69	>3.51
5	note taking is time consuming	30	29	2.87	0.90	>2.51

**Table 5** (Continue)

No.	Items	Frequency (n= 30)	Df	Mean	SD	$\alpha = 0.05$
6	like note taking	30	29	3.17	0.79	>2.51
7	dislike note taking	30	29	3.37	1.16	>2.51
8	avoid using note taking	30	29	3.70	0.88	3.51
9	reviewing note taking	30	29	2.90	1.03	>2.51
10	feeling proud of note taking product	30	29	3.30	0.95	>2.51
11	Feeling embarrassed of note-taking product	30	29	3.87	0.87	>3.51
12	Want to review others' note taking	30	29	3.43	1.25	3.51
13	Consider note taking as difficult and complicated tool	30	29	3.60	1.04	3.51
14	Impressed with note taking experience	30	29	3.60	0.72	3.51
15	Overall satisfaction	30	29	3.60	0.46	3.51

\* *Sig. < 0.05 (1-Tailed), Test Value = 2.51*

\*\**Sig. < 0.05 (1-Tailed), Test Value = 3.51*

\*\*\**Sig. < 0.05 (2-Tailed), Test Value = 3.51*

Table 5 presents that participants tend to believe that note taking enhance their vocabulary learning (mean = 4.20) and significantly consider note taking as important tool (mean = 3.93). It is worth to declare that significant number of the participants feel impressed and satisfied with their note taking experience (mean = 3.60). However, they still feel embarrassed with their own note taking products (mean = 3.87) and likely to read and review others' notes (mean = 3.43).

The reliability of statistics were presented in Table 5 below:

**Table 5** Reliability statistics

<b>Cronbach's Alpha</b>	<b>N of Items</b>
<b>0.877</b>	<b>28</b>

*ANOVA*

No.	Items	Sum of Squares	Df	Mean Square	F	Sig.
1	Between people	137.552	29	4.743		
	Between items	190.514	27	7.056	12.065	.000
2	Within people					
	Residual	457.914	783	.585		
	Total	648.429	810	.801		
	Total	785.981	839	.937		

*Grand Mean = 3.5048*

Table 5 indicates the reliability statistics for the questions used in this study is 0.877 which means the information from this sample is considered as adequate reliability.

According to the interview, the following suggestions about using note taking to enhance vocabulary learning were recommended:

1. Students require more time and advice on taking note. They believe having more time could help them understand and remember more words.
2. Since the note taking product was restricted in one A4 paper, some students ask for using other paper so they can draw and have more space.
3. Number of the words should be limited. This study provide seven target words, and some students think they are too much. Small number of target word per week would be better when they get back to the review session.

**5. Discussions**

Overall participants' perceptions on using note taking to enhance their vocabulary learning could be considered as effective learning tool. Especially, in the aspect of learning target vocabulary meaning. In addition, the result presents that participants believe in the importance of note taking and consider it as the effective vocabulary learning tool. The finding is supported by the study of Dunkel & Davy (1989).

According to the participants' opinions towards using note taking in lectures, it encourages the participants to conceptualize the acquiring information. Therefore, learners who learn how to take note efficiently tend to access to insight information and be able to retain it over the period of time (Meyer, 2002). Interestingly, number of students believe that the most difficult part of note taking procedures is the summarizing part, which takes most of their time to accomplish. Inevitably, summarizing is complex and requires develop methods and specific note-taking training (Piolat, Olive & Kellogg, 2004). The lack of effective training limits the potential of product summary. It strongly confirms the conclusions drawn by Gray & Madson (2007) on the statement that the students who have learned how to take note are likely to conduct higher quality of note taking. In the same vein, Cetingoz (2010) supports that learning quality could be improved by note-taking instructions.

## **6. Conclusion**

The obtained finding of present study are of some important points that require to be taken into account by teachers and language learning students. The participants in this study have significantly high satisfaction towards using note taking to enhance vocabulary learning. The results show that note taking encourage the understanding of word meaning, usage and form recognition. Moreover, the participants tend to enjoy using note taking as a tool to learn English vocabulary. However, the time of implementation should be long enough for them to take note, add related information, and draw pictures. Finally, they also recommend to introduce applying note taking for vocabulary learning to other students who are studying in different level.

## **7. Recommendations**

7.1 The participants of this study is limited in the level of upper secondary students. The result of perceptions would be more interesting if the participants could represent the attitude of students from various levels.

7.2 This study focuses on one particular style of note taking. For further study, it is recommended to emphasis on individual note taking style of the students and longer time period of implementation.

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## Thai Graduate Students' Perceptions on Using Collocation in Thesis Writing

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### Abstract

The purposes of this research were 1) to investigate Thai graduate students' perception on using collocation in their thesis writing at Khon Kaen University in Thailand, 2) to investigate how Thai graduate students choose the collocation if they meeting collocation using problems in their thesis writing. The samples were composed of 10 students who are the 5<sup>th</sup> year graduate students in English program. They were selected through a randomly sampling method. The instruments consisted of focus group discussion and group interview. Interviewed 10 prepared questions and recorded conversations as participants allowed. The result revealed that most participants had the problems on using collocation in their thesis writing. Participants always check dictionary or other previous studies when they cannot memorize which collocation should be used.

**Keywords :** collocation, thesis writing

### 1. Introduction

Vocabulary seems to be one of the most vital factors that benefit the use of English as a communication tool. It is the core of language and it is essential for typical language learner (Zimmerman, 1997). So, it is clearly to confirm that without the sufficient or good vocabulary knowledge, the effective communication could not be occurred. Vocabulary can be divided into many parts as it consists of various things to be considered e.g. phrasal verbs, collocations and idioms.

Collocations are regarded as one part of vocabulary that has effects on the effectively performance on communication. Collocation is a common combination of words that native speakers instinctively use (Lewis, 2000). For example, *take a photograph*, *key ring* or *answer question*. Mostly, they have extra meaning more than

themselves original meaning. For example the collocation “*black list*”, it does not mean a list with a black color; conversely it means a list of person under suspicion, disfavor or censure.

Ellis (1996) pointed out that the proper use of collocation is crucial if a second language learner wants to sound like a native speaker. Knowledge of collocations also helps to identify a L2 learner as a successful, proficient writer in academic writing (Coxhead & Byrd, 2007; Hong, Hua, & Mengyu, 2017; Peters & Pauwels, 2015). In addition, they provide many benefits for language students, such as: improving learners' language skills, improving learners' communicative skills, and gaining localizing fluency (Darvishi, 2011). For the native speakers of English, they learn collocations naturally whereas second language learners have difficulties in learning collocations (e.g. Pei 2008, Wolter2006, Lombard 1997, and Bahns, 1993). This may be due to the collocation under some restrictions that are completely unmarked for second language speakers unless they realize it (Lombar, 1997).

Nevertheless, the accurate use of collocations seems to be a great hindrance for both ESL (Fan, 2009; Wray, 2000; Yamashita & Jiang, 2010) and Thai EFL learners (Boonyasaquan, 2006; Mongkolchai, 2008; Phoocharoensil, 2011). Collocation can be one of the toughest problems for Thai learners to solve.

Collocations benefit the writing task; however, there are still some problems of collocations in the writing task. Many errors of using collocations in ESL or EFL learners are occurred because lacking collocational knowledge (Howarth, 1998). Some studies on the analysis of collocation errors show that collocation has become a main problem as learners continuously generate all kinds of collocation errors (Nesselhauf, 2003). Many previous studies (Farghal & Obiedat, 1995; Gitsaki, 1997; Liu, 1999a; Lien, 2003) concluded that L2 students have many collocational mistakes in their writing component because of the lack of collocation ability (Cited from Darvishi, 2011).

Writing skill is considered as one of the most complicated language skill, it is critical to develop the human culture (Munoz-Luna, 2015). According to White and Arndt (1991) in Hammad (2013, p. 1), writing is a thought process that requires intellectual work. It contains conducting ideas, planning, making goals, monitoring, evaluating what is going to be written and what has been written, and using language to express the correct meaning. Writing is an important skill in learning a language as it is also a productive means for communication apart from speaking.

Academic writing on the other hand, is far from basic. Whether in L1 or L2, academic writing will be used in academic settings and is the means of communicating



### **3.2 Research Instruments**

The research instruments consisted of focus group discussion and group interview. The purpose of the interview is to understand the student's opinion by questioning the students' in-depth views on the use of the collocation in their writing thesis. Students were asked to give opinions on how to choose collocation in their writing. Semi-structured interviews will be used in this study when collecting qualitative data. A group interview will be conducted on the guide. Semi-structured interviews will be used as the primary method for the final stage of data collection to ask participants for their views on wiring by using collocations. The issue of semi-structured interviews included 10 projects.

### **3.3 Data Collection**

The following were the stages of data collection:

The methods of developing the research tools were discussed as follows:

3.3.1 Met the students at KKU according to our appointment. Schedule each interviewee to interview based on their preferences.

3.3.2 Briefing the interviewees on the interview objectives of this survey.

3.3.3 Interviewed 10 prepared questions and record conversations as they allow.

3.3.4 Used the data obtained through interviews to generate ideas about the use of collocation in academic thesis writing. Interview questions will be carefully examined by the researcher's supervisor and experts, and then modified according to their recommendations.

3.3.5 Interview questions were piloted by English professionals from the target population who have not participated in the study to check if all questions are clear to the responder.

### **3.4 Data Analysis**

During group discussion and group interview, the conversation between the interviewee and interviewer was recorded. After the interview the researcher replayed the recording, analyzed and collated the answers from interviewers.

## **4. Research Result**

The results were presented according to the research objectives as follows:

4.1 Most participants had the problems on using collocation in their thesis writing, and they do not have high awareness of exist of collocation in their thesis writing.

4.2 Many participants heavily replied on checking related grammar application

which is downloaded in their telephone when they met collocation using problems

## 5. Discussion

The results of this study revealed that the students' knowledge of English collocation is rather limited. It is plausible to say that some students lacked an awareness of the existence of collocation. Also, they were probably not well-trained on vocabulary specialization. When the researcher tried to explain what the collocation is, some participants cannot understand totally. Lewis (1993) points out that raising awareness of collocation can be incorporated into the teaching and learning process to expand the learners' mental lexicon efficiently.

In addition, the findings revealed that a lack of knowledge about specific collocation led the students to reply heavily on related grammar application in telephone. When meeting collocation using problem, such as cannot memorize the matched vocabulary word, many students preferred to search the answer in related grammar application in telephone, not to remember it in mind.

## 6. Conclusion

The purposes of this study were to investigate Thai graduate students' perception on using collocation in their thesis writing at Khon Kaen University in Thailand, and to investigate how Thai graduate students choose the collocation if they meeting collocation using problem in their thesis writing.

In this study, group discussion and group interview were used as instruments. The purpose of the interview is to understand the student's opinion by questioning the students' in-depth views on the use of the collocation in their writing thesis. Students were asked to give opinions on how to choose collocation in their writing and how to solve the problem if they cannot memorize the matched word.

The results pointed out that most participants had the problems on using collocation in their thesis writing, and they do not have high awareness of exist of collocation in their thesis writing. Moreover, when they met collocation using problems, many participants prefer to search the answer from related grammar application which is downloaded in their telephone, instead of memorize it in mind.

## 7. Recommendations

Learning individual words and their meaning is not enough to achieve great fluency in a second language. Knowing the way words combine into chunks is





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## Harmonious Living in Multi-religious Society according to Buddhadasa Bhikkhu

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### Abstract

This paper aims at 1) exploring approaches for understanding and cooperation among religions in Thailand according to Buddhadasa Bhikkhu, and 2) broadening the understanding and harmonious living among followers of religions. The study revealed that it is generally admitted that all religions share and promote goodness and peace among men irrespective of their backgrounds, but practically religious identity has continued to be one of the most significant predictors of intolerance towards otherness of different faiths. To deal with the different faiths, three theologian points of view, i.e. exclusivism, inclusivism and pluralism, inevitably concerned. Pluralism seems to be most fit since it admits that the world religions are true and equally valid in their communication of the ultimate truth, the world, and the path to salvation. Bearing pluralism in his mind, Buddhadasa Bhikkhu was the leading Buddhist voice in Thailand speaking for mutual understanding and cooperation among religions and different sects in Buddhism. Pluralism can be clearly seen through his own lifelong intentions: 1) to help others to realize the heart of their own religion, 2) to work for mutual good understanding among the religions, and 3) to cooperate in dragging the world out of the power of materialism. For him, a common enemy the followers of all religions have faced is the material hedonism that perpetuates selfishness. He believed that any religion, when it is true to its real mission, is the most effective way to free humanity from selfishness.

**Keywords :** Harmonious Living, Religions, Buddhadasa Bhikkhu

### 1. Introduction

Thailand does not have an official state religion. Though more than 93 percent of her population is Buddhist, she allows free beliefs and exercises of religions. She hopefully see the harmony among people with different believes and the application of

religious teachings to enhance the quality of life. Though all religions aim at teaching humans to be moral and well established in the wholesomeness, they culture the sense of belonging and identity among their congregations. This seems to be a dividing factor rather than a unifying one. This is true even within a country that has only one religion, as different interpretations and practices of that faith can cause conflicts and intolerance. Therefore, there are both intra-religious conflicts and inter-religious conflicts as we may have learnt throughout history, we have seen clashes of inter-religions like the Crusade Wars between Christianity and Islam, of the intra-religious conflicts of the same faith like the Protestant and Catholic Sects, and the Shunni and Shia division within Islam. In Thailand, we have also learnt that the violence frequently broke out in the down southern provinces by the Muslim separatists. For Buddhists, there are also the Anti-Islam Movements as to protests against the construction of mosques in many provinces such as in Nan, Khon Kaen, Mukdahan, and mobilization to oppose the construction of Halal Food Industrial Complexes in all districts of Chiang Mai (Don Pathan and others, 2018). Among Buddhists, we also witness the non-conventional Buddhist movements such as Dhammakaya and Santi-Asoke groups grow and are openly critical to the traditional heretical Buddhist sects.

As much as a religion can be used as a unifying force in a certain society, it can also be easily abused by politicians, terrorists, activists, etc. to win supports from the congregation. This is because religion can easily arouse emotions of love or hate, construction or destruction, peace or war, depending on the intent and purpose of its preachers. Hence, when it comes to managing multi-religious interaction and relationships, it is important to refrain from arguing over exclusive religious claims or attempting to convert others directly, but rather to use it as an opportunity to promote mutual respect, understanding and recognition of different faiths and spiritual traditions. More importantly, we should focus on the commonality that is present in each and every religion – values of goodwill, love, justice and peace. In this regard, Buddhadasa Bhikkhu is well known for his attempts at mutual understanding and cooperation among religions. Therefore, attempts are made in this paper, 1) to explore a reasonable way of harmony among religions prescribed by Buddhadasa Bhikkhu, and 2) to broaden our understanding of inter-community relations among religions.

### **Theologian Theories as conditions for harmonious living**

To live harmoniously amid different faiths in a particular society needs to understand and adopt a right way of standpoint towards other faiths. According to the

theologians, there are three different points of view that condition harmonious living in a multi-religious society. They are exclusivism, inclusivism and pluralism.

### **Exclusivism**

Exclusivism stands for the idea that only one particular faith or belief system is true. There is no perfection of the doctrine, no religious experience or no salvation in others' religion or belief system. This idea raises a strong confidence and affirmation of faith in a particular religion. It may be said that all religions share this attitude. Here are some examples drawn from the religious texts.

In Mahasatipatthana Sutta which the Buddha addressed to a group of monks at the city of Kuru runs thus: "There is, monks, this one way to the purification of beings, for the overcoming of sorrow and distress, for the disappearance of pain and sadness, for the gaining of the right path, for the realization of Nibbana, that is to say the four foundations of mindfulness." (Tipitaka, 12/106/101) In this saying, it can be seen that there is only 'one way' to the purification of beings and for the overcoming of suffering, and such a way is the fourfold foundations of mindfulness available only in the teaching of Buddha. Without this way the salvation cannot be possible. In Culasihanada Sutta, the Buddha also confirmed that in his teaching and discipline, the true monk is found of the first, the second, the third, the fourth. The doctrines of others are devoid of true monks (Tipitaka 12/139/133). The words 'the first, second, third, and fourth' refer to hierarchy of the noble ones called Sotapanna, Sakadamgami, Anagami and Arahant, respectively. These four kinds of true monks are found only in Buddhism. It is seen that any path or fruits regarded as the ultimate are not found in other religions, but only in Buddhism.

This attitude can be also seen in the Bible: "I am the way and the truth and the life. No one comes to the Father except through me. If you really know me, you will know[b] my Father as well. From now on, you do know him and have seen him." (John 14:6-7) Therefore everyone who hears these words of mine and puts them into practice is like a wise man who built his house on the rock. The rain came down, the streams rose, and the winds blew and beat against that house; yet it did not fall, because it had its foundation on the rock. But everyone who hears these words of mine and does not put them into practice is like a foolish man who built his house on sand. The rain came down, the streams rose, and the winds blew and beat against that house, and it fell with a great crash.' (Matthew 7: 24-27)

The sayings above show that Jesus's teaching is the best and most beneficial. One who does not follow it encounters a great disaster. This concept limits the other

way for good deeds, i.e. there is no any other way for good deeds. The so called good deeds must base on the teaching of Jesus. If one does not follow it, he will be a foolish man and encounter disaster at the end. Therefore it can be said that the above teaching shares the concept of Exclusivism because 1) the doctrine of Christianity is the most authentic, 2) the doctrine of others is totally wrong, i.e. not leading to salvation, and 3) if one follows the doctrine of Christianity, one needs not to learn the doctrine of others.

### **Inclusivism**

It stands in contrast to the aforesaid exclusivism which asserts that only one way is true and all others are in error. Inclusivism asserts that while one set of beliefs is absolutely true, other sets of beliefs are at least partially true. All beliefs are equally valid within a believer's particular context. There is possibility of goodness or success in others' religion, but no salvation or ultimate truth. In Sisapavana Sutta, the discourse on the handful leaves, asserts this idea: 'So too, monks, the things I have directly known but have not taught you are numerous, while the things I have taught you are few. And why, monks, have I not taught those many things? Because they are unbeneficial, irrelevant to the fundamentals of the holy life, and do not lead to revulsion, to dispassion, to cessation, to peace, to direct knowledge, to enlightenment, to Nibbana. Therefore I have not taught them.' (Tipitaka 19/1101/613) In this Sutta, the Buddha compared his teaching with a handful Sisapa leave, whereas the other teachings with those Sisapa leaves in the forest, though there are so many, but cannot be fruitful like his handful teaching. Through his teaching, one can attain the ultimate truth. Jesus also asserts this: 'Do not think that I have come to abolish the Law or the Prophets; I have not come to abolish them but to fulfill them.' (Matthew 5: 17) This passage shows that though Jesus partially admits Judaism since it is not the perfect law, he came to make it complete. It is seen that the so called Law was not yet perfect; Jesus came to fulfill it. For the adherents of other faith, the salvation can be achieved only through the grace of God. The so called grace comes from the Christ.

### **Pluralism**

It is an attitude regarding the diversity of religious belief systems and co-existing in society. A particular form of religion is not held to be the sole and exclusive source of truth. It acknowledges at least some truths and true values exist in other religions. Hence, one should respect faiths, practices and religious experiences of others. In Kalama Sutta, once the Buddha warned Kalama people who were doubtful and confused in different teachings rendered by different groups of ascetics: "It is, Kalamas, suitable for you to be doubtful, to be uncertain. You have raised a doubt, an uncertainty

in a doubtable state. Come on, Kalamas, you should not led by oral tradition, by lineage of teaching, by hearsay, by a collection of scriptures, by logical reasoning, by inferential reasoning, by reflection on reasons, by acceptance of a view after pondering it, by the seeming competence of speakers, or even by the idea, ‘This is our teacher’. Whenever you, Kalamas, know for yourselves - these things are not wholesome, these of fault, these blamed by the wise, these practiced by an individual leading to non-benefit, to suffering, then you should reject them”. (Tipitaka 20/66/256) The Buddha did not judge whose teachings are right or wrong, he just reminded the Kalamas to think over of what is right or wrong in general. It seems the Buddha identified his teaching as merely one among many equal religious teachings. Pluralism is also found in a political sense as depicted in the Rock Edicts by King Ashoka of India thus: ‘All religions should reside everywhere, for all of them desire self-control and purity of heart. Contact between religions is good. One should listen to and respect the doctrines professed by others. Beloved-of-the-Gods, King Piyadasi, desires that all should be well-learned in the good doctrines of other religions’. (Wikipedia, 18 December 2018, online access)

We have gone through the tree main ideas on how we can live harmoniously among adherents of different faiths. To live in a multi-religious society, it can be said that exclusivism and inclusivism may be adopted by an individual as one’s spiritual aspiration. Pluralism should be practiced in a socio-political sphere. As the Dalai Lama pointed out: ‘For individual practitioners, having one truth, one religion, is very important. Several truths, several religions, is contradictory. I am Buddhist. Therefore, Buddhism is the only truth for me, the only religion. To my Christian friend, Christianity is the only truth, the only religion. To my Muslim friend, Islam is the only truth, the only religion. In the meantime, I respect and admire my Christian friend and my Muslim friend. If by unifying you mean mixing, that is impossible; useless.’ (Zenit, 8 October 2003, online access) The so called pluralism had been seriously promoted by the late Buddhadasa Bhikkhu as his three vows were publicly made since his early years of mission.

### **Buddhadasa Bhikkhu on Pluralism**

Buddhadasa Bhikkhu was born as Nguam Phanitch (เงื่อม ฟานิช) in 1906 in Ban Phumriang, Chaiya District, Suratthani, in the southern Thailand. He became a monk in 1926 at the age of twenty. By the guidance of his elder cousin monk, he traveled to Bangkok for pursuing a higher study according to the Thai ecclesiastical education. Later on, he found such a study is preoccupied with prestige, position, and comfort with little interest in the highest ideal of Buddhism. As a result, he returned to

his native rural district and occupied a forest near to his village, founding Suan Mokkh or the Garden of Liberation in 1932. He did not only confine himself to investigate accurate Buddhism through Pali Tipitaka, but he also extended intentions in other schools of Buddhism as well as other religious texts along with modern sciences. His intention regarding other religions can be seen in terms of his lifelong three vows:

1. To help others to realize the heart of their own religion
2. To work for mutual understanding among the religions
3. To cooperate in dragging the world out of the power of materialism and consumerism

Though he died in 1993 at the age of eighty seven, his reputation on boosting mutual understanding and cooperation amid diversity of religions still echoes louder worldwide. On his centennial anniversary, UNESCO recognized him as one of the world great personalities in 2006. It acknowledges him as a pioneer in the promotion of the inter-religious understanding through dialogue, integration of Buddhism in the world and the spirit of its origins, as a precursor of ecological thought and a champion of peace among nations, a very considerable influence on the renewal of Buddhist thinking, so that his thoughts potential to create a just and equitable social, political and economic order (Buddhadasa Indapanno Archives, 2014, online access). Buddhadasa Bhikkhu's teachings not only attracted Thai Buddhists or even non-Buddhists, but also attracted many international seekers to his approaches. The following are his interesting approaches for mutual understanding and harmony among religions:

### **Theoretical Approaches**

Unlike any other Thai Buddhists, Buddhadasa Bhikkhu not only studied and preached the authentic Theravada Buddhism, but also the other schools of Buddhism as well as other major world religions. Regarding his attempts to boost mutual understanding in other schools of Buddhism and other religions, he made two theoretical outputs: translation of the classical texts, and universalization of religions.

1. Translation of the classical Chinese Mahayana texts was made by him, and well known translations are major parts of the Lankavatara Sutra which is an important Mahayana text, as well as the Platform Sutra of Hui Neng or Sutra of Wei Lang, and the Teachings of Huang Po.

2. Universalization of religions was made by him after having gone thoroughly the great religious texts such as the Upanishads, the Bible, the Koran, and other great texts, and after discussing with followers of different faiths, he came to

conclude that all religions share the same truth and perform the same basic function of saving human beings from selfishness and suffering.

He believed that the true religions lead to salvation or liberation from suffering. All living beings share the same instincts of fear and wanting to survive. So the heart of all religions is non-selfishness. He made an example that teachings and practices in Christianity aim at getting rid of selfishness. If one truly believes that God loved the world, so He gave His only beloved Son to redeem the world. God renders the most important commandment as to 'love your neighbor as yourself', it is impossible to be selfish. Buddhadasa Bhikkhu also described the discipline and effort of Islam as a way to restrain and overcome selfishness. In Buddhism, there is the core teaching on Anatta or non-self, so there is nothing to be clung to as 'me' or 'mine'. Realization this leads to selflessness. In the aforementioned examples, he pointed out that the common element and shared value of all religions mainly focus on overcoming selfishness (Buddhadasa Bhikkhu, 1993).

Buddhadasa Bhikkhu's viewpoint for universalizing religions can be seen through his lecture series called the Fifth Series Sinclair Thompson Memorial Lectures, in 1967 at Chiang Mai. He gave three talks that were later published in one volume as 'Christianity and Buddhism'. In his lectures, he offered comparative views on Christianity and Buddhism and suggested that both the religions have commonalities to offer to human beings for the attainment of Nibbana or salvation. Throughout these lectures he tries to share his understanding about Christianity from the Buddhist perspective. He proposed three basic concepts, i.e. the concept of the God, the scriptures, and the paths to emancipation (Buddhadasa Bhikkhu, 1967). Later on, he gave a series of talks at Suan Mokkh published as 'The Essence of Christianity as Far as Buddhists Should Know'. He emphasized that Buddhists have much to learn from Christian teachings about the practice of loving kindness or Metta in Buddhism, the so called Metta requires more than just sitting on the cushion wishing other beings well since it is just a ritual with less action. He recognized that Christian tradition has a more developed and focused history on the social service than do the Buddhist traditions.

### **Practical Approaches**

To harmonize with followers of other religions or various schools of Buddhism, two important approaches were made by Buddhadasa Bhikkhu as follow:

1. Making friendships with non-Theravada Buddhists

Buddhadasa Bhikkhu not only had made friendships with all truth-seekers, but also encouraged Theravada Buddhists to open up to other Buddhist traditions. He



held talks with leading scholars and clergy of various faiths. His aim in these discussions was to probe the similarities at the heart of Buddhism as well as each of the major world religions. The following are some of his spiritual friends:

Since as a young monk, he made friends with followers of other religions. In the early 1930's in Bangkok, he was close to Swami Satyanandaburi, an Indian thinker who was expert in Indian philosophy and religions. They frequently talked and shared about their respective religions, modern developments, and what they were interested in.

A visiting American Catholic priest who had come for a conference in Bangkok was brought to Suan Mokkh by one of Thailand's Catholic bishops, Christians visiting Thailand who wanted to meet a prominent Buddhist were usually taken to see him.

One of his leading students was Haji Prayoon, a Muslim from Bangkok, who became a regular visitor at Suan Mokkh after reading articles written by Buddhadasa Bhikkhu. Haji Prayoon wrote books about religious cooperation and openly spoke of him as one of his teachers. By the end of Buddhadasa Bhikkhu's life there were Muslims, Christians, Sikhs, and Hindus who considered him to be their teacher.

The Dalai Lama made two visits to Thailand before opposition from the Chinese government made it become politically impossible. Buddhadasa Bhikkhu first met the Dalai Lama in Bangkok in 1964. A few years later, the Dalai Lama visited Suan Mokkh, mainly to discuss the mindfulness with breathing or the practice of Anapanasati. The Dalai Lama felt that Tibetan Buddhists needed more practice cultivating Samadhi and regarded Theravada Buddhism as the important resource concerning Anapanasati, the classic meditation practice of early Buddhism. At that time, they also discussed the possibility of Tibetan monks coming to live at Suan Mokkh. Buddhadasa Bhikkhu began to draw plans to build a Tibetan corner in Suan Mokkh. However, this plan never put into action due to the political opposition by Chinese government (Santikaro, 2006, online access).

## 2. Establishing International Suan Mokkh or International Dharma Hermitage

In 1989, Buddhadasa Bhikkhu established an International Dharma Hermitage Center where people from all over the world can stay and study the 'truth of nature', and engage in mental cultivation or meditation. This center provides monthly intensive courses on practice of meditation, gatherings of adherents of different communities in Thailand and abroad as to develop mutual understanding and cooperate for harmony. Since the establishment more than 25,000 people, coming from all over

the world, from many walks of life, between 17 and more than 70 years of age, have participated in the monthly meditation retreat which is a 10-day silent meditation retreat at the 1<sup>st</sup> day of each month.

## 2. Conclusion

As we have seen above, multi-religious society encounters challenges on the basis of recognizing religious diversity and differences. To cope with the diversity, adherents of religions should clarify the three theological concepts, exclusivism, inclusivism and pluralism. As individual belief and practice, exclusivism and inclusivism seem to be accepted. As a socio-political concerns, pluralism should be adopted as to enhance mutual understanding and harmony. For many decades, Buddhadasa Bhikkhu has been the leading Buddhist voice in Thailand speaking for mutual understanding and cooperation among religions through the concept of pluralism. His lasting influences have been his friendliness, open-mindedness and interest in other religions and other schools of Buddhism. So he is widely accepted for his efforts at both inter-religious and intra-religious cooperation and understanding for the sake of all. However, Buddhadasa Bhikkhu was criticized as being unorthodox from the viewpoint of Thai Theravada Buddhism for his generalizing Buddhism with other faiths. Meanwhile, he was also criticized by non-Buddhists for expressing his understanding of other religions, such as Christianity from a Buddhist perspective. In doing so, he compared and contrasted the components of the Christian and Buddhist traditions in a generalized way with his limited understanding and experiences in Christianity. However, he pointed towards the way where a mutual acceptance and appreciation of inter-religious traditions can provide a base for effective interfaith dialogue. Through these dialogues, these two religious communities can not only enrich each other, but also can contribute meaningfully to the peaceful social relationship in contemporary society. From this viewpoint, his proposal is a useful resource to those who are interested in inter-religious dialogue and harmony in our multi-religious society.

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## Gender and Handling Environmental Challenges: Myanmar Education Context

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### Abstract

Sustainability of the environment is one of the major problems facing the people all around the world. It is unfortunate that women, by the nature of their daily activities of managing the homes and families are in touch with nature and environment and are at greater risk of health hazards and damage. Increased knowledge about the environment is assumed to change environmental attitudes, and both environmental knowledge and attitudes are assumed to influence environmental policy. Thus, this research focuses on the type of education that women need to instill in their knowledge and skills for handling environmental problems. For collection of the data in this research, questionnaire based survey was used. A questionnaire was developed to measure the level of awareness, knowledge, and attitudes of the 180 teachers (32 primary teachers, 47 secondary teachers and 101 university teachers) by filling up the survey forms and sharing their opinions regarding knowledge and skills for handling environmental problems. The purpose of this research was to evaluate the knowledge and attitudes for handling environmental problems among the teachers. The survey represented responses from 180 teachers, 96 female and 84 males. This research found that levels of awareness, knowledge, and attitudes of the teachers as related to environmental issues were very divergent. These findings contribute a great deal in enhancing the environmental problems at Myanmar education context with positive attitude towards such problems. The research concludes with some recommendations that environmental science online courses which integrate basic sciences and apply that knowledge to analysis and solutions of current environmental problems, training and retraining of teachers, university bridging course and networking with NGOs on environmental education for sustainability should be implemented. To this end, the government should put in place policies for effectiveness of environmental programmes.

**Keywords :** Gender, environmental challenges, awareness, knowledge, and attitude



increase their potentials beyond the traditional household tasks so that they can take their place in local, national and global development.

In September 2000, 189 world leaders met at the millennium summit and committed themselves and their countries to eight goals known as Millennium Development Goals (MDGs) aimed at meeting the needs of the world's poorest people (UNDP, 2005). The eight goals, which are to be met in partnership with the world's leading development institutions by the target date of 2015, are to eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDS, malaria and other diseases, ensure environmental sustainability and lastly, develop a global partnership for development (United Nations Millennium Declarations, 2000). For each of these goals, the world leaders established yardsticks for measuring results, not just for the developing countries but also for the developed countries that assist in providing the funds for development programmes and for the multilateral institutions that help countries implement them (UNDP, 2005). However, for the purpose of this research, the focus will be on Goal 7 which is targeted towards environmental sustainability. In general environmental problems affect human health and survival. However, the impact is more on women than men and this could be reduced if the state of preparedness is better.

## **2. Research Objective**

The objective of this research is to evaluate the knowledge and attitudes for handling environmental problems among the teachers.

## **3. Research Methodology**

### **3.1 Samples**

The samples were composed of 180 teachers, 32 out of 180 are primary teachers, 47 out of 180 are secondary teachers and 101 of whom are university teachers.

### **3.2 Research Instruments**

As a research instrument, questionnaire-based survey was used. A questionnaire was developed to measure the level of awareness, knowledge, and attitudes of the 180 teachers.

### 3.3 Data Collection

The survey represented responses from 180 teachers, 96 female and 84 males. The data is collected from 180 teachers who fill up the survey forms and sharing their opinions regarding knowledge and skills for handling environmental problems.

### 3.4 Data Analysis

This research focuses on the type of education that women need to instill in their knowledge and skills for handling environmental problems. The education of women promotes improved health to the woman and other family members; it helps to maintain hygienic behaviour among others. An educated woman is likely to understand the advantages of using cooking stove instead of firewood, if she can afford both. Therefore educating the girl child is a worthwhile investment for a country's development. The purpose of environmental education is to assist the public to understand, appreciate and change their attitude favourably towards their environment.

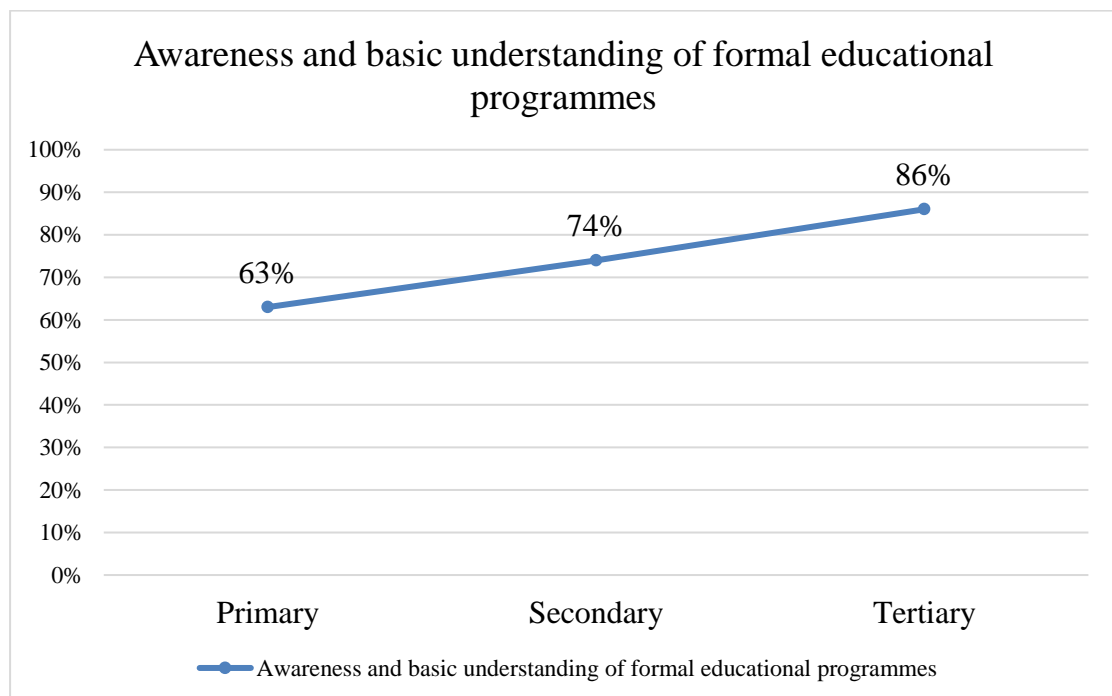
The objectives of environmental education are to help individuals and social groups to acquire an awareness, basic understanding, social values and skills to solve environmental measures and educational programme, in terms of ecological, political, economic, social aesthetic and educational factors. Its main function is to make people aware of the problems around them and enlighten them on the activities they can engage into improve their surroundings for better living. Sixty-three percent of the participants think that primary education of the girl child needs to be slightly different from that of the boys. It must be streamlined to prepare her for academic excellence, home management and complete adaptation of the natural environment. This will make for a 'complete woman'. However, education about the environment is life-long and the process can be categorized into two-formal and non-formal. The formal education takes place in the school – primary, secondary and the tertiary level. The non-formal takes place at home through adult literacy programmes, the media, organized campaign, and other methods. In Myanmar, there already exist a curriculum that incorporates nature study, hygiene and agriculture in the primary school. Children are taught to keep clean environments and to love nature and the entire environment. Environmental education falls within the affective domain and this would be demonstrated through appreciation and cultivation of a life-long respect for nature and the environment even after leaving school.

At the secondary schools in Myanmar, the following subjects are taught: Physics, Chemistry, Biology, Geography and Economics. They are considered as relevant to environmental education to all students. It is being suggested by the 74% of the

participants that a separate subject on the environment should be taught in secondary schools and more girls could be encouraged to take it. This would enable female students in particular to have an understanding of ecosystem, preventive health, appropriate use of pesticides and other agricultural products and knowledge of handling cases of land, water, air and industrial pollution.

At the tertiary level at universities, the purpose of environmental education is to develop knowledge and skills so that when girls are in a position to apply them they will do so. There is need to offer environmental science courses, in all higher institutions. Also, in Myanmar, most undergraduates are expected to participate in the general studies programme which requires selecting an additional course from either humanities, science, agriculture and technology. Each student must take two of these courses from the field outside his or her study. 86% of the participants consider that at the end of university education, the graduate female should be knowledgeable on environmental education.

The figure of awareness and basic understanding to solve environmental measures in terms of levels of formal educational programmes is presented as follows:



*Figure 1 Awareness as well as basic understanding to solve environmental measures in terms of levels of formal educational programmes*

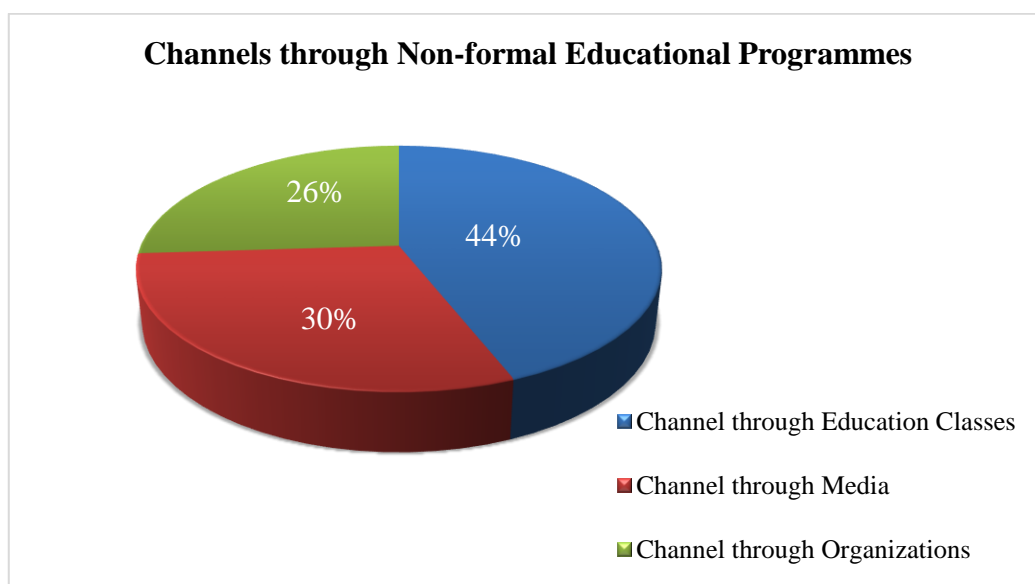


Non-formal education programmes, usually take place outside the school system and for all ages. According to the data, educational programmes could be channeled through:

(i) Adult education classes which could be organized in schools and universities by regional governments. (44%)

(ii) Print and broadcast media like newspapers, radio, television, bill boards, cartoons and other audiovisual methods which are quite effective in disseminating information. (30%)

(iii) Clubs, organizations, socio-cultural and religious groups, NGOs and other interest groups or agencies which are good way to distribute the information. (26%)



**Figure 1** Channels through non-formal education programmes that usually take place for all ages

The learning content should be broad based, localized and directed at problems that are visible or anticipated in each locality. The female students should be enlightened about the effects of air pollution and how to cope with it; others are flood control, proper waste disposal and sanitation and domestic health and hygiene. This is to change their notions and attitudes towards the environment and help them to commit themselves towards working individually and collectively for a better environment as well as for sustainable life styles.

#### **4. Research Results**

Environmental science is a branch of science that deals with the study of atmosphere. In addition, it also includes the study of social sciences for understanding human relationships, perceptions and policies towards the atmosphere. In general, environmental science can be defined as a multitude study of the scientific branches directed towards the atmosphere and environment surrounding it. Increased knowledge about the environment is assumed to change environmental attitudes, and both environmental knowledge and attitudes are assumed to influence environmental policy. This research uses a survey data from 180 participants to address this gap in the literature. Specifically, this analysis examines how environmental knowledge and attitudes are related socio-demographic factors (gender, age, education, income and residence). The respondents to this survey did not score well on the measures of environmental knowledge. Environmental knowledge is found to be consistently and positively related to environmental attitudes, although the relationship is not especially strong.

#### **5. Research Discussions**

Over the years, due to negligence and lack of knowledge and skill, the environment has been polluted over the years. Air and water pollution, waste disposal, deforestation and land degradation are some of the problems that have to be tackled by the present generation in order to sustain the environment for the future. Women interact more closely with nature and the environment. They are the suppliers of fuel in the family for cooking, tenderers of animals and mothers of all. Consequently, they create some of these environmental problems and are at the receiving end of these problems. To this end, it becomes paramount that a well constructed educational programmes be implemented at all levels for female; both formal and informal to curb the degradation of the environment and the health hazards associated with it and also prevent the effects on all members of the society.

#### **6. Conclusion**

Environmental Science is the study of interrelationships between human activities and the environment. We will have information about recommended or required pre-requisites to study at primary and secondary schools before starting an environmental science degree at university. Chemistry and Mathematics were also a pre-requisite, either in high school years or the intermediate level plus a university

bridging course. Good writing and analysis skills developed through English literature classes at high school also helped. High school physics definitely helped. Geography would probably be a good starting point, too. Core courses in the Environmental Science major include biology, chemistry, geology, and mathematics. Upper-level courses integrate basic sciences and apply that knowledge to analysis and solutions of current environmental problems. Upper-level courses are rich in lab and field experiences. We can find out the courses in the environmental science by checking the websites of the open universities that we are interested in. In the environmental science degree, courses included: Environmental Law, Environmental Ethics, Environmental Biology, Environmental Biophysics, and Environmental Management. Depending on the specialties of the university, the courses in an environmental science degree could include, for instance, geographical information systems, evolutionary biology, science communication or environmental policy.

## 7. Recommendation

The following recommendations are suggested by the participants.

7.1 74% of participants suggested that there should be formal training of special / regular teachers; workshops, conferences and other training programmes should be organized for the teachers to improve their knowledge on environmental education.

7.2 32% of participants suggested that at schools as well as universities, girls should be encouraged to form conservation clubs and societies to create and promote environmental awareness.

7.3 53% of participants suggested that there should be a network for interactions between teachers and non-governmental organizations or agency on environmental sustainability.

7.4 78% of participants suggested that some subjects taught in the primary and secondary and tertiary levels on environmental education could be made compulsory for all students especially girls. Also, at the tertiary level, more students need to be encouraged to take courses on environmental education.

7.5 66% of participants suggested that laws and policies on environmental education will also compel the introduction and teaching of some core courses on environmental education for all females.



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## Implementing Democracy in the Classroom: Myanmar Higher Education Context

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### Abstract

Democracy is a highly desirable but contested concept in education. However, little is known about how current and future educators perceive experience and relate to democracy, which could have a significant impact on how students learn about, and become involved in, civic engagement and democracy. According to Davies (1999), the task of the teachers is threefold: (i) to bring relevant information and knowledge into the classroom as well as the tools by which students can acquire their own information, (ii) to set the ground rules for mutually respectful dialogue, and (iii) to provoke critical thinking among participants in the dialogue. The idea of ‘democracy in the classrooms can apply very generally to a broad range of subjects and courses with a variety of objectives. A ‘democracy’ model is simply one that provides for collaborative intellectual engagement among students and dialogical engagement between students and teachers when these attributes are considered important to accomplishing the objectives of a particular course. The aim of this research is to explore the democratic pedagogy that contains numerous practices which teachers can utilize to foster democratic dispositions in their students. It is the educational objectives associated with democracy linked to the teacher’s teaching and fostering actions that are of main interest. The results are based on an analysis of data from student questionnaire and contextualized interviews with university teachers during a period of one and a half years. Questionnaires were administered to 103 students in five different universities of upper Myanmar. Interview data collected from 81 university teachers bring some challenges of implementing a democratic pedagogy into focus. Using data from questionnaire responses, audio recordings and notes taken from observations, we have analyzed the students’ behaviour and attitudes in relation to educational objectives and the teacher’s teaching and

fostering actions. A logical conclusion would be that the more of these practices teachers engage in the classrooms, the more democratic their pedagogy becomes.

**Keywords :** Democracy in the classroom, Higher Education, Myanmar

Democracy is a highly desirable but contested concept in education. However, little is known about how current and future educators perceive, experience and relate to democracy, which could have a significant impact on how students learn about, and become involved in, civic engagement and democracy. This paper reports on a study of 129 College of Education students, finding that they generally have a narrow conceptualization of democracy, primarily focused on electoral politics, only weakly connecting it to education. Social justice, in particular, was highlighted as requiring more attention. Democracy is a highly desirable but contested concept in education. However, little is known about how current and future educators perceive, experience and relate to democracy, which could have a significant

impact on how students learn about, and become involved in, civic engagement and democracy. This paper reports on a study of 129 College of Education students, finding that they generally have a narrow conceptualization of democracy, primarily focused on electoral politics, only weakly connecting it to education. Social justice, in particular, was highlighted as requiring more attention. Democracy is a highly desirable but contested concept in education. However, little is known about how current and future educators perceive experience and relate to democracy, which could have a significant impact on how students learn about, and become involved in, civic engagement and democracy. This paper

reports on a study of 129 College of Education students, finding that they generally have a narrow conceptualization of democracy, primarily focused on electoral politics, only weakly connecting it to education. Social justice, in particular, was highlighted as requiring more attention.

## 1. Introduction

This research attempts to explore how educators conceptualize experience and approach democracy in the classroom and, moreover, how this might frame how they teach about, influence, and engage in democracy, which will undoubtedly have an effect on students, inside and outside of the classroom. In present day Myanmar, teachers are caught in a government policy, which focuses on increased teacher

accountability and standardized curricula, and focusing on the inclusion of democracy in education. Myanmar educationists emphasize the need for teachers to deliberately support democratic citizenship as a fundamental goal and organize their subject-matter, their pedagogy, and their classrooms to attain it. However, a key challenge for teachers exists not in embracing democratic pedagogy, but in knowing what a democratic pedagogy actually is. Following this vignette, this research dedicates itself to describing, in a practical sense, what a democratic pedagogy can look like in the Myanmar university classrooms. In education, Dewey (1938) viewed democracy in education as a “social process”. This social process is dependent upon three democratic dispositions: all citizens are moral equals; all citizens are capable of intelligent judgment and action, with key importance being placed on reflection and the need to decide for themselves what to believe; and, all citizens are able to work together on a day-to-day basis to settle conflicts and solve problems. While broad, these dispositions provide a working framework with which to describe a democratic pedagogy. For the purpose of this research, pedagogy is viewed broadly, encompassing not only curriculum (*what we teach*) and method (*how we teach*), but also the classroom context.

Democratic pedagogy exists on a continuum (Davies, 1999) that contains numerous practices which teachers can utilize to foster democratic dispositions in their students. A logical inference would be that the more of these practices teachers engage in, the more democratic their pedagogy becomes. Equality represents the foundation of democratic dispositions (Dewey, 1938). It is the belief that everyone is equal, including students. To be equal, means that student voices are equal to that of their teachers, the curricula and the textbooks. To comprehensively examine what equality looks like in the classroom, it has been described that the effect of equality on *what* is taught in the classroom, as well as *how* that content affects classroom instruction and *how* resources are used. The *what* refers specifically to the curriculum. If all participants in the classroom are equal, this means that students are equals with their teacher. It means that their voices, their needs, their experiences, and their knowledge are equal to that of the teacher. It also means that the students’ interests are equal to the teacher’s interests, which are also equal to the interests or expectations of the curriculum. To support student experiences, teachers need to learn to select and construct curriculum that represents and connects to their students’ lives and experiences.

## **2. Research Objectives**

The aim of this research is to explore the democratic pedagogy that contains numerous practices which teachers can utilize to foster democratic dispositions in their students. This research consisted of two objectives:

2.1.1 To explore how Myanmar educators conceptualize experience and approach democracy in the classroom;

2.1.2 To investigate how they teach about, influence, and engage in democracy, which will undoubtedly have an effect on students, inside and outside of the classroom.

## **3. Research Methodology**

### **3.1 Samples**

This research reports a study of 103 university students' questionnaires responses and 81 university teachers' interview data. Questionnaires were administered to 17 – 29 year old students in five different universities of upper Myanmar. Interview data collected from 81 university teachers bring some challenges of implementing a democratic pedagogy into focus.

### **3.2 Research Instruments**

The research instruments consisted of student questionnaire and contextualized interviews with university teachers during a period of one and a half years. Using data from questionnaire responses, audio recordings and notes taken from observations, we have analyzed the students' behaviour and attitudes in relation to educational objectives and the teacher's teaching and fostering actions.

### **3.3 Data Collection**

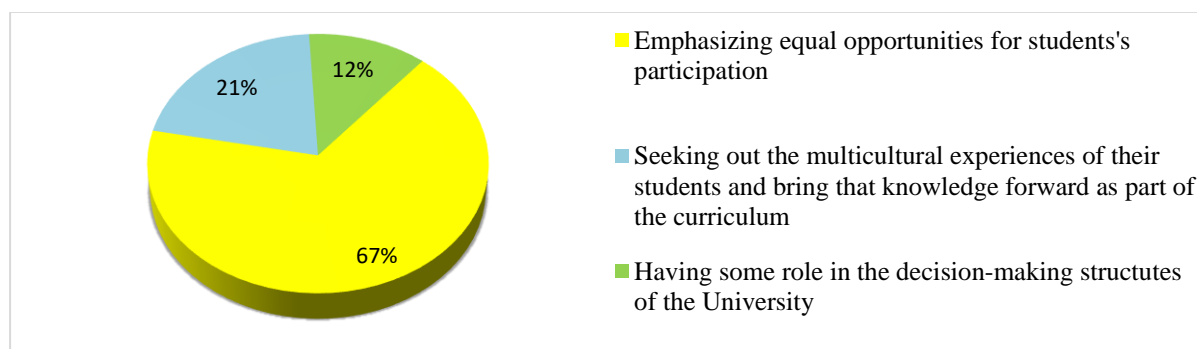
This section deals with student perceptions, experiences and perspectives, or, more generally speaking, attitudes, toward: 1) democracy in the US, in general; and 2) democracy and/in education This section deals with student perceptions, experiences and perspectives, or, more generally speaking, attitudes, toward: 1) democracy in the US, in general; and 2) democracy and/in education

This research examines the questionnaire for university students and semi-structured interviews for teacher participants. Each researcher had classroom observations that were also videoed and were subsequently coded by the researchers. There were also interviews throughout the seven month commitment. All classroom observations, interviews and questionnaire reflections were analysed and coded.



Emerging themes found from the interviews were synthesized with thematic analysis following the theory by Davies (1999) in order to describe the main issues identified by the participants.

### 3.4 Data Analysis

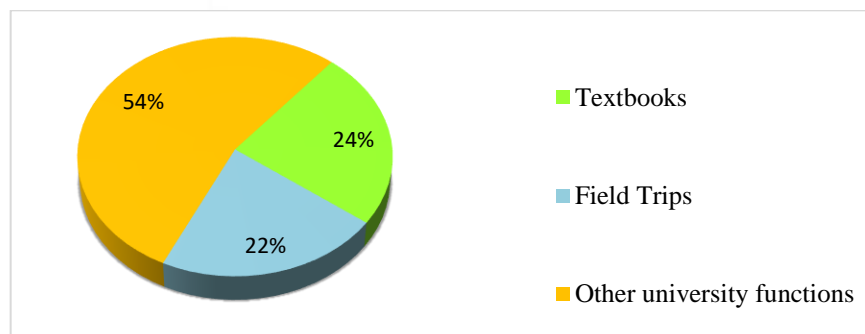


**Figure 1:** Responses of the teachers towards signs of democracy reflected in behaviour and attitudes that can be observed during the lessons

According to the data, the methods employed by 67% of participants need to emphasize equal opportunities for students' participation. Most of the teachers need to incorporate teaching strategies that encourage all students to share their experiences; their experiences represent knowledge that is valued and critically examined equally with that of textbooks and authority figures. The teachers responded that classroom interactions need to illustrate the value of sharing experiences and listening to each other as resources.

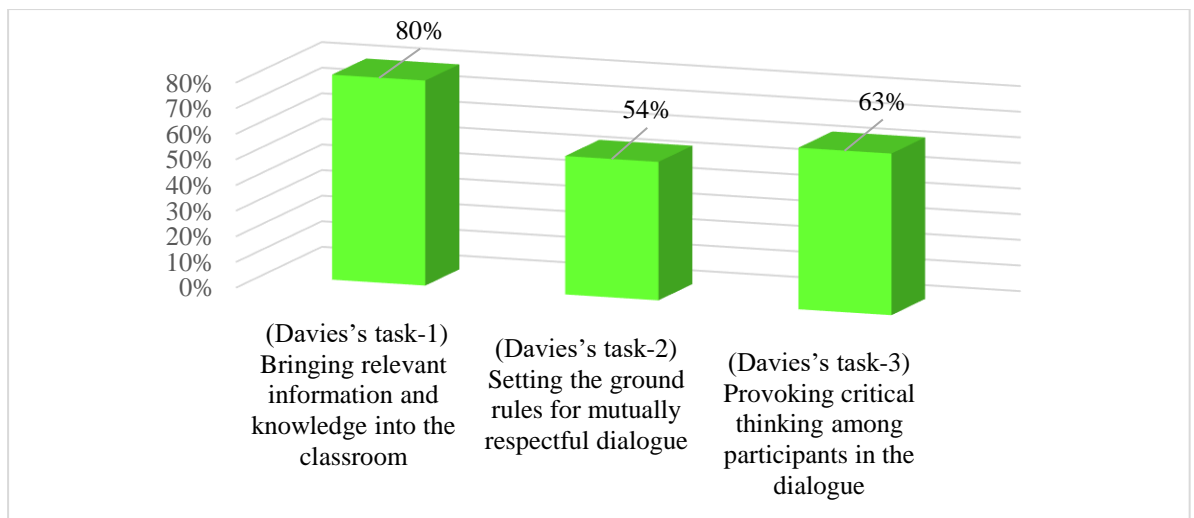
In practice, 21% of the teachers suggested that they must actively seek out the multicultural experiences of their students and bring that knowledge forward as part of the curriculum. In this sense, empowerment is gained from knowledge and social relations that dignify one's own history, language, and cultural traditions. By placing this knowledge within the curriculum, students are able to see themselves, their histories, their culture, and their knowledge as having an equal place in the classroom. It is important to note that the sharing of experiences can only be accomplished when students are working in a safe and respectful environment. Consequently, classroom interactions need to be both monitored and modelled to ensure that students can work in a supportive environment. To support curricular equality, *how* the curriculum is taught is also critical.

Beyond the emphasis on sharing experiences, classroom decision-making, critical discourse, and assessment practices also affect the degree of equality in a classroom. Davies (2006) emphasizes the importance of involving students in classroom decisions. If students are to be educated in and for global citizenship this suggests that they should experience democracy and human rights in their daily lives at university — and not just be told about it. 12% of the teachers said that students have some role in the decision-making structures of the university. Involving students in classroom decision-making can take several forms. For example, decisions can be made regarding which topics to study for an independent project, whether to work in groups, pairs, or independently. The aforementioned example demonstrates a teaching practice in which we can hear student voices equal with that of the teacher, curricula, and textbooks. However, some of the teachers responded that students do not always come to us ready to think critically, reflect on issues, make decisions, solve problems cooperatively, and feel a sense of ownership. Keeping this in mind, incorporating student decision-making is a gradual process whereby teachers increase the degrees to which student voice plays a role in the classroom. Teachers can implement practices that work to increase opportunities for equal participation. The teachers and universities are accountable to students, just as students are accountable to them. This research describes how “through activities such as cooperative learning, peer tutoring, peer editing, cooperative researching and the sharing of creative writing, poetry, and literature, students begin to see the value of peer input and collaboration in the learning process. As a result, only some equality can be achieved with regards to student voices with the university as a whole since a few signs of democracy reflected in behaviour and attitudes that can be observed during the lessons.



**Figure 2** Responses of the students towards teachers' support on the ways democracy comes to life in everyday work of equality in the classroom





**Figure 3** Responses of the teachers towards Davies's three tasks of the teachers to implement democracy in the classroom

## 5. Discussion

Whether detailing the need for Myanmar students to listen to and share their voices, provide peer assessment and feedback, or engage in collaborative dialogue which deliberates controversial issues, cooperation and teamwork are imperative to a democratic pedagogy. As explained by McAninch (1999), "Democracy is the belief that even when needs and ends or consequences are different for each individual, the habit of amicable cooperation is itself a priceless addition to life". As already described in this research, in practice, this collaboration needs to permeate the classroom, but it also needs to exist between the classroom and the community at large — bringing community into the classroom while also taking the classroom out into the community. In this sense, community is defined broadly, including local and global, individuals and groups. Connections can be made to students in other countries through multimedia, local community members can be brought into the classroom for presentations and projects, global organizations can be contacted and supported, and student field trips can take place throughout the community. With each example of collaboration in practice, recognition needs to be given to schools and universities as both a part of society and a creator of society. As described by Giroux and McLaren (1986), ensuring classroom-community collaboration, beyond strengthening students' ability to work

together, provides a much needed opportunity for equality that extends beyond the classroom.

## 6. Conclusion

According to Davies (1999), democratic pedagogy exists on a continuum that contains numerous practices which teachers can utilize to foster democratic dispositions in their students. A logical inference would be that the more of these practices teachers engage in, the more democratic their pedagogy becomes. Equality represents the foundation of democratic dispositions. Teachers implementing a democratic pedagogy not only seek classrooms of open dialogue, they also encourage critical student feedback on traditional aspects of the university. This in turn requires teachers to critically evaluate their own classrooms. It has been found that to encourage student voice in the classroom requires teachers who value and use their own voices. Standing for democracy is more powerful than standing for a teaching method. And criticizing democracy is much more difficult than attaching a teaching method. Researchers let the students tell how they like to learn, what they want to learn, and how you can improve. When the students generate ideas, it is crucial that the teachers should praise and encourage each student to share so that they know their ideas are valid and continue to participate. It is also crucial to hold them accountable to the classroom that they create. For example, if the teacher wants to do an icebreaker activity before every class, have a new student lead it each day. If the students determine a list of agreements that says they will not interrupt one another, and they do, remind them of the list they created. Or, better yet, ask them to evaluate themselves to see if they are sticking to the agreements they created.

## 7. Recommendation

One challenge to practicing democracy in the classroom that has not yet been resolved is that of Davies's task-2. Some of the teachers use to provide practice in making informed judgments and action which is the discussion and debate of controversial issues. In this sense, the classroom becomes an open environment where critical issues affecting students and the world can be constructively addressed. It is hoped that raising awareness about the need to practice democracy helps raise its priority, and therefore perhaps more time might be allocated to ensuring its practice. Future research might examine this for the implementation of democratic practices. Another challenge mentioned in the survey comments was that of the maturity level of

students. Future research might focus on age-appropriate ways to bring the practice of democracy into the classroom. Survey responses reveal areas in which teachers need to do a better job in order to foster a democratic environment. Survey results highlight teaching approaches and strategies that need to be implemented for a more democratic classroom. The results also show a need to educate teachers about the importance of the democratic value of freedom and how it can be practiced in the classroom. The teachers interviewed provided strategies, suggestions, and advice to help other teachers implement the practice of democracy in their own classrooms.

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## Communication Skills in Day to Day Practice of the Doctors: Myanmar Context

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### Abstract

Doctors work in many healthcare settings, such as hospitals, private offices, clinics or community healthcare facilities. Within these settings, the doctor can expect to work long, often irregular hours. Other than the doctor's scientific specialty, communication may be the most important skill for a doctor. Doctor's work all day with patients from all walks of life and ages, asking them questions about their health and then explaining their diagnoses and treatment plans in terms the patients can understand. The process of curing a patient requires a holistic approach which involves considerations beyond treating a disease. It warrants several skills in a doctor along with technical expertise. Studies have shown that good communication skill in a doctor improve patient's compliance and overall satisfaction. There are certain basic principles of practicing good communication. Patient listening, empathy, and paying attention to the paraverbal and non verbal components of the communication are the important ones that are frequently neglected. In total, doctors, junior doctors including postgraduate students, fellows, patients, nurses and attendants (n=142) participated and interview responses were analyzed. Only some of the doctors proved to be capable of practising many communication skills, such as listening and empathic communication behaviour. It is crucial therefore to pay attention to language in fostering a trustful and comprehensible relationship between medical staff and both patients and family members. Thus Formal training of the doctors in improving communication skills is necessary and has proven to improve overall outcome. The authors recommend inclusion of formal training in communication skills in medical curriculum and training of practising doctors in the form of Continuing Medical Education (CMEs) and Continuing Professional Education (CPEs).

**Keywords:** Communication Skills, Day to Day Practice, Doctors

## 1. Introduction

Doctors are healthcare workers who treat and assist patients with a variety of problems. The skills needed to work as a doctor are reflected through the amount of time doctors spend in school learning about the human body. However, there are other skills important to doctors that allow them to excel in their specialty. Doctors must be skilled in science, diagnosis and treatment. The skills learned in these sciences are the core to understanding diagnosis and treatment. Diagnosing a patient involves understanding the symptoms exhibited and putting them together to understand what is wrong with the patient internally. The doctor may then treat the patient. Treatment involves providing the correct recommendations to a patient, including medicine, referral to another doctor, and surgery. In that, good communication skill has been considered extremely important for medical practitioners. Its significance is now being acknowledged in our country and some authors have expressed the view that it is “the need of the hour” to train medical professionals in this important yet ignored aspect in clinical medicine. Recently, the medical system has witnessed an increase in the incidences of conflict between doctors and patients or their attendants. Such incidents are not only appalling but also ignominious for the noble medical profession. There is enough evidence in literature to suggest that poor communication between doctors and patients is an important attributing factor. Good practices like detailed explanation by clinicians along with enduring listening to the patients or their families have been found to decrease such incidences. This article strives to underline basic principles of the communication skills along with some practical suggestions useful in day to day practice of doctors.

### 1.1 Benefits of Good Communication Skills

The practice of good communication skills in the medical profession is integral for the development of meaningful and trustworthy relationship between the doctors and patients and, thus, is beneficial to both of them.

### 1.2 Components of Communication

Effective communication has three basic components-Verbal, non-verbal and paraverbal. Verbal component deals with the content of the message including selection of the words. Non-verbal component includes body language like posture, gesture, facial expression and spatial distance. Paraverbal component includes tone, pitch, pacing and volume of the voice. While communicating, most of us focus on the verbal component that constitutes only ten percent of the message delivered whereas non-verbal and paraverbal components contribute ninety percent of the total message delivered. Verbal



component (content) is important and it includes information about the nature, course and prognosis of the disease; various treatment options available; nature, cost and yield of the investigations and risks/benefits of invasive procedures. Although nonverbal component of the communication is frequently considered less important, literature suggest that it significantly influences important outcomes like patient's satisfaction, adherence to advices and clinical outcome.

### **1.3 Barriers to Good Communications**

There are several barriers to effective communication between patients and doctors. The most important one is lack of insight due to inadequate knowledge and training in communication skills. Many a times, doctors do not give enough heed to the importance of keeping patients adequately informed. Non-verbal components of the communications are frequently neglected. Language barrier is also important. It is not unusual for patients speaking in their local languages and giving tough time to doctors.

### **1.4 Learn to Listen to the Patients Patiently**

The importance of listening extends far beyond the academic and professional settings and is extremely important in creating a trustworthy doctor-patient relationship which is a prerequisite for therapeutic success. It is an active process that involves imbibing all the information expressed verbally or nonverbally by the patient. It is a major part of communication process. It helps in better understanding of the patient's problem and finding better decisions. Studies exploring the reasons for filing litigations against doctors found that a significant proportion of the patients were dissatisfied because the doctor had not listened or understood their problem fully.

### **1.5 Before Starting Formal Interview with Patient**

One can actually win patient's confidence in the first interaction even before starting formal interview. First impression is extremely crucial and instrumental for building doctor-patient relationship. The major determining factor for this first impression is not what the doctor says but how the doctor says it.

### **1.6 Conducting Medical Interview with the Patient**

The medical interview is an opportunity for the doctor to understand the patient's problems and learn its psychosocial bearing. Simply writing a prescription has got no value and is actually wastage of time and energy unless and until it is adequately honoured by patients. It is extremely important, especially in cases with chronic illness, where good communication skill is useful in allaying anxiety and motivating the patient for good compliance regarding advices.

### **1.7 Communicating with the Attendants**

This scenario usually comes when a doctor is treating an indoor patient. Attendants are apprehensive and at times full of doubts and queries. Communicating with the attendants assumes great importance especially when patient is critically ill or admitted in ICU.

### **1.8 Communicating with Colleagues**

Junior doctors including postgraduate students, fellows and interns along with nursing and supportive staffs are part of the team.

### **1.9 Managing Difficult Encounters**

Difficult encounters are not uncommon in medical practice and, in a study, approximately a few of the doctor-patient interactions were labelled as “difficult” encounters. It is worth noting that difficult encounters may be consequent to a combination of factors related to doctor, patient and even the circumstances. It is precipitated by an imbalance between the expectations, perceptions and the conduct of the doctor and the patient involved. Difficult encounters may occur when a doctor deals with a patient having multifarious medical ailments that are exacerbated by complex social issues.

### **1.10 Breaking Bad News**

Bad news means any information that has a potential to have devastating influence on one’s life. However, its impact is highly dependent on the recipient’s expectation and understanding. Disclosing bad news is a complex communication art that not only involves verbal component of actual news breaking but also includes empathetic response of the doctor to tackle the reaction. Poor communication skills of an inexperienced clinician can ruin the goal of providing support to the patient and eliciting patient’s collaboration for future treatment. Over half of the participants recommended that many doctors lack competence as well as confidence in their ability to divulge bad news and there is necessity to provide didactic training. Several protocols have been devised to guide the doctors for imparting this skill.

## **2. Research Objectives**

The objectives of the research are to investigate the beliefs of doctors towards the impact of good communication and to investigate the content of training in communication skills in medical curriculum and practice of doctors.





Always comprehend details in simple language. The use of medical jargons and abbreviations can have a negative effect.

### 3.3.7 Communicating with the Attendants

The followings recommended by the 42% participants are certain tips in Communicating with the attendants that will definitely improve one's ability to communicate:

Never be informal with them. Conduct conferences once and if possible twice daily. Talk about and appreciate the efforts made by them. Most of the attendants surf internet and gather lots of information. Try to satisfy their queries by giving better references. Always explain the dynamic nature of disease. This is especially important for critically ill patients.

Second opinion should be sought proactively. This is important not only in patient management when one is in doubt but also helpful in building attendant's confidence. One will be more convinced and ready to accept bad outcome if the same fact is explained by more than one consultants. Never express shock. Try to convince that all efforts are being made to bring situation under control or will be controlled. Consent taking is very important part of counseling. Never neglect this and give it to paramedical staffs or interns who may fail to explain convincingly.

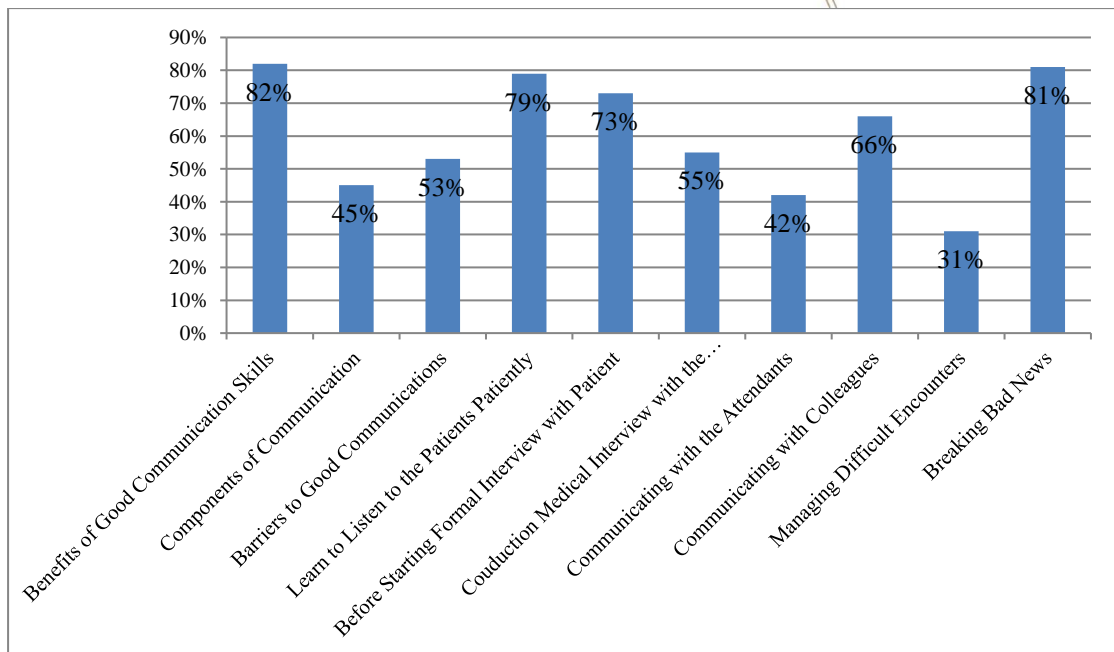
### 3.3.8 Communicating with Colleagues

Following principles recommended by the 66% participants should be followed:

Never talk low about your colleagues or scold residents, fellows or other students in front of patients or attendants. One should be extremely cautious while asking questions from Junior Residents on rounds. Patient may feel insecure in absence of senior consultants who may not present at all the time. This may also create doubts in the minds of patients even if Junior Residents prescribe drugs for common complaints. Greatest courtesy should be displayed for all staffs including nurses, paramedical staffs and other supporting staffs. Make them realise that they are a part of the team and their role and responsibility is also important. A system with effective teamwork can improve the quality of patient care and reduce workload among healthcare professionals.

Lead by setting examples. Supporting staff will never work with full sincerity unless and until they appreciate the hard work and ability of doctor. Try to teach them the basics and the principles of management of commonly encountered diseases in your ward. This will keep them motivated. Audit and regular feedback

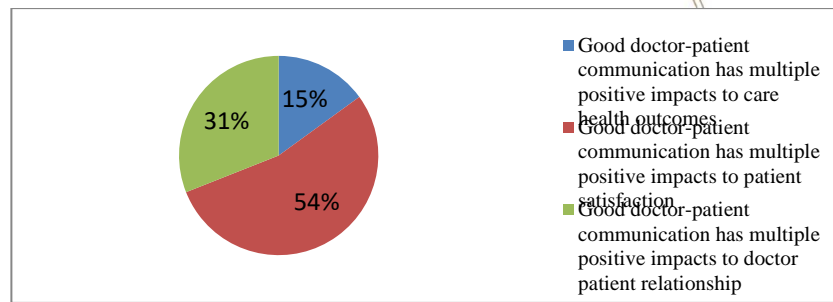




**Figure 1** Responses of the participants on basic principles of the communication skills useful in day to day practice of doctors

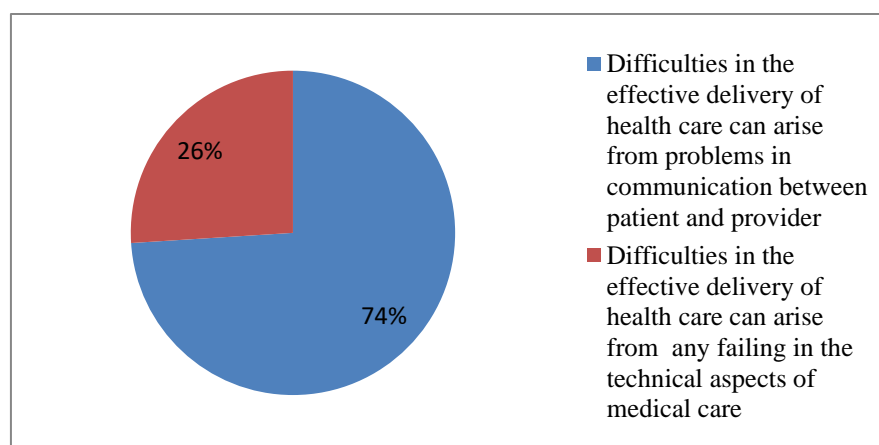
### 3.4 Data Analysis

Communication between doctor and a patient is certainly a very important component of patient care and is somehow not given due importance in our country. According to the data, participants responded that good doctor-patient communication has multiple positive impacts on various aspects of health outcomes which include improved care health outcomes (15%), improved patient satisfaction (54%) and improved doctor-patient relationship (31%). With all the growing level of mistrust among the people for the medical profession, increase in number of complaints, malpractice claims for doctors and incidences of conflict between doctors and patients, good doctor-patient communication is certainly becoming even more important. It is high time that we train medical graduates, postgraduates and all health care providers in communication skills.



**Figure 2** Responses of the participants on positive impacts of good doctor-patient communication on various aspects of health outcomes

Certainly there has been a progressive deterioration of effective doctor-patient communication. Good communication skills in the doctors are important in the delivery of safe, high quality and effective patient care. Doctor-patient communication is very well addressed in western countries where communication skill development and training has been included in medical curriculum of medical training programs. In our country medical graduates are generally not given any specific training in communication skills. Somehow or other there is an informal learning as some basic communication skills are imbibed consciously or subconsciously from ward rounds, faculty feedback and observing peers and seniors.



**Figure 3** Responses of the participants on difficulties in the effective delivery of health care

Despite being an important part of treatment it is somehow been neglected. Large number of studies has shown that many patients are not satisfied with the



consultation and that doctors fail many a time in adequately communicating with the patients and providing adequate information to their patients. Importance of good doctor-patient communication: Being a good doctor requires not only knowledge and technical skills, but also effective communication skills. It is not only the right of the patient to know about his sickness and the treatment he will receive but also the moral duty of the treating doctor to communicate to the patient his disease, the treatment he is to receive, the complications and alternative treatments if any. It has been recognized by the participants that difficulties in the effective delivery of health care can arise from problems in communication between patient and provider (74%) rather than from any failing in the technical aspects of medical care (26%).

#### **4. Research Results**

Regarding the benefits of good communication, good doctor-patient communication is important and has multiple impacts on various aspects of health outcomes.

##### **4.1 Improvement in health care outcomes**

There are numerous studies to show that improving communication skills in doctors results in marked improvement in healthcare outcome. Improved communication has been shown to empower patients for better recuperation after surgery.

##### **4.2 Improved patient satisfaction**

Effective doctor-patient communication plays an important role in patient satisfaction with health care services. Patient's level of satisfaction is improved by better recognition and understanding of their ailment and the treatment available. When carried out properly, doctor-patient communication has shown to have a therapeutic effect equivalent to drugs and it also decreases the dissatisfaction amongst the patient.

##### **4.3 Improved compliance with the treatment**

Low compliance with prescribed medical interventions is an important problem in medical practice and it is associated with substantial medical cost including increased hospital admissions. Studies suggest that effective communication fosters understanding and increases patient's compliance to the advices given by the doctor.

##### **4.4 Improved health, functional and emotional status**

Effective communication has a positive impact on patient's psychology, mental health, tolerance power and quality of life.

#### **4.5 Reduces medical malpractice risk**

There is growing level of mistrust among the public for the medical profession as one hears of cases of negligence, misconduct, and unethical practices leading to legal suits. Recently there has been an increase in the number of complaints against the doctors and the malpractice claims for doctors. There also has been an increase in the incidences of conflict between doctors and patients or their attendants. Studies show that communication problems have been the most common factor in the initiation of malpractice suits. There are also studies to show that effective communication between doctor and patient decreases malpractice risk and is associated with fewer malpractice claims.

#### **4.6 Establishing doctor-patient relationship**

Doctor patient relation is probably the most sacred relation in mankind. It has always been and will be the core of the medical profession and relies on the trust and faith of the patient in the doctor. Communication skills are Important when establishing doctor-patient relationship. Improper communication with the patient often leads to dissatisfaction among patients, loss of faith on the doctor and in many cases violence. It has been very well reported that imparting communication skill training to doctors helps in improving doctor-patient relationship. Barriers to good communications Lack of adequate knowledge and training in communication skills is an important barrier. The patient populations in our outpatient clinics are diverse and there is a significant variation in their spoken language, culture, educational and social background and this gives a tough time to doctors and all these factors act as a barrier. It is important that doctor must be careful not to be judgmental or scolding because this may rapidly close down communication. During the conversation, doctor must use simple words and phrases that are understood by everybody as use of medical jargon – technical terms, which are not understood by majority of people act as a barrier. Noise, inappropriate medium and then the distractions as often is the case in overcrowded outpatient clinics of most of our state run institutions, does create a barrier for effective communication. Assumptions and misconceptions are also not in favor of an effective communication. It has also been reported that human failings like stress, tiredness or lack of time, arrogance and telephone calls are important barriers to good communication. Recent trends: There has been lot of technological advances in the modes of communication used by the people in modern society like e-mail, the internet and mobile phone etc. Electronic forms of communication are beneficial as they allow rapid exchange of healthcare information; however caution has to be exercised. It should not be allowed

to interrupt or supersede verbal and nonverbal communication, which are central to the development of trust in patient-doctor relationship. It is important that with all the technological advances, we do not lose sight of the physical, psychological, social, and spiritual totality of the patient. Training doctors: Not many doctors are naturally blessed to have good communication skills. Doctors need to be trained in communication and this has to be included as an important topic in medical education. As it is, medical graduates in our country are not trained sufficiently in communication skills resulting in gaps in doctor-patient communication. Inculcating habits of good communications skill during formative years will help the medical students and future practitioners. For already practicing doctors, short trainings can be organized to stress the importance of communication and to impart some skills in communication. This research suggests that good communication skill is an art which can be acquired or improved by putting conscious efforts in day to day practice.

Regarding breaking of bad news, it is better to plan an agenda with the patients including diagnosis, treatment, prognosis and support or coping. An initial warning may decrease the shock that can follow the disclosure of bad news. Use of simple and non-technical words, giving information in small portions and periodic assessment of the impact are some of the communication tools that can be extremely useful.

Addressing the patient's emotions – Patient's emotional reaction may vary from silence to disbelief, crying, denial, or anger. It is the physician's duty to support the patient by making an empathic response. Moving closer to the patient, holding the hands, and using empathic statements help the physician to not only support the patient but also to acknowledge their own sadness and emotion. Validating responses help the patient to overcome and accept the reality. Sometimes when the patient becomes silent or tearful, allow them time to recover. Exploratory questions may be helpful when the patient's reaction is ambiguous.

Treatment plan and summarize - It is important to formulate and discuss future plan of treatment with patients and/or attendants by involving them in the decision making. Those who are having a definite plan of action are less likely to get anxious or panic. Summarizing the whole discussions in the last is extremely useful and helps in assessing if patient has understood the facts correctly or not.

We have found that doctors did practice some but not all the relevant communicative skills between intercultural and patient-centred communication. Implications for practice could be to implement the relevant communicative skills in the



and improved management of families. By speaking to their patients, doctors can create a trust that will help them to more effectively deal with their health questions and problems. The authors recommend inclusion of formal training in communication skills in medical curriculum and training of practicing doctors in the form of Continuing Medical Education (CMEs) and Continuing Professional Education (CPEs).

The followings are just three things the participants can learn to improve his communication repertoire.

### **6.1 Listening skills**

Being a good and sincere listener is the cornerstone of great communication. We are all very good at talking, but it's the listeners who are actually the best communicators. Studies have shown that the average physician interrupts their patient about 20 seconds into talking. Of course, physicians have to remain focused due to time constraints, but 20 seconds isn't nearly long enough if somebody has something important they are trying to tell us!

### **6.2 Interpersonal skills with patients and colleagues.**

How we come across when we talk with people is something most of us are unaware of, or have never had any professional feedback on. Very subtle verbal and non-verbal behaviors will determine on a psychological level, whether people are likely to warm to you, especially in a professional situation. There are a myriad of factors including tone of voice, how you acknowledge what the other person is saying, and even how you smile. Most physicians can easily learn techniques to improve some of these. Ditto for how you talk with professional colleagues!

### **6.3. Empathy and emotional intelligence**

Empathy is a trait that is also intrinsically linked to many of the above points, especially listening. Emotional intelligence is simply the ability to recognize your own, and other peoples' emotions, and accordingly, guide your own behavior. Health care being the unique field it is, improving this part of your character will greatly enable you to show more compassion—which is a crucial aspect of being a great clinician.

Having the ability to communicate well is probably the single most important skill any professional needs to have for career success. Not least a doctor. To conclude, good communication skills among the doctors is crucial in building a trustworthy doctor-patient relationship that not only helps in therapeutic success by providing holistic care to the patient but also leads to job satisfaction among the doctors. Not many doctors are naturally blessed to have good communication skills and there is necessity of formal training in this.

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## The Importance of Language Support in Medical Tourism

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### Abstract

The primary objective of this research was to understand the role of language in health care services. This research aimed at investigating 1) how language barriers affect health care encounters and (ii) how health care companies overcome language barriers. The context of this research was medical tourism, and the secondary purpose of this research was also to comprehend the global phenomenon of medical tourism. For the study, three different groups working in the medical tourism sector were interviewed: 12 industry experts, 26 health care professionals and 6 directors / managers and facilitators from Medical travel companies. Semi-structured interviews were made for this research and transcriptions of the interviews formed the primary empirical data. The findings of this research indicate that language barriers are in many ways problematic in health care services and they may have various negative impacts on a patient. Moreover, patient's native language has an important role in health care services. Based on the findings of this study, native language use is particularly important in the beginning and end of the health care service process, as particularly in those phases patient and health care personnel must be able to communicate effectively.

**Keywords** : Health care services, medical tourism, language barriers, native language use

### 1. Introduction

Also due to medical tourism and other forms of globalization, in the global economy international interactions are increasing and people are spending more time

in other countries than their country of residence and learning new languages (Holmqvist, 2009). As both people and markets become multilingual, both consumers and companies come across situations in which they have to use other language than their native language. Simultaneously, despite the service language, language and communication are always integral parts of any service encounter at least to some degree. In fact, the importance of effective communication in service encounters is a well-known and researched phenomenon, but not much attention has been paid on situations in which the communication needs to be carried out in a language other than customer's native language (Holmqvist, 2009). Moreover, there are certain services in which using native language seems to be particularly important. These services are called high involvement services and they include for example medical and financial services. The global medical tourism generates service encounters in which patient and the service provider are not always sharing a common language, which indicates language barriers. If a customer and a service provider do not share a common language there is possibility for adverse impact on the personal interaction, which is at the core of the service communication and thus, the whole service itself. Language barriers may also have an impact on the outcome of a service encounter. Besides, particularly in the context of health care services, language barriers have been demonstrated empirically to have various negative consequences on patients. At the same time, Jacobs et al. (2006) note that an efficient dialogue between a doctor and a patient is understood to be of diagnostic import and therapeutic benefit. The history of medical tourism is as old as health care itself is dating back thousands of years to ancient civilizations that recognized therapeutic effects of mineral thermal springs and sacred temple baths resulting in people traveling to spa towns and mineral waters for treatments. Since then, medical tourism has grown in terms of travelers and destinations. Today, people travel for medical treatments primarily because of affordable, quality health care. With patients traveling for months at a stretch for medical treatments, interpreters and linguists are a vital tool for ensuring correct medical interpretation, preventing accidents and making informed decisions. Inadequate communication can complicate interactions between patients and medical practitioners, lead to possible delays in effective treatments and even contribute to disparities in quality. Increasingly, medical professionals are recognising the importance of bridging the language gap and how it can save medical resources by encouraging people to seek timely medical attention. In order to expect the medical tourism industry to grow, we must move towards integrating more medical interpreters into the ecosystem and remove the lack of language support from becoming



a shortcoming of the larger health care system. The focus on language support and medical assistance training can open new territories and result in boosting the country's credentials.

## **2. Research Objectives**

This research consisted of three objectives.

1. To investigate how language barriers affect health care encounters
2. To explore how health care companies overcome language barriers

## **3. Research Methodology**

### **3.1 Samples**

The samples were composed of 12 industry experts, 26 health care professionals and 6 directors / managers and facilitators from Medical travel companies.

### **3.2 Research instruments**

The research instruments consisted of semi-structured interview.

### **3.3 Data Collection**

Semi-structured interview were conducted in-person and via e-mail. The interview transcripts were coded and a thematic analysis developed.

### **3.4 Data Analysis**

A majority of patients are from non English speaking countries, making their visit complicated when it comes to communicating with medical practitioners and finding language support even outside of the hospital, in their day to day affairs. While large hospitals provide interpreters to patients and their families, the numbers may be limited. While a lot of travelers rely on Google translate, it is full of hiccups and proves to be a frustrating experience when it comes to understanding medical terminology. Most of the participants responded that training in handling patients from different countries, help desks in hospitals and setting standard rates of services to tackle the issue of language barriers in medical tourism. Importantly, it is imperative to raise awareness of the opportunity of language support within the healthcare ecosystem. Medical travel companies and facilitators must also hire skilled interpreters to enable better communication between patients and medical practitioners.

#### **3.4.1 The Significance of Communication in Health Care**

The vital role of good communication in health care is commonly acknowledged – and so is its complexity and difficulty. Gathering a comprehensive medical history is by no means a simple task for a doctor. It is equally demanding for

the patient to convey her ailments and medical history and to understand the suggested treatment. Medical jargon is difficult to understand, and a doctor's status and busy schedule does not encourage people to ask for further explanations. The potential for misunderstanding increases considerably if doctors and patients do not speak the same language. In the context of international medical travel, it is the norm, rather than the exception, for doctor and patient to speak different languages. Contrary to common perception, many medical tourists don't speak English. Moreover, many of them come from poor countries and have only a limited education. Communicating with a doctor is even more challenging for these patients. However, the language barrier does not prevent these patients from travelling; coming from countries with very limited health care facilities, they have little alternative if they want to receive treatment. 83% of the participants responded that although it generally doesn't, health care can go terribly wrong. More than in any other realm, miscommunication in health care can have far-reaching, irreversible consequences. The difficulties mount when patients travel to places where very few people speak their language.

### **3.4.2 Engaging interpreters to tackle the language problem in international medical travel**

Health care providers catering for foreign patients and medical travel intermediaries recognized the relevance of language at an early stage. They therefore offer websites in different languages and, where applicable, providers highlight their staff's proficiency in English. Most importantly, hospitals offer a complimentary interpreting service for non-English speaking patients. Hospitals usually rely on a mix of regularly employed and freelance interpreters. However, patients may also bring with them a relative or friend or a translator provided by a medical travel agency, or hire an interpreter. The findings indicate that health providers tend to consider that they have addressed the language challenge by ensuring that their staffs are proficient in English, and by offering complimentary translation services. Indeed, the primary data we have collected so far shows that 69% of the foreign patients really appreciate these services. The data also shows that hospital interpreters' tasks go far beyond merely translating between languages.

### **3.4.3 The job of interpreting in hospitals is much more than mere language translation.**

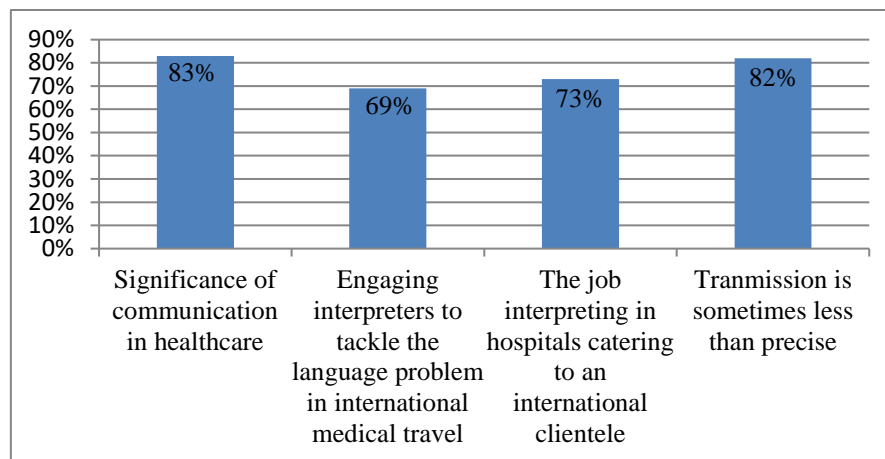
According to the data, interpreters complete or help with a whole range of tasks. They pick up patients from the airport, arrange accommodation after discharge, recommend places for shopping in the city, make appointments with doctors, collect

medical reports, guide patients around the hospital and sit with them in the doctor's office during the consultation or for a chat in the cafeteria. Interpreters see patients on a daily basis and seem to have more time than doctors or nurses. Additionally, interpreters mediate not only between different languages, but between different cultures too. They intuitively understand when a patient's customs, such as prayer times and dress, threaten to interfere with hospital routine, and can seek solutions. Hence, interpreters are well equipped to ease the unsettling feeling of being foreign. If foreign patients call interpreters their friends, then this reflects the interpreter's ability to make life easier for them. To sum up, interpreters are mediators in language and culture, guides through the unfamiliar city, an approachable point of contact who take care of foreign patients' non-medical needs. In fact, 73% of the participants agree that interpreters tend to shoulder a large part of the emotional work required to make foreign patients feel comfortable.

#### **3.4.4 Transmission is sometimes less than precise.**

However, interpreting in a medical context is a complex, responsible and consequential task. Accordingly, we would expect that the intermediary task of interpreting deserves significant attention from hospital management. Based on the data we have collected so far, 56% of the participants suggest that there is considerable room for improvement. First, hospitals do not require a medical background for interpreters; language expertise seems to be considered sufficient for effective communication. A manager made the responsibilities clear: doctors are bearers of medical expertise, while interpreters translate their words. Yet interpreting is difficult, particularly when it comes to transmitting complex, subjective issues including unpleasant messages. The requirements regarding language proficiency are relatively low; a certificate or diploma is usually considered sufficient. However, the lack of practical experience might impede communication, particularly when patients speak a dialect. Furthermore, a rich vocabulary is needed to convey nuances, for instance when a patient describes the kind of pain she is feeling, interpreting implies not only translating words, but also a deeper, contextual understanding of how physical and emotional states are expressed in the relevant culture. Since interpreters usually belong to either the source or (more commonly) the destination culture, and often have limited experience of the other, conveying the accurate meaning is challenging. 82% of the doctors treating foreign patients said that counseling via an interpreter is challenging and that the interpreter's competence and experience has a large impact on her counseling. If a doctor expresses doubts as to whether her words have been translated

accurately, this echoes the fact that there is not only room for improvement, but indeed a need for it.

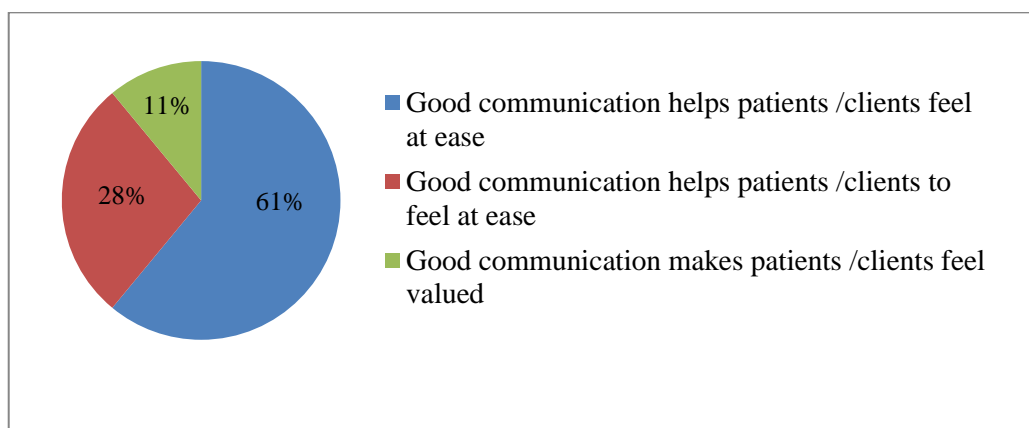


**Figure 1** Responses of the participants towards raising awareness of the opportunity of language support within the healthcare ecosystem

#### 4. Research Results

According to semi-structured interviews, most of the participants inform that language barriers are in many ways problematic in health care services and they may have various negative impacts on a patient. When communicating the details of a diagnosis or treatment, it is crucial to convey accurately the likelihood of the associated risk factors. Importantly, it is imperative to raise awareness of the opportunity of language support within the healthcare ecosystem.

##### 4.1 The Significance of Communication in Health Care



**Figure 2** Responses of the participants towards the significance of communication in Health Care

Having good communication with patients/clients helps the doctors in three main ways.

#### **4.1.1 Good communication helps patients/clients feel at ease**

According to the data, 61% of the participants feel that it's common for people who need health care services to feel anxious about their health, about what tests and treatment they might have to undergo and about what the future holds for them. This can sometimes lead them to speak out of character, perhaps being a bit rude or aggressive. Having good communication with health care workers will reduce their anxiety and build their confidence.

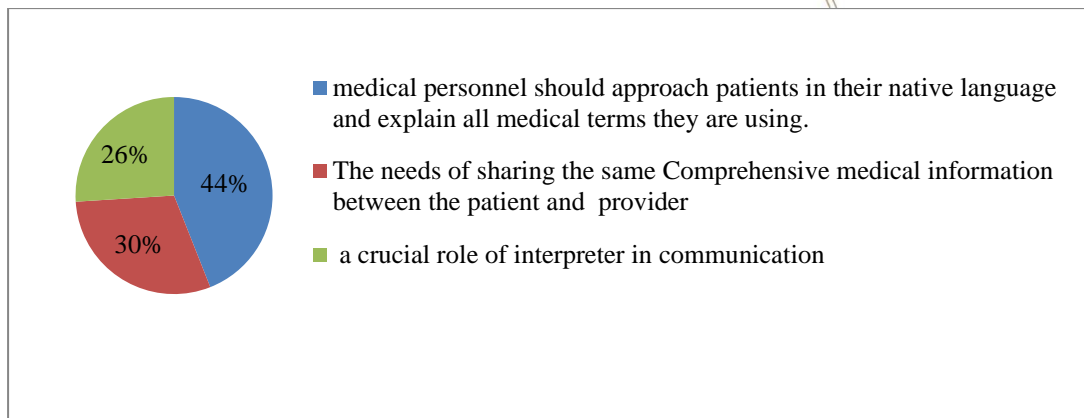
#### **4.1.2 Good communication helps patients/clients to feel in control**

It's easy for 28% of the participants to feel that they give up all control of their lives once they enter the health system. If they're in hospital, for instance, even simple everyday things they normally control, like when they get out of bed, when they wash and when they eat, might be dictated by someone else. Losing control can make people feel helpless and hopeless. But good communication can avoid these feelings.

#### **4.1.3 Good communication makes patients/clients feel valued**

The most precious thing one can give to another person is his/her time. When one listens to others, he/she will get to know them and understand how they are feeling. It shows that he/she really values others. 11% of the participants believed that being able to communicate well helps the doctors achieve this with patients/clients. More than in any other realm, miscommunication in health care can have far-reaching, irreversible consequences. The difficulties mount when patients travel to places where very few people speak their language. Most importantly, hospitals offer a complimentary interpreting service for non-English speaking patients. Hospitals usually rely on a mix of regularly employed and freelance interpreters.

### **4.2 Engaging interpreters to tackle the language problem in international medical travel**

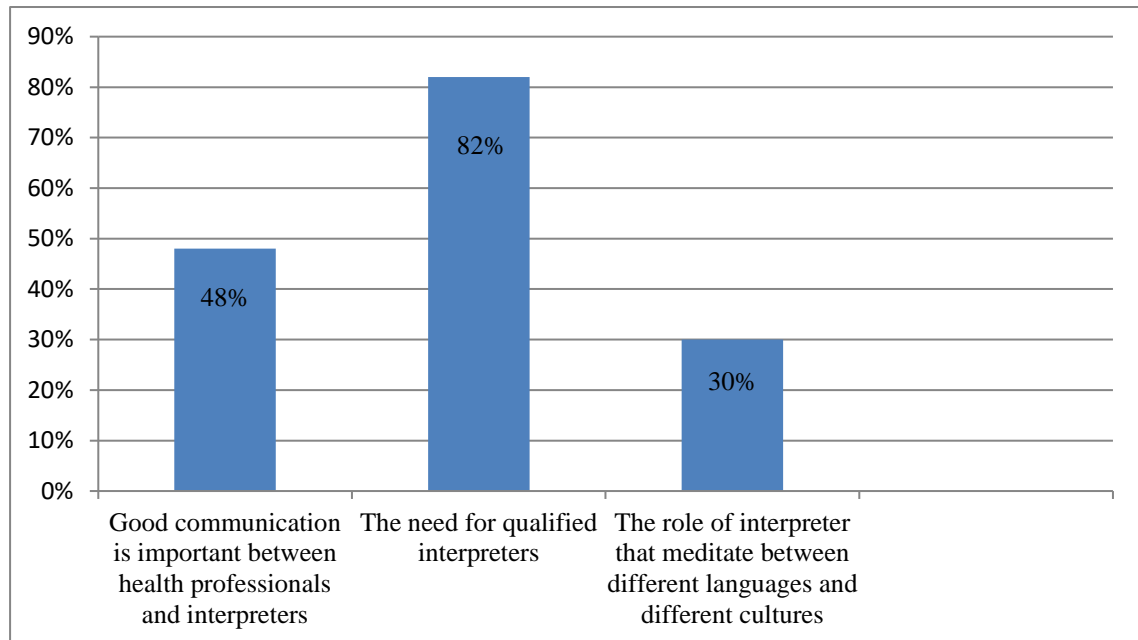


**Figure 3** Responses of the participants towards engaging interpreters to tackle the language problem in international medical travel

In health care services, patient has a key role as a source of medical information. In order to be able to do a proper diagnosis and treat the patient, the doctor needs to understand the symptoms and the clinical picture of a patient (Aantaa, 2012). Thus, in the beginning of a treatment process patient provides medical information for medical personnel by explaining his / her medical history, describing his / her current ailment and symptoms which can also be conducted by patient's family member or similar if the patient is too unwell to do it himself / herself. This is why 44% of the participants suggests that medical personnel should approach patients in their native language and explain all medical terms they are using. Comprehensive medical information cannot be given if the patient and service provider are not sharing the same language. 30% of the participants responded that if the patient and health care personnel do not share a language in which they are able to communicate and thus, the patient cannot share his / her medical history there is potentially an adverse impact for the patient safety. Miscommunication can increase the risk of medical errors, inappropriate treatments and emergency room visits. Thus 26% of the participants responded that interpreters can play a crucial role by facilitating verbal and nonverbal communication and 'mediating' concepts and cultural practices as needed. A highly skilled interpreter possesses a wide range of skills and abilities, including:

- (i) Professional training and certification
- (ii) Some knowledge of close language 'families' and related dialects.
- (iii) Some awareness of intercultural issues (e.g., different value systems, the role of individual family members, common taboos, and attitudes toward authority).

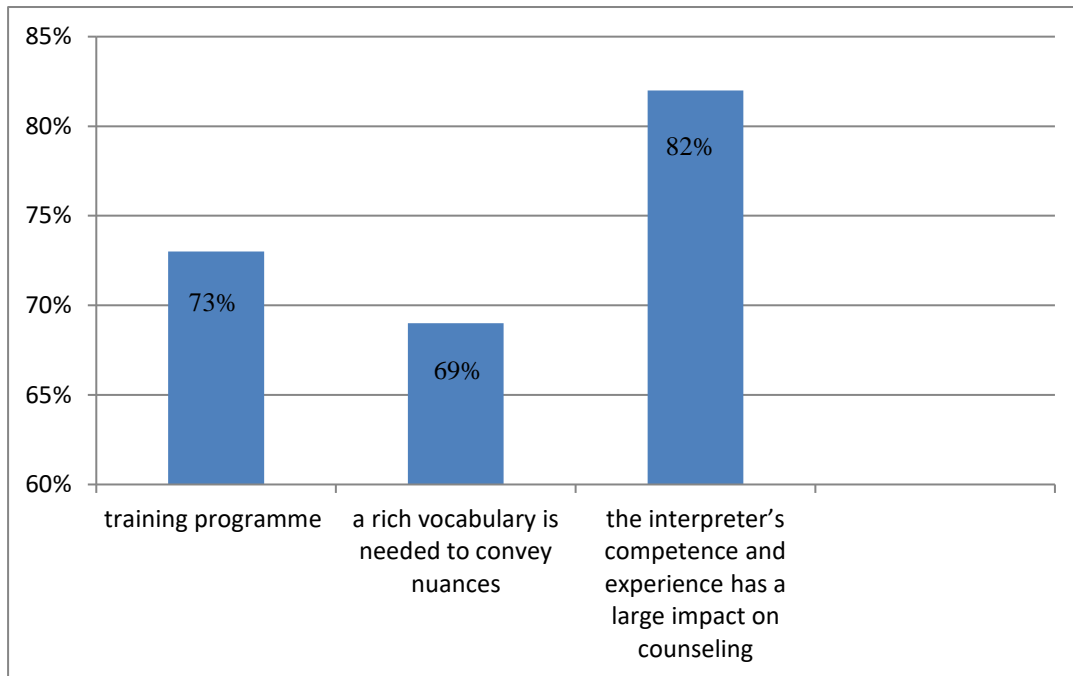
#### 4.2.1 The job of interpreting in hospitals is much more than mere language translation.



**Figure 4** Responses of the participants towards the job of interpreting in hospitals is much more than mere language translation.

The primary data we have collected so far shows that most of the foreign Communication problems may be caused by language and by different horizons of understanding, medical explanations and expressions of symptoms etc. 48% of the health professionals find it difficult to communicate well with patients through interpreters. Thus 82% of the participants said that interpreters are needed who are qualified to act as cultural mediators and who are legally and ethically authorized to do so. Interpreters complete or help the patients with a whole range of tasks. Only 30% of participants also considered that interpreters mediate not only between different languages, but between different cultures too. Thus, interpreters are mediators in language and culture, guides through the unfamiliar city, an approachable point of contact who take care of foreign patients' non-medical needs. In fact, most of the participants agree that interpreters tend to shoulder a large part of the emotional work required to make foreign patients feel comfortable.

#### 4.2.2 Transmission is sometimes less than precise.



**Figure (5):** Responses of the participants towards the significance role of interpreters and accuracy of interpretation

The role of interpreters is significant, and the accuracy of interpretation is the most critical component of safe and effective communication between clinicians and patients in medical settings characterized by language and cultural barriers. Their interpreting experience appeared to be a contributing factor on making errors. 73% of the participants suggested that implications for an integrated training programme to reduce interpretation errors and future research. The lack of practical experience might impede communication, particularly when patients speak a dialect. Furthermore, 69% of the participants suggested that a rich vocabulary is needed to convey nuances, for instance when a patient describes the kind of pain she is feeling, interpreting implies not only translating words, but also a deeper, contextual understanding. 82% of the doctors treating foreign patients said that counseling via an interpreter is challenging and that the interpreter's competence and experience has a large impact on her counseling. If a doctor expresses doubts as to whether her words have been translated accurately, this echoes the fact that there is not only room for improvement, but indeed a need for it.



## 5. Discussion

Neither has the medical tourism field been researched extensively, although medical tourism is a significant global business area. Many researchers (e.g. Wang, 2012) note that medical tourism is a little known and not sufficiently studied phenomenon. Primarily, the objective of this study is to understand the role of language in health care services. Moreover, this study also aims at investigating the impact of language barriers in health care services and especially the solutions health care companies have for overcoming them. In general, this study explains how health care companies take language issues into account when involving themselves to the global medical tourism field. Consequently, by understanding the phenomenon better and especially the motives and drivers of medical tourists to travel abroad for health care, health care companies could meet the demand better and thus, serve the growing foreign patients' segment more appropriately. This research explores language and language barriers as well as medical tourism from health care providers' perspective. However, the lack of alternatives does not release providers from their responsibility to facilitate optimal health care and not simply a medical cure. This entails that they adequately address the challenge of nuanced and clear communication across cultural and language boundaries. To do so, there is a need to acknowledge the full complexity of trans-cultural doctor-patient communication needs. Interpreters with a high level of language proficiency, in-depth knowledge of the source culture and a medical background are a major part of achieving this goal.

## 6. Conclusion

Today, people travel for medical treatments primarily because of affordable, quality health care. The data from semi-structured interview indicates that the interpreters and linguists are a vital tool for ensuring correct medical interpretation, preventing accidents and making informed decisions. Inadequate communication can complicate interactions between patients and medical practitioners, lead to possible delays in effective treatments and even contribute to disparities. Working as an interpreter requires continuous efforts in language learning and the familiarization with medical terminology. Based on the findings of this research, language has also an important role in medical tourism. This research concludes that patient's native language has an important role in health care services. To do so, there is a need to acknowledge the full complexity of trans-cultural doctor-patient communication needs. Interpreters

with a high level of language proficiency, in-depth knowledge of the source culture and a medical background are a major part of achieving this goal.

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## Science and Technology (Oral Presentation)

## Characterizations of Ordered $\Gamma$ -Semigroups by the Properties of Their Ordered $(m, n)$ -Quasi- $\Gamma$ -Ideals

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### Abstract

In this paper we show the way we pass from ordered semigroups to ordered  $\Gamma$ -semigroups by study the concept and characteristic of ordered  $(m, n)$ -quasi- $\Gamma$ -ideals in ordered  $\Gamma$ -semigroups that are studied from the concept and properties of  $(m, n)$ -quasi-ideals in ordered semigroups considered by Suthin Thongrak and Aiyared Iampan in 2018. Then we give characteristic of ordered  $m$ -left- $\Gamma$ -ideals, ordered  $n$ -right- $\Gamma$ -ideals in ordered  $\Gamma$ -semigroups and investigate the ordered  $(m, n)$  intersection property of ordered  $(m, n)$ -quasi- $\Gamma$ -ideals in ordered  $\Gamma$ -semigroups. Regular ordered  $\Gamma$ -semigroups and are characterize by their ordered  $(m, n)$ -quasi- $\Gamma$ -ideals and fact that every ordered  $(m, n)$ -quasi- $\Gamma$ -ideals of regular ordered  $\Gamma$ -semigroups has the ordered  $(m, n)$  intersection property. That is intersection of ordered  $m$ -left- $\Gamma$ -ideals and ordered  $n$ -right- $\Gamma$ -ideals of an ordered  $\Gamma$ -semigroups has the ordered  $(m, n)$  intersection property.

**Keywords :**  $\Gamma$ -semigroups, ordered  $\Gamma$ -semigroups, ordered  $(m, n)$ -quasi- $\Gamma$ -ideal, ordered  $(m, n)$  intersection property.

### 1. Introduction

The notion of  $\Gamma$ -semigroups was introduced by M.K. Sen (Sen, 1986, pp. 180-186) and that is the po- $\Gamma$ -semigroups that was introduced by Y.I. Kwon and S.K. Lee (Kwon and Lee, 1996, pp. 679-685). The notion of a quasi-ideals in semigroups was first invented by O. Steinfeld (Steinfeld, 1956, pp. 262-275). Thereafter, quasi-ideals have been studied in different algebraic structures in (Abbasi and Basar, 2013, pp. 1-7). N.

Kehayopulu, S. Lajos and G. Lepouras (Kehayopulu, Lajos and Lepouras, 1997, pp. 75-81) defined and studied an ordered quasi-ideal in ordered semigroups.

Recently, Suthin Thongrak and Aiyared Iampan in (Thongrak and Iampan, 2018, pp. 299-306) gave the characterizations of ordered semigroups and investigate the ordered  $(m, n)$ -quasi-ideals in ordered semigroups. In continuation of the study, we characterize of ordered  $\Gamma$ -semigroups and investigate the ordered  $(m, n)$ -quasi- $\Gamma$ -ideals which extends the results in ordered  $\Gamma$ -semigroups.

## 2. Research Objectives

This research consisted to provide new knowledge about education and research in semigroups.

## 3. Preliminaries

In this section, we recall some necessary definitions, notations and properties of some algebraic structures.

Let  $S$  and  $\Gamma$  be two nonempty sets. Then a system of the form  $(S, \Gamma, \cdot)$  is called a  $\Gamma$ -semigroup if  $(a \cdot \gamma \cdot b) \cdot \mu \cdot c = a \cdot \gamma \cdot (b \cdot \mu \cdot c)$  for all  $a, b, c \in S$  and all  $\gamma, \mu \in \Gamma$ . Also, for the sake of smoothness, we denote  $a \cdot \gamma \cdot b$  by  $a\gamma b$ . A nonempty subset  $N$  of a  $\Gamma$ -semigroup  $S$  is called a *sub- $\Gamma$ -semigroup* of  $S$  if  $a\alpha b \in N$ , for all  $a, b \in N$  and  $\alpha \in \Gamma$ . Let  $S$  be a semigroup and  $\Gamma$  a nonempty set. For  $x, y \in S$  and  $\gamma \in \Gamma$ , define  $x\gamma y = xy$ . Then  $S$  is a  $\Gamma$ -semigroup. Let  $S$  be a  $\Gamma$ -semigroup. For  $A, B \subseteq S$ , let  $A\Gamma B = \{a\gamma b \mid a \in A, b \in B \text{ and } \gamma \in \Gamma\}$ . Let  $S$  be a  $\Gamma$ -semigroup.  $A$  of  $S$  is called a *left (resp. right) ideal* of  $S$  if  $S\Gamma A \subseteq A$  (resp.  $A\Gamma S \subseteq A$ ). If  $A$  is both left and right ideal of  $S$ , then  $A$  is called an ideal of  $S$ . A nonempty subset  $Q$  of  $S$  is called a *quasi-ideal* of  $S$  if  $Q\Gamma S \cap S\Gamma Q \subseteq Q$ . Every right ideal and left ideal is a Quasi-ideal.

**Definition 3.1** (Chotchaisthit, 2012, pp. 1099-1103) A  $\Gamma$ -semigroup  $S$  is called an *ordered  $\Gamma$ -semigroup (po- $\Gamma$ -semigroup)* if there is a relation  $\leq$  on  $S$  such that  $x \leq y$  imply  $x\gamma z \leq y\gamma z$  and  $z\gamma x \leq z\gamma y$  for any  $x, y, z \in S$  and all  $\gamma \in \Gamma$ .

A nonempty subset  $T$  of an ordered  $\Gamma$ -semigroup  $S$  is called a *sub- $\Gamma$ -semigroup* of  $S$  if for all  $x, y \in T$  and  $\gamma \in \Gamma$ ,  $x\gamma y \in T$  and  $(T) \subseteq T$ .

Let  $S$  be an ordered  $\Gamma$ -semigroup. For  $A, B$  of an ordered  $\Gamma$ -semigroup  $S$ , the product set  $A \cdot B$  of the pair  $(A, B)$  relative to  $S$  is defined as

$$A \cdot \Gamma \cdot B = \{a \cdot \gamma \cdot b \mid a \in A, b \in B \text{ and } \gamma \in \Gamma\}$$

and for  $A \subseteq S$ , the product set  $A \cdot A$  relative to  $S$  is defined as  $A^2 = A \cdot A = A \cdot \Gamma \cdot A$ . Let  $S$  be a ordered  $\Gamma$ -semigroup. For  $A \subseteq S$ , let

$$[A] = \{x \in S \mid x \leq a \text{ for some } a \in A\}.$$

Also we write  $[s]$  instead of  $(\{s\})$  for  $s \in S$ . Let  $B \subseteq S$ . Then for a non-negative integer  $m$ , the power of  $B^m = B\Gamma B\Gamma \dots$ , where  $B$  occurs  $m$  times. And  $\Gamma$  occurs  $m - 1$  times. Note that the power is suppressed

when  $m = 0$ . So  $B^0\Gamma S = S = S\Gamma B^0$ .

In what follows we denote the po- $\Gamma$ -semigroup  $(S, \Gamma, \cdot, \leq)$  by  $S$  unless otherwise specified. Throughout the paper, for the sake of brevity, we denote  $a \cdot \gamma \cdot b$  by  $a\gamma b$ .

**Definition 3.2** (Hila, 2014, pp. 253-270) Let  $S$  be a ordered  $\Gamma$ -semigroup and  $I$  be a nonempty subset of  $S$ . Then  $I$  is called an *right* (resp. *left*) *ideal* of  $S$  if

- (i)  $I\Gamma S \subseteq I$  (resp.  $S\Gamma I \subseteq I$ ),
- (ii)  $a \in I, b \leq a$  for  $b \in S \Rightarrow b \in I$ .

Equivalent definition:

- (i)  $I\Gamma S \subseteq I$  ( resp.  $S\Gamma I \subseteq I$ ),
- (ii)  $[I] = I$ .

$I$  is called an *ideal* of  $S$  if it right and left ideal of  $S$ .

**Definition 3.3** (Chotchaisthit, Changphas) Let  $S$  be a ordered  $\Gamma$ -semigroup. A nonempty subset  $Q$  of  $S$  is called a *quasi- $\Gamma$ -ideal* of  $S$  if

- (i)  $(Q\Gamma S] \cap (S\Gamma Q) \subseteq Q$ ,
- (ii) for  $x \in Q$  and  $y \in S$  such that  $y \leq x$  implies  $y \in Q$ .

**Definition 3.4** Let  $S$  be a ordered  $\Gamma$ -semigroup. A nonempty subset  $Q$  of  $S$  is called an *ordered  $m$ -left* (resp. *ordered  $n$ -right*)- $\Gamma$ -ideal of  $S$  if

- (i)  $S^m\Gamma B \subseteq B$ , (resp.  $B\Gamma S^n \subseteq B$ ),
- (ii) for  $x \in Q$  and  $y \in S$  such that  $y \leq x$  implies  $y \in Q$ .

**Definition 3.5** Assume  $Q$  is a sub- $\Gamma$ -semigroup (resp. nonempty subset) of an ordered- $\Gamma$ -semigroup  $S$ . Then  $Q$  is called an (resp. generalized) *ordered  $(m, n)$ -quasi- $\Gamma$ -ideal* of  $S$ . if

- (i)  $(Q\Gamma S^n] \cap (S^m\Gamma Q) \subseteq Q$ ,
- (ii) for  $x \in Q$  and  $y \in S$  such that  $y \leq x$  implies  $y \in Q$ .

**Lemma 3.6** (Iampan, 2011, pp. 13-23) Let  $S$  be an ordered  $\Gamma$ -semigroup, and  $A, B$  subset of  $S$ . Then the following statement hold.

- (i)  $A \subseteq (A]$ .
- (ii)  $((A]) = (A]$ .
- (iii) If  $A \subseteq B$ , then  $(A] \subseteq (B]$ .
- (iv)  $(A \cap B) \subseteq (A] \cap (B]$ .
- (v)  $(A \cup B) = (A] \cup (B]$ .
- (vi)  $(A]\Gamma(B) \subseteq (A\Gamma B]$ .
- (vii)  $((A]\Gamma(B)) = (A\Gamma B]$ .

**Lemma 3.7** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $\{A_i \mid i \in I\}$  a nonempty family of sub- $\Gamma$ -semigroup. Then  $\bigcap_{i \in I} A_i = \emptyset$  or  $\bigcap_{i \in I} A_i$  is a sub- $\Gamma$ -semigroup of  $S$ .

*Proof.* Let  $\{A_i \mid i \in I\}$  a nonempty family of sub- $\Gamma$ -semigroup and  $\bigcap_{i \in I} A_i \neq \emptyset$ . Let  $a, b \in \bigcap_{i \in I} A_i \neq \emptyset$ , we have  $a, b \in A_i$  for all  $i \in I$ . Then  $a\gamma b \in A_i$  for all  $i \in I$ . Thence  $a\gamma b \in \bigcap_{i \in I} A_i$ . Therefore  $\bigcap_{i \in I} A_i$  is a sub- $\Gamma$ -semigroup of  $S$ .

**Lemma 3.8** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $A$  a sub- $\Gamma$ -semigroup of  $S$ . Then  $A^n \subseteq A$  for all positive integer  $n$ .

**Proposition 3.9** Let  $S$  be an ordered  $\Gamma$ -semigroup,  $Q$  an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$  and  $A$  a sub- $\Gamma$ -semigroup of  $S$ . Then  $A \cap Q = \emptyset$  or  $A \cap Q$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $A$ .

*Proof.* Assume that  $A \cap Q \neq \emptyset$ . Since  $Q$  and  $A$  are sub- $\Gamma$ -semigroup of  $S$ , we have  $A \cap Q$  is a sub- $\Gamma$ -semigroup of  $S$ . Since  $A \cap Q \subseteq A$ , we have  $A \cap Q$  is a sub- $\Gamma$ -semigroup of  $A$ . Thus

$$\begin{aligned} (A^m \Gamma (A \cap Q)) \cap ((A \cap Q) \Gamma A^n) \cap A &\subseteq A \cap (A^m \Gamma Q) \cap (Q \Gamma A^n) \\ &\subseteq A \cap (S^m \Gamma Q) \cap (Q \Gamma S^n) \\ &\subseteq A \cap Q. \end{aligned}$$

and

$$\begin{aligned} (A \cap Q) \cap A &\subseteq A \cap (A) \cap (Q) \\ &\subseteq A \cap (Q) \\ &= A \cap Q. \end{aligned}$$

Therefore,  $A \cap Q$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $A$ .

**Proposition 3.10** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $\{Q_i \mid i \in I\}$  a nonempty family of ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ . Then  $\bigcap_{i \in I} Q_i = \emptyset$  or  $\bigcap_{i \in I} Q_i$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ .

*Proof.* Assume that  $\bigcap_{i \in I} Q_i \neq \emptyset$ . By Lemma 3.7, we have  $\bigcap_{i \in I} Q_i$  is a sub- $\Gamma$ -semigroup of  $S$ . For all  $i \in I$ , we have  $(S^m \Gamma (\bigcap_{i \in I} Q_i)) \cap ((\bigcap_{i \in I} Q_i) \Gamma S^n) \subseteq (S^m \Gamma Q_i) \cap (Q_i \Gamma S^n) \subseteq Q_i$





**Lemma 4.1.2** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $Q$  a nonempty subset of  $S$ . Then the following statements hold.

- (i)  $(S^m \Gamma Q]$  is an ordered  $m$ -left- $\Gamma$ -ideal of  $S$ .
- (ii)  $(Q \Gamma S^n]$  is an ordered  $n$ -right- $\Gamma$ -ideal of  $S$ .

*Proof.* (i) By Lemma 3.8, we have that

$$\begin{aligned}
 (S^m \Gamma Q] \Gamma (S^m \Gamma Q] &\subseteq ((S^m \Gamma Q) \Gamma (S^m \Gamma Q]) \\
 &\subseteq ((S^m \Gamma S) \Gamma (S^m \Gamma Q]) \\
 &\subseteq (S \Gamma (S \Gamma S^{m-1} \Gamma Q]) \\
 &= ((S \Gamma S) \Gamma (S^{m-1} \Gamma Q]) \\
 &\subseteq (S \Gamma (S^{m-1} \Gamma Q]) \\
 &= ((S \Gamma S^{m-1}) \Gamma Q] \\
 &= (S^m \Gamma Q].
 \end{aligned}$$

Then  $(S^m \Gamma Q]$  is a sub- $\Gamma$ -semigroup of  $S$ . We see that

$$\begin{aligned}
 S^m \Gamma (S^m \Gamma Q] &\subseteq S \Gamma (S \Gamma S^{m-1} \Gamma Q] \\
 &= (S] \Gamma (S \Gamma S^{m-1} \Gamma Q] \\
 &\subseteq (S \Gamma (S \Gamma S^{m-1} \Gamma Q]) \\
 &= ((S \Gamma S) \Gamma (S^{m-1} \Gamma Q]) \\
 &\subseteq (S \Gamma (S^{m-1} \Gamma Q]) \\
 &= ((S \Gamma S^{m-1}) \Gamma Q] \\
 &= (S^m \Gamma Q].
 \end{aligned}$$

and  $((S^m \Gamma Q]) = (S^m \Gamma Q]$ . Therefore,  $(S^m \Gamma Q]$  is an ordered  $m$ -left- $\Gamma$ -ideal of  $S$ .

(ii) By Lemma 3.8, we have that

$$\begin{aligned}
 (Q \Gamma S^n] \Gamma (Q \Gamma S^n] &\subseteq ((Q \Gamma S^n) \Gamma (Q \Gamma S^n]) \\
 &\subseteq ((Q \Gamma S^n) \Gamma (S \Gamma S^n]) \\
 &\subseteq ((Q \Gamma S^n) \Gamma S] \\
 &= ((Q \Gamma S^{n-1}) \Gamma (S \Gamma S])
 \end{aligned}$$

$$\begin{aligned}
 &\subseteq ((Q\Gamma S^{n-1})\Gamma S] \\
 &= (Q\Gamma(S^{n-1}\Gamma S)] \\
 &= (Q\Gamma S^n].
 \end{aligned}$$

Then  $(Q\Gamma S^n]$  is a sub- $\Gamma$ -semigroup of  $S$ . We see that

$$\begin{aligned}
 (Q\Gamma S^n]\Gamma S^n &\subseteq (Q\Gamma S\Gamma S^{n-1})\Gamma S \\
 &= (Q\Gamma S\Gamma S^{n-1})\Gamma(S] \\
 &\subseteq (Q\Gamma S\Gamma S^{n-1}(\Gamma S)] \\
 &= (Q\Gamma S^{n-1}(S\Gamma S)] \\
 &\subseteq (Q\Gamma S^{n-1}(\Gamma S)] \\
 &= (Q\Gamma(S\Gamma S^{n-1})] \\
 &= (Q\Gamma S^n].
 \end{aligned}$$

and  $((Q\Gamma S^n]) = (Q\Gamma S^n]$ . Therefore,  $(Q\Gamma S^n]$  is an ordered  $n$ -left- $\Gamma$ -ideal of  $S$ .

**Lemma 4.1.3** Let  $S$  be an ordered  $\Gamma$ -semigroup. Then the following statements hold.

(i) Every ordered  $m$ -left- $\Gamma$ -ideal is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$  for all positive integer  $n$ .

(ii) Every ordered  $n$ -right- $\Gamma$ -ideal is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$  for all positive integer  $m$ .

*Proof.* (i) Assume that  $A$  is an ordered  $m$ -left- $\Gamma$ -ideal of  $S$  and let  $n$  be a positive integer. Then  $A$  is a sub- $\Gamma$ -semigroup of  $S$ . Thus

$(S^m\Gamma A] \cap (A\Gamma S^n] \subseteq (S^m\Gamma A] \subseteq (A] = A$  and  $(A] \subseteq A$ . Therefore,  $A$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$  for all positive integer  $n$ .

(ii) Assume that  $B$  is an ordered  $n$ -right- $\Gamma$ -ideal of  $S$  and let  $m$  be a positive integer. Then  $B$  is a sub- $\Gamma$ -semigroup of  $S$ . Thus

$$(S^m\Gamma B] \cap (B\Gamma S^n] \subseteq (B\Gamma S^n] \subseteq (B] = B \text{ and } (B] \subseteq B.$$

Therefore,  $B$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$  for all positive integer  $m$ .

**Theorem 4.1.4** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $A$  an ordered  $m$ -left- $\Gamma$ -ideal and  $B$  an ordered  $n$ -right- $\Gamma$ -ideal of  $S$ . Then  $A \cap B = \emptyset$  or  $A \cap B$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ .

*Proof.* Assume that  $A \cap B \neq \emptyset$ . Then  $A \cap B$  is a sub- $\Gamma$ -semigroup of  $S$ . Thus

$$\begin{aligned}
 (S^m \Gamma (A \cap B)] \cap ((A \cap B) \Gamma S^n] &\subseteq (S^m \Gamma A] \cap (B \Gamma S^n] \\
 &\subseteq (A] \cap (B] \\
 &\subseteq A \cap B.
 \end{aligned}$$

and  $(A \cap B] \subseteq (A] \cap (B] = A \cap B$ . Hence,  $A \cap B$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ .

**Definition 4.1.5** A sub- $\Gamma$ -semigroup  $Q$  of an ordered  $\Gamma$ -semigroup  $S$  has the ordered  $(m, n)$  intersection property if  $Q$  is the intersection of an ordered  $m$ -left- $\Gamma$ -ideal and an ordered  $n$ -right- $\Gamma$ -ideal of  $S$ .

**Theorem 4.1.6** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $Q$  an ordered  $(m, n)$ -quasi  $\Gamma$ -ideal of  $S$ . Then following statements are equivalent.

- (i)  $Q$  has the ordered  $(m, n)$  intersection property.
- (ii)  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ .
- (iii)  $(S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] \subseteq Q$ .
- (iv)  $(Q \cup S^m \Gamma Q] \cap (Q \Gamma S^n] \subseteq Q$ .

*Proof.* (i)  $\rightarrow$  (ii) Assume that  $Q$  has the ordered  $(m, n)$  intersection property.

Since  $Q \subseteq Q \cup (S^m \Gamma Q] = (Q] \cup (S^m \Gamma Q] = (Q \cup (S^m \Gamma Q])$   
 and  $Q \subseteq Q \cup (Q \Gamma S^n] = (Q] \cup (Q \Gamma S^n] = (Q \cup (Q \Gamma S^n])$ ,  
 we have  $Q \subseteq (Q \cup S^m \Gamma Q] \cap (Q \cup (Q \Gamma S^n])$ .

Since  $Q$  has ordered  $(m, n)$  intersection property. Then exist an ordered  $m$ -left- $\Gamma$ -ideal  $A$  and an ordered  $n$ -right- $\Gamma$ -ideal  $B$  of  $S$ .

Such that  $Q = A \cap B$ .

Thus  $Q \subseteq A$  and  $Q \subseteq B$ , so  $(S^m \Gamma Q] \subseteq (S^m \Gamma A] \subseteq (A] = A$

and  $(Q \Gamma S^n] \subseteq (B \Gamma S^n] \subseteq (B] = B$ .

Thus  $(Q \cup S^m \Gamma Q] = (Q] \cup (S^m \Gamma Q] = Q \cup (S^m \Gamma Q] \subseteq A$

and  $(Q \cup Q \Gamma S^n] = (Q] \cup (Q \Gamma S^n] = Q \cup (Q \Gamma S^n] \subseteq B$ .

Hence,  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] \subseteq A \cap B = Q$ .

Therefore,  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ .

(ii)  $\rightarrow$  (i) Assume that  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ . We shall show that  $(Q \cup S^m \Gamma Q]$  is an ordered  $m$ -left- $\Gamma$ -ideal and  $(Q \cup Q \Gamma S^n]$  an ordered  $n$ -right- $\Gamma$ -ideal of  $S$ . By Lemma 4.1.2, we have  $(S^m \Gamma Q]$  is an ordered  $m$ -left- $\Gamma$ -ideal and  $(Q \Gamma S^n]$  an ordered  $n$ -right- $\Gamma$ -ideal of  $S$  and so  $(S^m \Gamma Q]$  and  $(Q \Gamma S^n]$  are sub- $\Gamma$ -semigroup of  $S$ . We see that

$$\begin{aligned}
 (Q \cup S^m \Gamma Q] \Gamma (Q \cup S^m \Gamma Q] &= (Q \cup (S^m \Gamma Q]) \Gamma (Q \cup (S^m \Gamma Q]) \\
 &= (Q \Gamma Q) \cup (S^m \Gamma Q] \Gamma Q \cup Q \Gamma (S^m \Gamma Q] \cup (S^m \Gamma Q] \Gamma (S^m \Gamma Q] \\
 &= (Q \Gamma Q) \cup (S^m \Gamma Q] \Gamma (Q] \cup (S] \Gamma (S^m \Gamma Q] \cup (S^m \Gamma Q] \Gamma (S^m \Gamma Q] \\
 &\subseteq (Q \Gamma Q) \cup (S^m \Gamma Q \Gamma Q] \cup (S \Gamma S^m \Gamma Q] \cup (S^m \Gamma Q \Gamma S^m \Gamma Q] \\
 &\subseteq Q \cup (S^m \Gamma Q] \cup (S^m \Gamma Q] \cup (S^m \Gamma Q] \\
 &= Q \cup (S^m \Gamma Q] \\
 &= (Q \cup S^m \Gamma Q].
 \end{aligned}$$

Thus  $(Q \cup S^m \Gamma Q]$  is a sub- $\Gamma$ -semigroup of  $S$ . Now,

$$\begin{aligned}
 S^m \Gamma (Q \cup S^m \Gamma Q] &= S^m \Gamma (Q \cup (S^m \Gamma Q]) \\
 &= S^m \Gamma Q \cup S^m \Gamma (S^m \Gamma Q] \\
 &\subseteq S^m \Gamma Q \cup (S^m \Gamma Q] \text{ (By Lemma 4.1.2)} \\
 &= (S^m \Gamma Q] \\
 &\subseteq (Q] \cup (S^m \Gamma Q] \\
 &= (Q \cup S^m \Gamma Q].
 \end{aligned}$$



we have  $Q \subseteq (Q \cup S^m \Gamma Q] \cap (Q \cap Q \Gamma S^n]$ . Now,

$$\begin{aligned} (Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] &= (Q \cup (S^m \Gamma Q]) \cap (Q \cup (Q \Gamma S^n]) \\ &= (Q \cap (Q \cup (Q \Gamma S^n])) \cup ((S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n]) \\ &\subseteq Q \cup Q \\ &= Q. \end{aligned}$$

Therefore,  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ .

(ii)  $\rightarrow$  (iv) Assume that  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ .

Since  $(Q \Gamma S^n] \subseteq (Q] \cup (Q \Gamma S^n] = (Q \cup Q \Gamma S^n]$ , we have  $(Q \cup S^m \Gamma Q] \cap (Q \Gamma S^n] \subseteq (Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ . Hence,  $(Q \cup S^m \Gamma Q] \cap (Q \Gamma S^n] \subseteq Q$ .

(iv)  $\rightarrow$  (ii) Assume that  $(Q \cup S^m \Gamma Q] \cap (Q \Gamma S^n] \subseteq Q$ .

Since  $Q \subseteq Q \cup (Q \Gamma S^n] = (Q \cup Q \Gamma S^n]$  and  $Q \subseteq Q \cup (S^m \Gamma Q] = (Q \cup S^m \Gamma Q]$ , we have  $Q \subseteq (Q \cup S^m \Gamma Q] \cap (Q \cap Q \Gamma S^n]$ . Now,

$$\begin{aligned} (Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] &= (Q \cup (S^m \Gamma Q]) \cap (Q \cup (Q \Gamma S^n]) \\ &= ((Q \cup (Q \Gamma S^n]) \cap Q) \cup ((Q \cup (S^m \Gamma Q]) \cap (Q \Gamma S^n]) \\ &\subseteq Q \cup Q \\ &= Q. \end{aligned}$$

Therefore,  $(Q \cup S^m \Gamma Q] \cap (Q \cup Q \Gamma S^n] = Q$ .

**Lemma 4.1.7** Every ordered  $m$ -left- $\Gamma$ -ideal and ordered  $n$ -right- $\Gamma$ -ideal of an ordered  $\Gamma$ -semigroup have the ordered  $(m, n)$  intersection property.

*Proof.* Let  $A$  be an ordered  $m$ -left- $\Gamma$ -ideal and  $B$  an ordered  $n$ -right- $\Gamma$ -ideal of an ordered  $\Gamma$ -semigroup  $S$ . By Lemma 4.1.3, we have that  $A$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ . Now,

$$\begin{aligned}
 (S^m \Gamma A] \cap (A \cup A \Gamma S^n] &= (S^m \Gamma A] \cap (A \cup (A \Gamma S^n]) \\
 &= ((S^m \Gamma A] \cap A) \cup ((S^m \Gamma A] \cap (A \Gamma S^n]) \\
 &\subseteq A \cup A \\
 &= A.
 \end{aligned}$$

By Theorem 4.1.6, we have that  $A$  has the ordered  $(m, n)$  intersection property.

Same, By Lemma 4.1.3, we have that  $B$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ . Now,

$$\begin{aligned}
 (S^m \Gamma B \cup B] \cap (B \Gamma S^n] &= ((S^m \Gamma B] \cup B) \cap (B \Gamma S^n] \\
 &= ((S^m \Gamma B] \cap B \Gamma S^n) \cup (B \cap (B \Gamma S^n]) \\
 &\subseteq B \cup B \\
 &= B.
 \end{aligned}$$

By Theorem 4.1.6, we have that  $B$  has the ordered  $(m, n)$  intersection property.

**Proposition 4.1.8** Let  $S$  be an ordered  $\Gamma$ -semigroup and  $Q$  an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ . If  $S^m \Gamma Q \subseteq Q \Gamma S^n$  or  $Q \Gamma S^n \subseteq S^m \Gamma Q$ , then  $Q$  has the ordered  $(m, n)$  intersection property.

*Proof.* Assume that  $S^m \Gamma Q \subseteq Q \Gamma S^n$ . Then  $(S^m \Gamma Q] \subseteq (Q \Gamma S^n]$ . Since  $Q$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ , we have  $S^m \Gamma Q \subseteq (S^m \Gamma Q] = (S^m \Gamma Q] \cap (Q \Gamma S^n] \subseteq Q$ . Therefore  $Q$  is an ordered  $m$ -left- $\Gamma$ -ideal of  $S$ . By Lemma 4.1.7, we have that  $Q$  has the ordered  $(m, n)$  intersection property.

Assume that  $Q \Gamma S^n \subseteq S^m \Gamma Q$ . Then  $(Q \Gamma S^n] \subseteq (S^m \Gamma Q]$ . Since  $Q$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ , we have  $Q \Gamma S^n \subseteq (Q \Gamma S^n] = (S^m \Gamma Q] \cap (Q \Gamma S^n] \subseteq Q$ . Therefore  $Q$  is an ordered  $n$ -right- $\Gamma$ -ideal of  $S$ . By Lemma 4.1.7, we have that  $Q$  has the ordered  $(m, n)$  intersection property.

#### 4.2 Ordered $(m, n)$ -Quasi- $\Gamma$ -ideal in Regular Ordered $\Gamma$ -semigroups

We have investigated in the previous part that every ordered  $m$ -left- $\Gamma$ -ideal and ordered  $n$ -right- $\Gamma$ -ideal of an ordered  $\Gamma$ -semigroup have the ordered  $(m, n)$  intersection property, but not for ordered  $(m, n)$ -quasi- $\Gamma$ -ideals in ordered  $\Gamma$ -



semigroups. In this part, we will prove that every ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of a regular ordered  $\Gamma$ -semigroup has the ordered  $(m, n)$  intersection property.

**Definition 4.2.1** (Seetamraju, Anjaneyulu, Madhusudana, 2012, pp. 1-11)

An element  $a$  of an ordered  $\Gamma$ -semigroup  $S$  is said to be regular provided  $a \leq a\alpha x\beta a$ , for some  $x \in S$  and  $\alpha, \beta \in \Gamma$ .

**Lemma 4.2.2** Let  $S$  be a regular ordered  $\Gamma$ -semigroup and  $A$  a nonempty subset of  $S$ . Then the following statements hold.

- (i)  $A \subseteq (S^m \Gamma A)$  for all positive integer  $m$ .
- (ii)  $A \subseteq (A \Gamma S^n)$  for all positive integer  $n$ .

*Proof.* (i) Let  $a \in A$ . Since  $S$  is regular, there exists  $x \in S$  and  $\alpha, \beta \in \Gamma$  such that  $a \leq a\alpha x\beta a$ . Since  $a\alpha x \in S$ , we have  $a \leq a\alpha x\beta a = (a\alpha x)\beta a \in S\Gamma A$  and so  $A \subseteq (S\Gamma A)$ . Let  $m$  be a positive integer such that  $A \subseteq (S^m \Gamma A)$ . Then  $S\Gamma A \subseteq S\Gamma(S^m \Gamma A) = (S)\Gamma(S^m \Gamma A) \subseteq (S\Gamma(S^m \Gamma A)) = (S^{m+1} \Gamma A)$ . Therefore,  $A \subseteq (S^m \Gamma A)$  for all positive integer  $m$ .

(ii) Let  $a \in A$ . Since  $S$  is regular, there exists  $x \in S$  and  $\alpha, \beta \in \Gamma$  such that  $a \leq a\alpha x\beta a$ . Since  $x\beta a \in S$ , we have  $a \leq a\alpha x\beta a = a\alpha(x\beta a) \in A\Gamma S$  and so  $A \subseteq (A\Gamma S)$ . Let  $n$  be a positive integer such that  $A \subseteq (A\Gamma S^n)$ . Then  $S\Gamma A \subseteq S\Gamma(A\Gamma S^n) = (S)\Gamma(A\Gamma S^n) \subseteq (S\Gamma(A\Gamma S^n)) = (A\Gamma S^{n+1})$ . Therefore,  $A \subseteq (A\Gamma S^n)$  for all positive integer  $n$ .

**Theorem 4.2.3** Every ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of a regular ordered  $\Gamma$ -semigroup has the ordered  $(m, n)$  intersection property.

*Proof.* Let  $Q$  be an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of a regular ordered  $\Gamma$ -semigroup  $S$ . By Lemma 4.2.2, we have  $Q \subseteq (Q\Gamma S^n)$  and the  $(Q \cup (Q\Gamma S^n)) = Q \cup (Q\Gamma S^n) = (Q\Gamma S^n)$ . Thus  $(S^m \Gamma Q) \cap (Q \cup Q\Gamma S^n) = (S^m \Gamma Q) \cap (Q\Gamma S^n) \subseteq Q$ . By Lemma 4.1.6, we have that  $Q$  has the ordered  $(m, n)$  intersection property.

**Theorem 4.2.4** Let  $S$  be a regular ordered  $\Gamma$ -semigroup and  $A$  a nonempty subset of  $S$ . Then  $A$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$  if and only if

$$A = (S^m \Gamma A] \cap (A \Gamma S^n].$$

*Proof.* Assume that  $A$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ . Then  $(S^m \Gamma A] \cap (A \Gamma S^n] \subseteq A$ . By Lemma 4.2.2, we have  $A \subseteq (S^m \Gamma A]$  and  $A \subseteq (A \Gamma S^n]$  and thus  $A \subseteq (S^m \Gamma A] \cap (A \Gamma S^n]$ . Therefore,  $A = (S^m \Gamma A] \cap (A \Gamma S^n]$ .

Conversely, assume that  $A = (S^m \Gamma A] \cap (A \Gamma S^n]$ . By Theorem 3.1.2, we have  $(S^m \Gamma A]$  is an ordered  $m$ -left- $\Gamma$ -ideal and  $(A \Gamma S^n]$  an ordered  $n$ -right- $\Gamma$ -ideal of  $S$ . By Theorem 4.1.4, we have that  $A$  is an ordered  $(m, n)$ -quasi- $\Gamma$ -ideal of  $S$ .

## 5. Discussion and Conclusion

In this research, we now have the notions of ordered  $m$ -left- $\Gamma$ -ideals, ordered  $n$ -right- $\Gamma$ -ideals and  $(m, n)$ -quasi- $\Gamma$ -ideals in ordered  $\Gamma$ -semigroups which are the characteristics of ordered  $\Gamma$ -semigroups and some of their properties. Moreover, we have characterised investigation of the ordered  $(m, n)$  intersection property of ordered  $(m, n)$ -quasi- $\Gamma$ -ideals in ordered  $\Gamma$ -semigroups and every ordered  $(m, n)$ -quasi- $\Gamma$ -ideals of a regular ordered  $\Gamma$ -semigroups has the ordered  $(m, n)$  intersection property which are extensions of results (Thongrak and Iampan, 2018, pp. 299-306).

## 6. Recommendations

In this research explained the concept and content of knowledge in the field of semigroups to achieve new knowledge and apply the research content in the group of abstract algebra.

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## On $(m, n)$ - $\Gamma$ -ideals of an ordered $\Gamma$ -semigroup

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### Abstract

The concept of  $(m, n)$ -simple ordered semigroups has been introduced by T. Changphas (Changphas, 2015, pp. 1-5). Let  $m, n$  be nonnegative integers. An ordered semigroup  $S$  is said to be  $(m, n)$ -simple if it does not contain proper  $(m, n)$ -ideal. In this paper, we introduce the concept of  $(m, n)$ -simple ordered  $\Gamma$ -semigroup extending the notion of  $(m, n)$ -simple in ordered semigroup. In addition, we prove that an ordered  $\Gamma$ -semigroup  $(S, \Gamma, \cdot, \leq)$  does not contain proper  $(m, n)$ - $\Gamma$ -ideal if and only if it is both  $(m, 0)$ -simple and  $(0, n)$ -simple.

**Keywords :**  $\Gamma$ -semigroup, ordered  $\Gamma$ -semigroup,  $(m, n)$ - $\Gamma$ -ideal,  $(m, n)$ -simple, left (right) simple

### 1. Introduction

The notion of the  $\Gamma$ -semigroup was introduced by M. K. Sen (Sen, 1984, pp. 301-308) as a generalization of semigroups and ternary semigroups and the concept of the ordered  $\Gamma$ -semigroup was given by Y. I. Kwon and S. K. Lee (Kwon and Lee, 1996, pp. 679-685). Thereafter different aspects of ideal-theoretic results have been extensively studied in  $\Gamma$ -semigroups and ordered  $\Gamma$ -semigroups in (Hila and pisha, 2011, pp. 793-804), (Jantan and Changphas, 2015, 137-145).

The concept of the  $(m, n)$ -ideal in semigroup (without order) was given by S. Lajos (Lajos, 1961, pp. 217-222). Using the notion of  $(m, n)$ -ideal in semigroup (without order), J. Sanborisoot and T. Changphas (Sanborisoot and Changphas, 2012, pp. 75-86) introduced the concept of  $(m, n)$ -ideals in ordered semigroups. Thereafter, in 2015 the concept of the (generalized)  $(m, n)$ - $\Gamma$ -ideals was introduced in ordered  $\Gamma$ -semigroup by M. Y. Abbasi and A. Basar (Abbasi and Basar, 2015, pp. 247-254). Based on this

concept, we introduce  $(m, n)$ -simple ordered  $\Gamma$ -semigroups and prove that an ordered  $\Gamma$ -semigroup  $(S, \Gamma, \cdot, \leq)$  does not contain proper  $(m, n)$ - $\Gamma$ -ideal if and only if it is both  $(m, 0)$ -simple and  $(0, n)$ -simple.

## 2. Research Objectives

This research objectives consisted to define and study the concept of  $(m, n)$ -simple ordered  $\Gamma$ -semigroup and prove that an ordered  $\Gamma$ -semigroup  $(S, \Gamma, \cdot, \leq)$  does not contain proper  $(m, n)$ - $\Gamma$ -ideal if and only if it is both  $(m, 0)$ -simple and  $(0, n)$ -simple.

## 3. Preliminaries

In this section, we recollect the definitions that will be needed in this paper. Let  $S$  and  $\Gamma$  be two nonempty sets. Then a system  $(S, \Gamma, \cdot)$  is called a  $\Gamma$ -semigroup, where  $\cdot$  is a ternary operation  $S \times \Gamma \times S \rightarrow S$  such that

$$(x \cdot \alpha \cdot y) \cdot \beta \cdot z = x \cdot \alpha \cdot (y \cdot \beta \cdot z)$$

for all  $x, y, z \in S$  and  $\alpha, \beta \in \Gamma$ . Let  $A$  be a nonempty subsets of  $(S, \Gamma, \cdot)$ . Then  $A$  is called a sub- $\Gamma$ -semigroup of  $(S, \Gamma, \cdot)$  if  $a \cdot \gamma \cdot b \in A$  for all  $a, b \in A$  and  $\gamma \in \Gamma$ . Furthermore, a  $\Gamma$ -semigroup  $S$  is said to be commutative if  $a \cdot \gamma \cdot b = b \cdot \gamma \cdot a$  for all  $a, b \in S$  and  $\gamma \in \Gamma$ . We can see some properties of  $\Gamma$ -semigroups in (Impan, 2009, pp. 181-188), (Chinram and Jirojkul, 2007, pp. 231-234), (Jantan and Changphas, 2015, 137-145).

**Definition 3.1.** An ordered  $\Gamma$ -semigroup is a partially ordered set  $A$  which at the same time is a  $\Gamma$ -semigroup such that for all  $a, b, c \in A$  and for all  $\gamma \in \Gamma$

$$a \leq b \Rightarrow a\gamma c \leq b\gamma c, c\gamma a \leq c\gamma b.$$

For other basic definitions and properties of an ordered  $\Gamma$ -semigroups, we refer (Abbasi and Basar, 2015, pp. 247-254), (Basar, Abbasi and Khan, 2017, pp. 345-352), (Hila and pisha, 2011, pp. 793-804), (Abbasi, Basar and Ali, 2018, pp. 1-8), (Kehayopulu, 2010, pp. 37-43), (Chinram and Tinpum, 2009, pp. 1-5), (Chanphas, 2012, 2745-2748).

Let  $S$  be an ordered  $\Gamma$ -semigroup. For subsets  $A, B$  of an ordered  $\Gamma$ -semigroup  $S$ , the product set  $A \cdot B$  of the pair  $(A, B)$  relative to  $S$  is defined as

$$A \cdot \Gamma \cdot B = \{a \cdot \gamma \cdot b \mid a \in A, b \in B \text{ and } \gamma \in \Gamma\}$$

and for  $A \subseteq S$ , the product set  $A \cdot A$  relative to  $S$  is defined as  $A^2 = A \cdot A = A \cdot \Gamma \cdot A$ . For  $T \subseteq S$ ,  $(T] = \{s \in S \mid s \leq t \text{ for some } t \in T\}$ . Also, we write  $(s]$  instead of  $(\{s\}]$  for  $s \in S$ . Let  $A \subseteq S$ . Then for a non-negative integer  $k$ , the power  $A^k = A \Gamma A \Gamma A \dots$ , where  $A$  occurs  $k$  times. Note that the power is suppressed when  $k = 0$ . Therefore  $A^0 \Gamma S = S = S \Gamma A^0$ .

A nonempty subset  $B$  of an ordered  $\Gamma$ -semigroup  $S$  is called a sub- $\Gamma$ -semigroup of  $S$  if for all  $x, y \in B$  and  $\gamma \in \Gamma$ ,  $x \gamma y \in B$  and  $b \in B, s \in S, s \leq b \Rightarrow s \in B$ .

In what follows we denote the ordered  $\Gamma$ -semigroup  $(S, \Gamma, \cdot, \leq)$  by  $S$  unless otherwise specified. Throughout the paper, we denote  $a \cdot \gamma \cdot b$  by  $a \gamma b$ .

**Lemma 3.2.** (Iampan, 2009, pp. 17-25) The following statements hold for any nonempty subsets  $A, B$  of an ordered  $\Gamma$ -semigroup  $S$ :

- (1)  $A \subseteq (A]$ ;
- (2)  $A \subseteq B \Rightarrow (A] \subseteq (B]$ ;
- (3)  $(A] \Gamma (B] \subseteq (A \Gamma B]$ ;
- (4)  $(A \cup B] = (A] \cup (B]$ ;
- (5)  $(A \cap B] \subseteq (A] \cap (B]$ ;
- (6)  $((A]) = (A]$ .

The notion of  $(m, n)$ -ideals was given by Lajos (Lajos, 1961, pp. 217-222). Let  $S$  be semigroup and  $A$  be a nonempty subset of  $S$ , then  $A$  is called a generalized  $(m, n)$ -ideal of  $S$  if  $A^m S A^n \subseteq A$ , where  $m, n$  are arbitrary non-negative integers. Note that if  $A$  is a subsemigroup of  $S$ , then  $A$  is called an  $(m, n)$ -ideal of  $S$ . Thereafter, many authors studied various aspects of  $(m, n)$ -ideals in different algebraic structures (Bussaban and changphas, 2016, pp.199-206), (Akram, 2013, pp. 2187-2191), (Protic, 2015, pp. 147-156), (Gaketem, 2018, pp. 143-153), (Yagoob et all, 2013, pp. 119-128), (Yousafzai, Khan and lampan, 2015, pp. 357-70).

We now need the following definition:

**Definition 3.3.** Suppose  $A$  is a sub- $\Gamma$ -semigroup (resp. nonempty subset) of a ordered  $\Gamma$ -semigroup  $S$ . Then  $A$  is called an (resp. generalized)  $(m, n)$ - $\Gamma$ -ideal (Abbasi and Basar, 2015, pp. 247-254) of  $S$  if

- (1)  $A^m \Gamma S \Gamma A^n \subseteq A$ ;
- (2) for any  $x \in A$  and  $y \in S$ ,  $y \leq x \Rightarrow y \in A$ .

If  $A$  is an  $(m, n)$ - $\Gamma$ -ideal of  $S$  such that  $A \subset S$  (the symbol  $\subset$  stands for proper subset), then it is a proper  $(m, n)$ - $\Gamma$ -ideal of  $S$ .

Note that an  $(1, 1)$ - $\Gamma$ -ideal of an ordered  $\Gamma$ -semigroup  $S$  are called (generalized) bi- $\Gamma$ -ideal of  $S$ .

In (Abbasi, Basar and Ali, 2018, pp. 1-8), proved the following lemma:

**Lemma 3.4.** For any element  $a$  of an ordered  $\Gamma$ -semigroup  $S$ ,

$$(a \cup a^2 \cup \dots \cup a^{m+n} \cup a^m \Gamma S \Gamma a^n]$$

Is the  $(m, n)$ - $\Gamma$ -ideal of  $S$  containing  $a$ .

#### 4. Main Results

We define  $(m, n)$ -simple ordered  $\Gamma$ -semigroups as follows:

**Definition 4.1.** Let  $m, n$  be nonnegative integers. An ordered  $\Gamma$ -semigroup  $S$  is said to be  $(m, n)$ -simple if it does not contain proper  $(m, n)$ - $\Gamma$ -ideal.

Note that a left simple (right simple) ordered  $\Gamma$ -semigroup is an  $(0, 1)$ -simple  $((1, 0)$ -simple).

**Lemma 4.2.** Let  $S$  be an ordered  $\Gamma$ -semigroup, and let  $m, n$  be nonnegative integers. The following statements hold:

- (1)  $S$  is  $(m, 0)$ -simple if and only if  $S = (a^m \Gamma S]$  for all  $a \in S$ ;
- (2)  $S$  is  $(0, n)$ -simple if and only if  $S = (S \Gamma a^n]$  for all  $a \in S$ .

*Proof.* (1) Assume that  $S$  is  $(m, 0)$ -simple, and let  $a \in S$ . By

$$(a^m \Gamma S] \Gamma (a^m \Gamma S] \subseteq (a^m \Gamma S \Gamma a^m \Gamma S] \subseteq (a^m \Gamma S]$$

and

$$\begin{aligned} (a^m \Gamma S]^m \Gamma S &= (a^m \Gamma S]^m \Gamma (S] \\ &\subseteq (a^m \Gamma S] \Gamma (S] \\ &\subseteq (a^m \Gamma S \Gamma S] \\ &\subseteq (a^m \Gamma S] \end{aligned}$$

and if  $x \in (a^m \Gamma S]$ ,  $y \in S$  such that  $y \leq x$  then  $y \in (a^m \Gamma S]$ . It follows that  $(a^m \Gamma S]$  is an  $(m, 0)$ - $\Gamma$ -ideal of  $S$ . Hence  $S = (a^m \Gamma S]$  by assumption.

Conversely, assume that  $S = (a^m \Gamma S]$  for all  $a \in S$ . Let  $A$  be an  $(m, 0)$ - $\Gamma$ -ideal of  $S$ . To show  $S = A$  let  $a \in S$ . By assumption, we have

$$S = (a^m \Gamma S] \subseteq (A^m \Gamma S] \subseteq (A) = A.$$

Therefore  $S$  is  $(m, 0)$ -simple.

(2) This can be proved similarly.

**Corollary 4.3.** (Changphas, 2012, pp. 2745-2748) The following statements hold for an ordered  $\Gamma$ -semigroup  $S$ :

- (1)  $S$  is left simple if and only if  $S = (S \Gamma a]$  for all  $a \in S$ ;
- (2)  $S$  is right simple if and only if  $S = (a \Gamma S]$  for all  $a \in S$ .

Now, we prove the main result:

**Theorem 4.4.** Let  $m, n$  be nonnegative integers. An ordered  $\Gamma$ -semigroup  $S$  does not contain proper  $(m, n)$ - $\Gamma$ -ideal if and only if it is both  $(m, 0)$ -simple and  $(0, n)$ -simple.

*Proof.* Assume that  $S$  does not contain proper  $(m, n)$ - $\Gamma$ -ideal. If  $A$  is an  $(m, 0)$ - $\Gamma$ -ideal of  $S$ , then  $A$  is an  $(m, n)$ - $\Gamma$ -ideal of  $S$  because



$$A^m \Gamma S \Gamma A^n \subseteq A^m \Gamma S \subseteq A$$

and if  $x \in A$ ,  $y \in S$  such that  $y \leq x$  then  $y \in A$ . Hence  $A = S$ . Similarly, if  $A$  is an  $(0, n)$ - $\Gamma$ -ideal of  $S$ , then  $A$  is an  $(m, n)$ - $\Gamma$ -ideal of  $S$ . Therefore  $A = S$ . Conversely, we assume that  $S$  is both  $(m, 0)$ -simple and  $(0, n)$ -simple. Let  $A$  be an  $(m, n)$ - $\Gamma$ -ideal of  $S$ . To show that  $S \subseteq A$ , let  $a \in S$  and  $b \in A$ . By Lemma 3.4., we have

$$S = (b \cup b^2 \cup \dots \cup b^m \cup b^m \Gamma S).$$

There are two cases to consider.

Case 1:  $a \leq b^k$  for some  $1 \leq k \leq m$ . By  $b^k \in A$ . It follows that  $a \in A$ .

Case 2:  $a \leq b^m \gamma x$  for some  $x \in S$  and  $\gamma \in \Gamma$ . We have

$$S = (b \cup b^2 \cup \dots \cup b^n \cup S \Gamma b^n).$$

There are two subcases to consider.

Case 2.1:  $x \leq b^k$  for some  $1 \leq k \leq n$ . Since

$$a \leq b^m \gamma x \leq b^m \gamma b^k \in A,$$

It follows that  $a \in A$ .

Case 2.2:  $x \leq y \beta b^n$  for some  $y \in S$  and  $\beta \in \Gamma$ . We have

$$a \leq b^m \gamma x \leq b^m \gamma y \beta b^n \in A^m \Gamma S \Gamma A^n \subseteq A.$$

Hence  $a \in A$ .

**Corollary 4.5.** (Changphas, 2012, pp. 2745-2748) An ordered  $\Gamma$ -semigroup  $S$  does not contain proper bi- $\Gamma$ -ideals if and only if it is both left simple and right simple.

## 5. Discussion and Conclusion

In the current research, we investigated  $(m, n)$ -simple ordered  $\Gamma$ -semigroups in terms of ordered  $(m, n)$ - $\Gamma$ -ideals. We proved that if  $S$  is an ordered  $\Gamma$ -semigroup;  $m, n$  are nonnegative integers. Then  $S$  does not contain proper  $(m, n)$ - $\Gamma$ -ideal if and only if it is both  $(m, 0)$ -simple and  $(0, n)$ -simple.

## 6. Recommendations

In this paper is explain the concept and content knowledge in the field of semigroups to achieve to new knowledge and extends the research content in the ordered semihypergroups and ordered semirings.

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## Influence of Crosslink Density on Strain-induced Crystallization and Strength of Sulphur-vulcanized Natural Rubber

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### Abstract

The present work is concerned with the study on the effect of crosslink of sulphur-vulcanized natural rubber (NR) on strain-induced crystallization (SIC) and tensile properties of NR vulcanizate. It was found that the crosslink density has almost no effect on the onset of SIC for low crosslink density, but for high crosslink density (above  $8 \times 10^{-5}$  mole/cm<sup>3</sup>), the onset of SIC showed slight decrease. The strain-induced crystallinity index was found to increase with increasing crosslink density then decreased. Tensile strength showed similar dependence on the crosslink density. The crystalline fraction developed reaches a constant value of about 15% even at high strain. Since the stress still continues to rise even after the degree of crystallinity reaches a constant value, it was proposed that the high tensile strength of NR vulcanizate is not the direct consequence of SIC as is widely believed but is due to orientation of the molecular segments, particularly those connected to the crystalline structures.

**Keywords** : natural rubber, crystallization, mechanical properties, WAXD

### 1. Introduction

Natural rubber (NR, cis-1,4-polyisoprene) vulcanizates show great physical and mechanical properties in tensile strength and fatigue resistance, together with high hysteresis energy (Gent, 1992). Since these characteristics take place without addition of any filler. In particular, its high tensile strength (20-30 MPa) and large strain at break (8.0-10.0) are excellent in comparison with the case of unfilled SBR (Styrene Butadiene Rubber) vulcanizate where the tensile strength is about 1.5-2.0 MPa and the strain at break is 4.0-5.0. These superior properties of NR have been assumed to be due to its

strain-induced crystallization (SIC) ability (Roberts, 1988; Murakami, Senoo, Toki, & Kohjiya, 2002). Therefore, the study on SIC behavior of crosslinked NR is the most importance for elucidating the mechanical characteristics of NR.

The strain-induced crystallization in NR has been observed and studied by X-ray since 1925 (Katz, 1925). The increase of strain-induced crystallization in NR with strain had been studied extensively (Bunn, 1941; Gehman & Field, 1939; Luch & Yeh, 1973; Shimomura & White, 1982). The simultaneous measurements of the stress-strain relation and the strain-induced crystallization by wide angle X-ray diffraction (WAXD) using a conventional X-ray instrument (Toki, Fujimaki, & Okuyama, 2000) revealed that the hysteresis of stress-strain relation is caused by the strain-induced crystallization. The results show that the strain-induced crystallization decreases the stress since the length of amorphous molecule along the stretching direction increases due to its crystallization.

Synchrotron X-ray and modified stretching machine make it clear to show the both hysteresis in the stress-strain relation and in the strain-induced crystallization in rubbers and to elucidate the stress decrease by the onset of strain-induced crystallization (Murakami, Senoo, Toki, & Kohjiya, 2002; Toki & Hsiao, 2003; Tosaka, Kohjiya, Murakami, Poompradub, Ikeda, Toki, et al., 2004a). The experimental results agree with classical thermo-mechanical theories on strain-induced crystallization (Bekkedahl & Wood, 1941; Flory, 1947) that suggested the onset of strain-induced crystallization decrease the stress before the upturn of stress.

Sulphur vulcanized rubbers have network structures that are mainly composed of monosulphidic, disulphidic, and polysulphidic crosslinks (Brydson, 1978). The structures including the crosslink densities and types of vulcanizates are very important parameters because of their dominant effects on the mechanical properties. The ratio of polysulphidic, disulphidic and monosulphidic crosslinks depends on the ratio of sulphur to the accelerators, cure time and the kind of accelerator in the formulation. The crosslink has been considered to be vital for SIC since the theory of rubber elasticity of polymer crosslink network has applied to elucidate SIC at thermo-mechanical equilibrium state.

## 2. Research Objectives

In this paper, we focus on the effect of crosslink densities on the strain-induced crystallization (SIC) and tensile properties. Five levels of crosslink density were studied. The crosslink density was varied by changing the amounts of sulphur and

accelerator (N-cyclohexyl-2-benzothiazyl sulphenamide, CBS) at a fixed sulphur to accelerator ratio (2.67).

### 3. Research Methodology

#### 3.1 Materials

Commercial grade of Standard Thai Natural Rubber Light (STR-5L) was used for this research activity. The compositions of several natural rubber compounds tested in this study are shown in Table 1. All the ingredients including sulphur and accelerator were mixed on a laboratory-scale 6-in. roll mill. Vulcanization was carried out in an electrically heated hydraulic press at 150°C using the optimum cure time ( $T_c90$ ) previously determined with a moving die rheometer (TechPro MD+) at 150°C following ASTM D-5289.

#### 3.2 Determination of crosslink density

Equilibrium swelling in toluene was used to determine the crosslink densities of the rubber vulcanizates. The Crosslink density was determined using the method described by Cunneen and Russell (1970). The molecular weight of the network chain between chemical crosslinks for a phantom network,  $M_c$ ; is expressed by the Flory-Rehner relationship (Flory & Rehner, 1943):

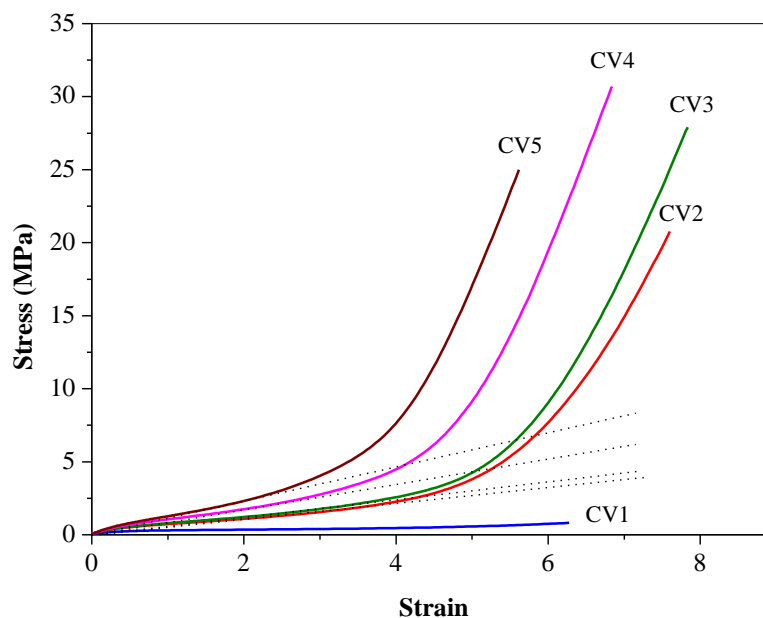
$$M_c = \frac{-2\rho_r V_s (V_r^{1/3} - V_r/2)}{[\ln(1 - V_r) + V_r + \chi V_r^2]} \quad (1)$$

where  $V_r$  is the volume fraction of rubber in the swollen sample,  $V_s$  is the molar volume of the swelling solvent,  $\rho_r$  is the density of the rubber sample, and  $\chi$  is the rubber-solvent interaction parameter. The values of the constant used in the above calculation were  $V_s = 107 \text{ cm}^3/\text{mole}$  and  $\chi = 0.393$  (Brydson, 1978). The crosslink density ( $\nu$ ) (Blow, 1975) is given by

$$\nu = \frac{1}{2M_c} \quad (2)$$



larger, the upturn in stress. The sample with the larger crosslink density showed the upturn in stress at lower strain.



**Figure 1** Tensile stress-strain curves of NR vulcanizates with various crosslink densities

**Table 2** Total crosslink densities and mechanical properties of the samples

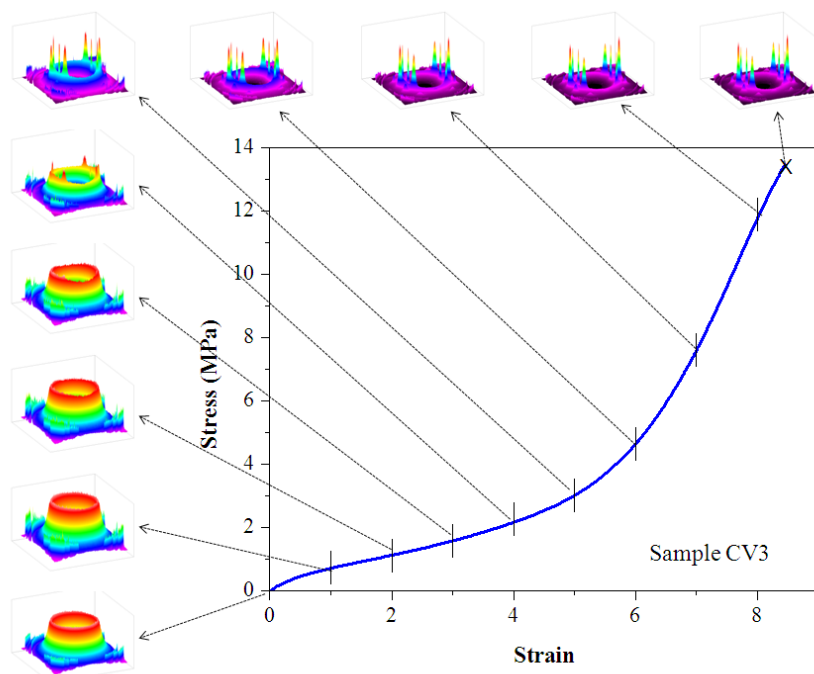
Sample	CV1	CV2	CV3	CV4	CV5
Total crosslink density [ $\times 10^{-5}$ mol/cm <sup>3</sup> ]	0.54	5.61	7.83	8.66	11.29
Modulus at strain 1.0 [MPa]	0.3	0.7	0.8	1.0	1.3
Modulus at strain 3.0 [MPa]	0.4	1.5	1.9	2.7	4.1
Tensile strength [MPa]	0.9	20.5	28.7	30.6	24.9
Strain at break	6.2	7.6	7.5	6.9	5.8

#### 4.2 Strain-induced crystallization behavior

The stress-strain curve and selected 3D WAXD patterns during deformation (at a 10 mm/min rate) of sample CV3 at 25C are shown in Figure 2. Each WAXD image is taken at the strain indicated by the arrow. The high intensity of synchrotron X-rays made it possible to collect the WAXD patterns during deformation in real time without holding the sample still. It was seen that stress generally increased with strain. In Figure 2, it is seen that 3D WAXD patterns exhibited an amorphous halo below strain 3.0,

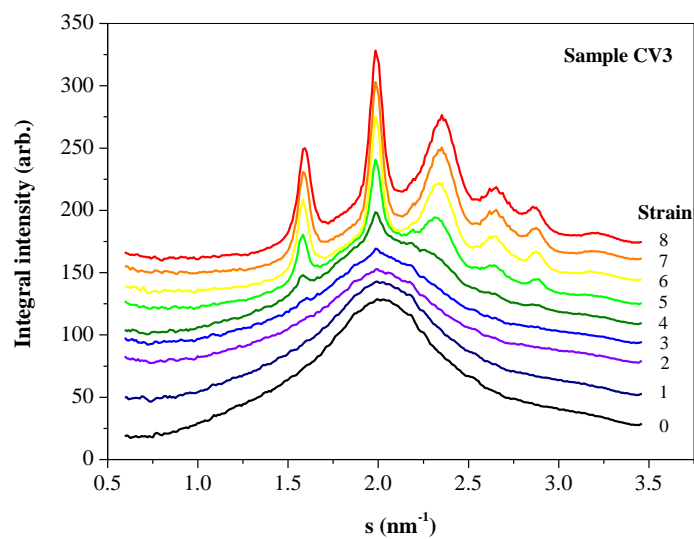


while its intensity distribution shifted slightly toward the equator with increasing strain (e.g., strain 3.0). At strain 4.0, the deformation of the halo pattern became more intense, and several weak but distinct crystalline reflections are seen. These reflections are sharp and highly oriented and appeared in smaller numbers than those in fully crystallized patterns (e.g., at strains 5 and more). These reflections are caused by the first-formed strain-induced crystallites, which are defective in crystalline ordering or registration but highly oriented with respect to the stretching direction. This finding is consistent with the fringemicelle crystal model induced by strain during deformation of rubber recently proposed by Toki and coworkers (Toki, Sics, Ran, Liu, Hsiao, Murakami et al., 2002; Toki, Sics, Ran, Liu, & Hsiao, 2003). In contrast, at strains above 4 (e.g., strains 5.0 and more), the WAXD patterns exhibited well oriented crystalline reflections from a monoclinic unit cell with parameters similar to  $a = 1.25$  nm,  $b = 0.89$  nm,  $c = 0.81$  nm, and  $\gamma = 92$ , as previously reported by Bunn (Bunn, 1941). It is interesting to see that, even at strains 5.0 and more, one can observe the persistence of the unoriented amorphous halo, which is consistent with the finding that a substantial amount of amorphous chains remain unstretched at high extension (Toki, Sics, Hsiao, Murakami, Tosaka, Poompradub et al., 2004a).

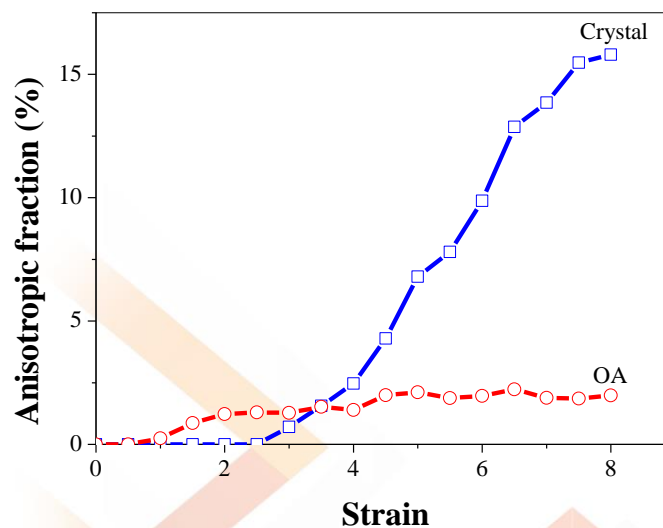


**Figure 2** The stress-strain relationship and selected WAXD patterns in 3D expression of the sample CV3. Each image was taken at the average strain indicated by the arrows.

WAXD patterns can be analyzed into three fractions such as crystal, oriented amorphous and unoriented amorphous. (The procedure to analyze the data is mentioned elsewhere (Tosaka, Murakami, Poompradub, Kohjiya, Ikeda, Toki et al., 2004b; Toki, Sics, Hsiao, Murakami, Tosaka, Poompradub et al., 2005). The integral intensities as a function of scattering vector “s” at each strain are shown in Figure 3. It is clear that the anisotropic fraction increases with strain smoothly.

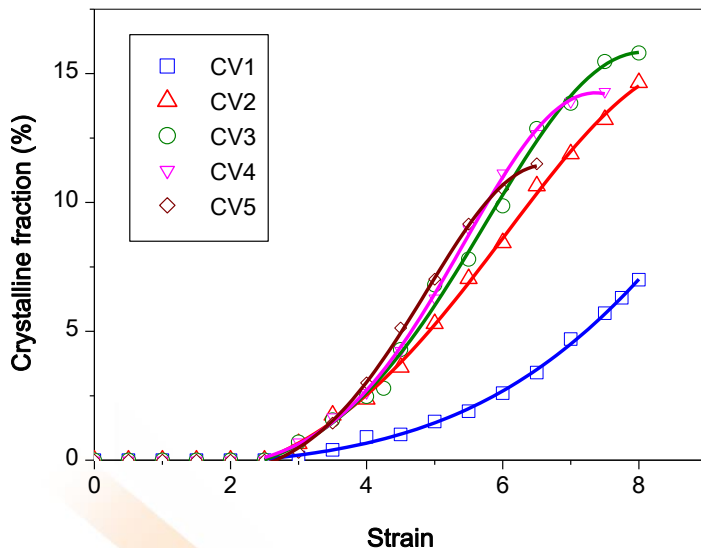


**Figure 3** 1D cylindrical intensity profiles as a function of scattering vector “s” of the sample CV3.



**Figure 4** The anisotropic fractions (oriented amorphous and crystal) of the sample CV3 at each strain during deformation.

From the integrated intensity patterns, we can evaluate crystalline fraction and oriented amorphous fraction as shown in Figure 4. Crystalline fraction increases with strain during deformation. The oriented amorphous fraction does not increase significantly and seems to be a precursor of strain-induced crystallization. The tendencies are similarly observed in pure vulcanized NR and pure vulcanized IR (Toki, Sics, Ran, Liu, Hsiao, Murakami et al., 2002; Toki, Sics, Ran, Liu, & Hsiao, 2003; Tosaka, Murakami, Poompradub, Kohjiya, Ikeda, Toki et al., 2004b). From the above observation, we can conclude that the oriented amorphous chains are precursors to the induced crystals. The crystallization rate from the oriented chains must be very fast, probably in the order of 60 m/s, as reported by Mitchell and Meier (1968). In addition, it is reasonable to rationalize that the strain-induced crystallites are in the extended chain crystal form having a microfibrillar structure. As only a small fraction of chains are oriented and crystallized, this suggests that the strain-induced crystallites form an additional physical crosslinking network, carrying most of the applied load. The above results indicate that even under a very high deformation state, the majority of the chains remain unoriented. This behavior seems to be very universal in rubbery materials.



**Figure 5** SIC fraction-strain relation of NR vulcanizates with various crosslink densities.

The variations of the crystalline fraction of NR vulcanizates with various crosslink densities during deformation at 25C are shown in Figure 5. It is found that the crystalline fraction starts to increase at strain around 2.5 in all samples. The crosslink

density had only negligible influence on the onset strain of crystallization (Table 3). At strain = 3.0, the crystalline fraction is almost identical. At strain larger than 3, the crystalline fraction becomes dominant. NR vulcanizates with various crosslink densities showed similar trends. The crystallization started after the sample is elongated to some extent. The sample with the larger crosslink density typically exhibited a steeper slope in the plot. It is interesting to find that the rate of SIC is the faster for the samples with the higher crosslink density.

The crystallization rate reflects a relative SIC rate and was obtained from the slope of linearly increasing part of the curve in Figure 5 (slope in the strain dependence of anisotropic fraction). In contrast to the almost no effect of crosslink density on the onset of SIC, the crosslink density was found to have definite influence on the rate of SIC as shown in Table 3. The rate of SIC showed linearly increases with increasing crosslink density up to the value of  $8 \times 10^{-5}$  mole/cm<sup>3</sup>. Further increasing of the crosslink density resulted in a nearly constant of the rate of crystallization.

**Table 3** Crystallization rate, incipient strain of crystallization and strain at upturn stress of the samples

Sample	Crystallization rate [min <sup>-1</sup> ]	Onset strain of crystallization	Strain at upturn stress
CV1	0.014	2.45	-
CV2	0.029	2.55	3.9
CV3	0.035	2.55	3.6
CV4	0.036	2.63	2.9
CV5	0.036	2.37	2.3

The upturn of stress in the stress-strain curve of NR vulcanizate has popularly been attributed to SIC (Versloot, Duin, Duynstee, Haasnoot, Put, & Reedijk, 1992). Results of the present study suggest otherwise. It can be seen that the crystallinity index developed approximately reaches a constant value at about 1.5 even at the large strain at which stress-upturn is observed. The results of the present study, thus, indicate that stress-upturn and the high tensile strength of NR vulcanizate are not the direct consequence of SIC. For rubbery materials, this stress-upturn is generally associated with the stress at which the smallest chains reach their critical extensibility (Chenal, Chazeau, Guy, Bomal, & Gauthier, 2007). Therefore, it appears that molecular

orientation along the applied stress is responsible for the observed upturn of stress at a certain strain and also the final strength of the vulcanized rubber. SIC may contribute to the high strength by facilitating the formation of orientation of either molecules or crystals, increasing the rubber's ability to bear force.

## 5. Discussions

The effects of crosslink density on SIC and strength have been studied before. Thus, Tasoka and coworkers (Tosaka, Kohjiya, Murakami, Poompradub, Ikeda, Toki et al., 2004a) found that the crosslink density has almost no effect on the values of strain at which molecular segments begin to crystallize. In the present study, similar independence of the strains at the upturns of SIC was observed but only at small crosslink density values. At higher crosslink densities, the strains at which SIC were observed showed slight decrease with increasing crosslink density. This study covered wider range of crosslink density ( $0.54\text{-}11.34 \times 10^{-5}$  mole/cm<sup>3</sup>) than those studied by Tasoka and coworkers ( $1.01\text{-}2.12 \times 10^{-4}$  mole/cm<sup>3</sup>). Therefore, the present study contributes to additional knowledge of the effect of crosslink density on the initiation of SIC. The present study also showed that the rate of SIC increases with increasing crosslink density up to the crosslink density of  $8 \times 10^{-5}$  mole/cm<sup>3</sup>. Beyond this crosslink density, the rate of SIC became unchanged. The other new finding of the present study is that the % crystallinity increases with increasing crosslink density but decreases if the crosslink density is too high. Thus, the results showed that crosslinking facilitates alignment of the chain segments leading to crystallization but if crosslinking gets beyond a certain level, alignment of the segments becomes difficult and the ability to strain-crystallize decreases. The observed relationship between the % strain-induced crystallinity and the crosslink density is similar to the dependence of tensile strength on crosslink density which has long been reported (Trabelsi, Albouy, & Rault, 2003; Ikeda, Yasuda, Hijkata, Tosaka, & Kohjiya, 2008). The results reveal a correlation between SIC and tensile strength. Therefore, it may be concluded that SIC is important for the development of high strength of NR. However, it was also observed that the amount of strain-induced crystallinity is not very high and reaches a constant value of only 15-16 % even when the stress required to stretch the rubber still continue to rise greatly. The results suggest that, perhaps, SIC is not the only factor responsible for the development of high strength of NR vulcanizate as has been widely believed. It is thought that orientation of the chain segments should also play an important role. In the development of very strong plastics, the goal is to try to attain maximum orientation

of the molecules by various processing methods available (Callister, 2007; Hosford, 2010; Mark, 2007). In the case of elastomer, which is usually lightly crosslinked, orientation of the molecular segments may be difficult even at high strain. It can be envisaged that formation of crystallization as the rubber is being stretched help bring the chains together and form effective orientation which contributes to the ability to bear load of the elastomer, hence high strength.

## 6. Conclusion

1. In the NR samples vulcanizates with CV curing system an increase in the total crosslink densities, tensile strength and crystalline fraction are increased up to maximum, then decreased.

2. The NR vulcanizates with the larger crosslink density showed the upturn in stress at lower strain.

3. The crosslink density had only negligible influence on the onset strain of crystallization. The rate of SIC is the faster for the samples with the higher crosslink density.

4. The degree of crystallinity developed reaches a constant value of about 15 % even at high strain. Since the stress still continue to rise even after the degree of crystallinity reaches a constant value, the results of the present study indicate that stress-upturn and the high tensile strength of NR vulcanizate are not the direct consequence of SIC. Most probably, chain orientation has dominating effect on the stress required to deform NR sample at large deformation and also on the strength of NR vulcanizate. However, the orientation of molecular segments should be facilitated by the formation of crystalline fraction.

## 7. Recommendations

Further studies on SIC and orientation of sulphur-vulcanized NR samples are necessary in order to understand better the factors that are responsible for high strength of strain-crystallizable rubbers.

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## Characterizations of Ordered Semirings by The Properties of Their Ordered $(m, n)$ -Quasi-Ideals

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### Abstract

The purposes of this paper is to study ordered  $m$ -left ideals, ordered  $n$ -right ideals and ordered  $(m, n)$ -quasi-ideals of ordered semirings. Then we give characterize of ordered semirings and investigate the ordered  $(m, n)$  intersection property of ordered  $(m, n)$ -quasi-ideals in ordered semirings. Moreover, we found an interesting result that every ordered  $(m, n)$ -quasi-ideals of regular ordered semirings has the ordered  $(m, n)$  intersection property.

**Key words** : Ordered semiring, ordered  $(m, n)$ -quasi-ideal, ordered  $(m, n)$  intersection property

### 1. Introduction

The notion of a quasi-ideal of a ring was defined by O. Steinfeld (Steinfeld, 1978) then he studied some of its properties. After, M. Shabir, A. Ali and S. Batool (Shabir, Ali and Batool, 2004, pp.923-928) were studied some more properties of quasi-ideal and used them to characterize regular semiring. Then, R. Chinram (Chinram, 2008, pp.45-52) was defined generalization of a quasi-ideal of a semiring called a  $(m, n)$ -quasi-ideal, investigated its properties and used it to characterize a regular semiring.

An ordered semiring was introduced by A. P. Gan and Y. L. Jiang (Gan and Jiang, 2011, pp.989-996) as a semiring together with a partially ordered relation connected by the compatibility property and the concept of ordered left ideals, ordered right ideals and ordered ideals were also defined. Then, P. Palakawong na Ayutthaya and B. Pibaljommee (Palakawong na Ayutthaya and Pibaljommee, 2016, pp.1-8) were introduced the concept of ordered quasi-ideals in ordered semirings, studied some of their properties, investigated connections between them and other ordered ideals and

use them to characterize regular, left regular and right regular ordered semirings. After, N. Suporn and B. Pibaljommee (Suporn and Pibaljommee, 2018, pp.93-102) were studied ordered  $m$ -left ideal, ordered  $n$ -right ideal and ordered  $(m, n)$ -quasi-ideal of ordered semirings.

In this paper, we extend results of S. Thongrak and A. Iampun (Thongrak and Iampun, 2018, pp.299-306) to characterize of ordered semirings by the property of their ordered  $(m, n)$ -quasi-ideals.

## 2. Research Objectives

2.1. To study an ordered  $m$ -left ideal and an ordered  $n$ -right ideal of ordered semiring have the ordered  $(m, n)$  intersection property.

2.2. To study an ordered  $(m, n)$ -quasi-ideal of regular ordered semiring has the ordered  $(m, n)$  intersection property.

## 3. Preliminaries

A nonempty set  $S$  together with two binary operations addition  $(+)$  and multiplication  $(\cdot)$ . Then a system  $(S, +, \cdot)$  is called a *semiring* such that  $(S, +)$  is a commutative semigroup,  $(S, \cdot)$  is a semigroup and for all  $a, b, c \in S$ , we have  $a \cdot (b + c) = a \cdot b + a \cdot c$  and  $(a + b) \cdot c = a \cdot c + b \cdot c$ .

A nonempty subset  $A$  of  $(S, +, \cdot)$  is called a *subsemiring* of  $(S, +, \cdot)$  if for all  $a, b \in A$  we have  $a + b \in A$  and  $a \cdot b \in A$ .

**Definition 3.1.** (Palakawong na Ayutthaya and Pibaljommee, 2016, pp.1-8). An *ordered semiring* is a system  $(S, +, \cdot, \leq)$  consisting of a nonempty set that  $(S, +, \cdot)$  is a semiring,  $(S, \leq)$  is a partially ordered set, and for any  $a, b, x \in S$  the following conditions are satisfied :

- (i) if  $a \leq b$  then  $a + x \leq b + x$  and  $x + a \leq x + b$ ;
- (ii) if  $a \leq b$  then  $ax \leq bx$  and  $xa \leq xb$ .

We write ordered semiring  $S$  instead of  $(S, +, \cdot, \leq)$ .

For any subsets  $A, B$  of  $S$  and  $a \in S$ , we denote

$$(A] = \{x \in S \mid x \leq a \text{ for some } a \in A\},$$

$$A + B = \{a + b \in S \mid a \in A, b \in B\},$$

$$AB = \{ab \in S \mid a \in A, b \in B\},$$

$$A^n = AA \cdots A \text{ (} n \text{ copies)},$$

$$\Sigma A = \left\{ \sum_{i \in I} a_i \in S \mid a_i \in A \text{ and } I \text{ is a finite subset of } \mathbb{N} \right\},$$

$$\Sigma AB = \left\{ \sum_{i \in I} a_i b_i \in S \mid a_i \in A, b_i \in B \text{ and } I \text{ is a finite subset of } \mathbb{N} \right\},$$

$$\mathbb{N}a = \Sigma\{a\}.$$

We write  $\Sigma a$  instead of  $\Sigma\{a\}$  for any  $a \in S$  and note that  $\sum_{i \in \emptyset} a_i = 0$ .

(So,  $(S, +)$  is commutative semigroup, with zero 0)

**Definition 3.2.** (Palakawong na Ayutthaya and Pibaljommee, 2016, pp.1-8).

Let  $S$  be an ordered semiring and let  $(Q, +)$  be a subsemigroup of  $(S, +)$ . Then  $Q$  is said to be an *ordered quasi-ideal* of  $S$  if the following conditions are satisfied:

- (i)  $(\Sigma SQ] \cap (\Sigma QS] \subseteq Q$  ;
- (ii) If  $x \leq a$  for some  $a \in Q$  then  $x \in Q$  (i.e.,  $Q = (Q]$ ).

**Definition 3.3.** (Suporn and Pibaljommee, 2018, pp.93-102).

Let  $S$  be an ordered semiring,  $Q$  be a subsemiring of  $S$  and  $m, n \in \mathbb{N}$ . Then  $Q$  is said to be an *ordered  $m$ -left ideal* (resp. *ordered  $n$ -right ideal*) of  $S$  if  $S^m Q \subseteq Q$  (resp.  $Q S^n \subseteq Q$ ) and  $Q = (Q]$ .

**Definition 3.4.** (Suporn and Pibaljommee, 2018, pp.93-102).

Let  $S$  be an ordered semiring,  $Q$  be a subsemiring of  $S$  and  $m, n \in \mathbb{N}$ . Then  $Q$  is said to be an *ordered  $(m, n)$ -quasi-ideal* of  $S$  if  $(\Sigma S^m Q] \cap (\Sigma Q S^n] \subseteq Q$  and  $Q = (Q]$ .





and

$$\begin{aligned}
 (\Sigma A^m(A \cap Q]) \cap (\Sigma(A \cap Q)A^n] &\subseteq (\Sigma A^m Q] \cap (\Sigma Q A^n] \\
 &\subseteq (\Sigma S^m Q] \cap (\Sigma Q S^n] \\
 &\subseteq Q. \quad \dots\dots\dots(2)
 \end{aligned}$$

By (1) and (2) we have,  $(\Sigma A^m(A \cap Q]) \cap (\Sigma(A \cap Q)A^n] \subseteq A \cap Q$  and then

$$\begin{aligned}
 A \cap Q &\subseteq (A] \cap (Q] \\
 &\subseteq ((A] \cap (Q]) \\
 &= (A \cap Q]
 \end{aligned}$$

Consequently,  $A \cap Q$  is an ordered  $(m, n)$ -quasi-ideal of  $A$ .

**Proposition 3.9.** Let  $S$  be an ordered semiring and  $\{Q_i \mid i \in I\}$  a nonempty family of ordered  $(m, n)$ -quasi-ideal of  $S$ . Then  $\bigcap_{i \in I} Q_i = \emptyset$  or  $\bigcap_{i \in I} Q_i$  is an ordered  $(m, n)$ -quasi-ideal of  $S$ .

*Proof.* Assume that  $\bigcap_{i \in I} Q_i \neq \emptyset$ .

By Lemma 3.6, we get  $\bigcap_{i \in I} Q_i$  is a subsemiring of  $S$ .

Consider,

$$\begin{aligned}
 (\Sigma S^m(\bigcap_{i \in I} Q_i]) \cap (\Sigma(\bigcap_{i \in I} Q_i)S^n] &\subseteq (\Sigma S^m Q_i] \cap (\Sigma Q_i S^n] \\
 &\subseteq Q_i \text{ for all } i \in I.
 \end{aligned}$$

Such that  $(\Sigma S^m(\bigcap_{i \in I} Q_i]) \cap (\Sigma(\bigcap_{i \in I} Q_i)S^n] \subseteq \bigcap_{i \in I} Q_i$  and  $(\bigcap_{i \in I} Q_i] \subseteq \bigcap_{i \in I} (Q_i] = \bigcap_{i \in I} Q_i$ .

Obviously,  $\bigcap_{i \in I} Q_i$  is an ordered  $m, n$ -quasi-ideal of  $S$ .

## 4. Main Results

### 4.1 Ordered $(m, n)$ -Quasi-ideal and Ordered $(m, n)$ Intersection Property

**Theorem 4.1.1.** Let  $S$  be an ordered semiring. Then the following statements hold.

(i) If  $\{A_i \mid i \in I\}$  is a nonempty family of ordered  $m$ -left ideal of  $S$ , then

$$\bigcap_{i \in I} A_i = \emptyset \text{ or } \bigcap_{i \in I} A_i \text{ is an ordered } m\text{-left ideal of } S.$$

(ii) If  $\{B_i \mid i \in I\}$  is a nonempty family of ordered  $n$ -right ideal of  $S$ , then

$$\bigcap_{i \in I} B_i = \emptyset \text{ or } \bigcap_{i \in I} B_i \text{ is an ordered } n\text{-right ideal of } S.$$

*Proof.* (i) Assume that  $\{A_i \mid i \in I\}$  is a nonempty family of ordered  $m$ -left ideal of  $S$  and let  $\bigcap_{i \in I} A_i \neq \emptyset$ . By Lemma 3.6, we get  $\bigcap_{i \in I} A_i$  is a subsemiring of  $S$ .

Therefore  $S^m(\bigcap_{i \in I} A_i) \subseteq S^m A_i \subseteq A_i$ . and  $S^m(\bigcap_{i \in I} A_i) \subseteq \bigcap_{i \in I} A_i$  and then

$$(\bigcap_{i \in I} A_i) \subseteq \bigcap_{i \in I} (A_i) = \bigcap_{i \in I} A_i.$$

Consequently,  $\bigcap_{i \in I} A_i$  is an ordered  $m$ -left ideal of  $S$ .

(ii) Assume that  $\{B_i \mid i \in I\}$  is a nonempty family of ordered  $n$ -right ideal of  $S$  and let  $\bigcap_{i \in I} B_i \neq \emptyset$ . By Lemma 3.6, we get  $\bigcap_{i \in I} B_i$  is a subsemiring of  $S$ .

Therefore  $(\bigcap_{i \in I} B_i)S^n \subseteq B_i S^n \subseteq B_i$ . and  $(\bigcap_{i \in I} B_i)S^n \subseteq \bigcap_{i \in I} B_i$  and then

$$(\bigcap_{i \in I} B_i) \subseteq \bigcap_{i \in I} (B_i) = \bigcap_{i \in I} B_i.$$

Consequently,  $\bigcap_{i \in I} B_i$  is an ordered  $n$ -right ideal of  $S$ .





and  $(A \cap B] \subseteq (A] \cap (B] = A \cap B$ .

Consequently,  $A \cap B$  is an ordered  $(m, n)$ -quasi-ideal of  $S$ .

**Definition 4.1.5.** A subsemiring  $Q$  of an ordered semiring  $S$  has the ordered  $(m, n)$  intersection property if  $Q$  is the intersection of an ordered  $m$ -left ideal and an ordered  $n$ -right ideal of  $S$ .

**Theorem 4.1.6.** Let  $S$  be an ordered semiring and  $Q$  be an ordered  $(m, n)$ -quasi-ideal of  $S$ . Then following statements are equivalent.

(i)  $Q$  has the ordered  $(m, n)$  intersection property.

(ii)  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] = Q$ .

(iii)  $(\Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] \subseteq Q$ .

(iv)  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q S^n] \subseteq Q$ .

*Proof.*

(i)  $\rightarrow$  (ii)

Assume that  $Q$  has the ordered  $(m, n)$  intersection property.

Since  $Q \subseteq \Sigma Q \subseteq \Sigma Q \cup (\Sigma S^m Q] \subseteq (\Sigma Q] \cup (\Sigma S^m Q] = (\Sigma Q \cup \Sigma S^m Q]$  and

$Q \subseteq \Sigma Q \subseteq \Sigma Q \cup (\Sigma Q S^n] \subseteq (\Sigma Q] \cup (\Sigma Q S^n] = (\Sigma Q \cup \Sigma Q S^n]$ ,

we have  $Q \subseteq (\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n]$ .

Since  $Q$  has ordered  $(m, n)$  intersection property, there exist an ordered  $m$ -left ideal

$A$  and an ordered  $n$ -right ideal  $B$  of  $S$ . Such that  $Q = A \cap B$ .

Thus  $Q \subseteq A$  and  $Q \subseteq B$ , so  $(\Sigma S^m Q] \subseteq (\Sigma S^m A] \subseteq (\Sigma A] = (A] = A$  and

$(\Sigma Q S^n] \subseteq (\Sigma B S^n] \subseteq (\Sigma B] = (B] = B$ .

Thus  $(\Sigma Q \cup \Sigma S^m Q] = (\Sigma Q] \cup (\Sigma S^m Q] = Q \cup (\Sigma S^m Q] \subseteq A$

and  $(\Sigma Q \cup \Sigma Q S^n] = (\Sigma Q] \cup (\Sigma Q S^n] = Q \cup (\Sigma Q S^n] \subseteq B$ .

Hence,  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] \subseteq A \cap B = Q$ .

Consequently,  $(\Sigma Q \cup \Sigma S^m Q) \cap (\Sigma Q \cup \Sigma Q S^n) = Q$ .

(ii)  $\rightarrow$  (i)

Assume that  $(\Sigma Q \cup \Sigma S^m Q) \cap (\Sigma Q \cup \Sigma Q S^n) = Q$ .

We shall show that  $(\Sigma Q \cup \Sigma S^m Q)$  is an ordered  $m$ -left ideal and  $(\Sigma Q \cup \Sigma Q S^n)$  is an ordered  $n$ -right ideal of  $S$ .

By Lemma 4.1.2, we have  $(\Sigma S^m Q)$  is an ordered  $m$ -left ideal and  $(\Sigma Q S^n)$  is an ordered  $n$ -right ideal of  $S$ , so  $(\Sigma S^m Q)$  and  $(\Sigma Q S^n)$  are subsemirings of  $S$ .

Let  $x, y \in (\Sigma Q \cup \Sigma S^m Q)$ . Then  $x \leq x'$  and  $y \leq y'$  for some  $x', y' \in \Sigma Q \cup \Sigma S^m Q$ .

Since  $S$  is an ordered semiring, we obtain  $x + y \leq x' + y$  and  $x' + y \leq x' + y'$ .

Thus,  $x + y \in (\Sigma S \cup \Sigma S^m Q)$ .

Similarly,  $xy \in (\Sigma Q \cup \Sigma S^m Q)$ .

That is  $(\Sigma Q \cup \Sigma S^m Q)$  is a subsemiring of  $S$ .

Then,

$$\begin{aligned}
 S^m (\Sigma Q \cup \Sigma S^m Q) &\subseteq (S^m \Sigma Q \cup S^m \Sigma S^m Q) \\
 &\subseteq (\Sigma S^m Q \cup \Sigma S^m S^m Q) \\
 &\subseteq (\Sigma S^m Q \cup \Sigma S^m Q) \\
 &= (\Sigma S^m Q) \\
 &\subseteq (Q \cup \Sigma S^m Q) \\
 &\subseteq (\Sigma Q \cup \Sigma S^m Q)
 \end{aligned}$$

and  $((\Sigma Q \cup \Sigma S^m Q]) = (\Sigma Q \cup \Sigma S^m Q)$ .

Hence,  $(\Sigma Q \cup \Sigma S^m Q)$  is an ordered  $m$ -left ideal of  $S$ .

Let  $x, y \in (\Sigma Q \cup \Sigma Q S^n)$ . Then  $x \leq x'$  and  $y \leq y'$  for some  $x', y' \in \Sigma Q \cup \Sigma Q S^n$ .

Since  $S$  is an ordered semiring, we obtain  $x + y \leq x' + y$  and  $x' + y \leq x' + y'$ .

Thus,  $x + y \in (\Sigma Q \cup \Sigma Q S^n)$ .

Similarly,  $xy \in (\Sigma Q \cup \Sigma QS^n)$ .

That is  $(\Sigma Q \cup \Sigma QS^n)$  is a subsemiring of  $S$ .

Then,

$$\begin{aligned} (\Sigma Q \cup \Sigma QS^n]S^n &\subseteq (\Sigma QS^n \cup \Sigma QS^n S^n) \\ &\subseteq (\Sigma QS^n \cup \Sigma QS^n) \\ &= (\Sigma QS^n) \\ &\subseteq (Q \cup \Sigma QS^n) \\ &\subseteq (\Sigma Q \cup \Sigma QS^n) \end{aligned}$$

and  $((\Sigma Q \cup \Sigma QS^n]) = (\Sigma Q \cup \Sigma QS^n)$ .

Hence,  $(\Sigma Q \cup \Sigma QS^n)$  is an ordered  $n$ -right ideal of  $S$ .

Since  $(\Sigma Q \cup \Sigma S^m Q)$  is an ordered  $m$ -left ideal of  $S$ ,  $(\Sigma Q \cup \Sigma QS^n)$  is an ordered  $n$ -right ideal of  $S$  and  $(\Sigma Q \cup \Sigma S^m Q) \cap (\Sigma Q \cup \Sigma QS^n) = Q$ .

Consequently,  $Q$  has ordered  $(m, n)$  intersection property.

(ii)  $\rightarrow$  (iii)

Assume that  $(\Sigma Q \cup \Sigma S^m Q) \cap (\Sigma Q \cup \Sigma QS^n) = Q$ .

Since  $(\Sigma S^m Q) \subseteq (\Sigma Q) \cup (\Sigma S^m Q) = (\Sigma Q \cup \Sigma S^m Q)$ ,

we have  $(\Sigma S^m Q) \cap (\Sigma Q \cup \Sigma QS^n) \subseteq (\Sigma Q \cup \Sigma S^m Q) \cap (\Sigma Q \cup \Sigma QS^n) = Q$ .

Hence,  $(\Sigma S^m Q) \cap (\Sigma Q \cup \Sigma QS^n) \subseteq Q$ .

(iii)  $\rightarrow$  (ii)

Assume that  $(\Sigma S^m Q) \cap (\Sigma Q \cup \Sigma QS^n) \subseteq Q$ .

Since  $Q \subseteq Q \cup (\Sigma S^m Q) \subseteq \Sigma Q \cup (\Sigma S^m Q) \subseteq \Sigma(Q) \cup (\Sigma S^m Q) \subseteq (\Sigma Q) \cup (\Sigma S^m Q) = (\Sigma Q \cup \Sigma S^m Q)$

and  $Q \subseteq Q \cup (\Sigma QS^n) \subseteq \Sigma Q \cup (\Sigma QS^n) \subseteq \Sigma(Q) \cup (\Sigma QS^n) \subseteq (\Sigma Q) \cup (\Sigma QS^n)$ ,

we have  $Q \subseteq (\Sigma Q \cap \Sigma S^m Q) \cap (\Sigma Q \cap \Sigma QS^n)$ .

Then,

$$\begin{aligned}
 (\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] &= ((\Sigma Q] \cup (\Sigma S^m Q]) \cap (\Sigma Q \cup \Sigma Q S^n]) \\
 &= ((\Sigma Q] \cap (\Sigma Q \cup \Sigma Q S^n]) \cup ((\Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n]) \\
 &\subseteq Q \cup Q \\
 &= Q
 \end{aligned}$$

Therefore,  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] \subseteq Q$ .

Consequently,  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] = Q$ .

(ii)  $\rightarrow$  (iv)

Assume that  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] = Q$ .

Since  $(\Sigma Q S^n] \subseteq (\Sigma Q] \cup (\Sigma Q S^n] = (\Sigma Q \cup \Sigma Q S^n]$ ,

we have  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q S^n] \subseteq (\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] = Q$ .

Hence,  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q S^n] \subseteq Q$ .

(iv)  $\rightarrow$  (ii)

Assume that  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q S^n] \subseteq Q$ . Since  $Q \subseteq Q \cup (\Sigma Q S^n] \subseteq \Sigma Q \cup (\Sigma Q S^n] \subseteq \Sigma(Q] \cup (\Sigma Q S^n] \subseteq (\Sigma Q] \cup (\Sigma Q S^n] = (\Sigma Q \cup \Sigma Q S^n]$  and  $Q \subseteq Q \cup (\Sigma S^m Q] \subseteq \Sigma Q \cup (\Sigma S^m Q] \subseteq \Sigma(Q] \cup (\Sigma S^m Q] \subseteq (\Sigma Q] \cup (\Sigma S^m Q] = (\Sigma Q \cup \Sigma S^m Q]$ , we have  $Q \subseteq (\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n]$ .

Then,

$$\begin{aligned}
 (\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] &= (\Sigma Q \cup \Sigma S^m Q] \cap ((\Sigma Q] \cup (\Sigma Q S^n]) \\
 &= ((\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q]) \cup ((\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q S^n]) \\
 &\subseteq Q \cup Q \\
 &= Q.
 \end{aligned}$$

Therefore,  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] \subseteq Q$ .

Consequently,  $(\Sigma Q \cup \Sigma S^m Q] \cap (\Sigma Q \cup \Sigma Q S^n] = Q$ .

**Theorem 4.1.7.** Every ordered  $m$ -left ideal and ordered  $n$ -right ideal of an ordered semiring have the ordered  $(m, n)$  intersection property.

*Proof.* Let  $A$  be an ordered  $m$ -left ideal and  $B$  be an ordered  $n$ -right ideal of an ordered semiring  $S$ .

By Lemma 4.1.3, we have that  $A$  and  $B$  are an ordered  $(m, n)$ -quasi-ideal of  $S$ .

Then,

$$\begin{aligned}
 (\Sigma S^m A] \cap (\Sigma A \cup \Sigma A S^n] &= (\Sigma S^m A] \cap ((\Sigma A] \cup (\Sigma A S^m]) \\
 &\subseteq ((\Sigma S^m A] \cap (\Sigma A]) \cup ((\Sigma S^m A] \cap (\Sigma A S^m]) \\
 &\subseteq ((\Sigma A] \cap (\Sigma A]) \cup (A] \\
 &= (\Sigma A] \cup (A] \\
 &= (A] \cup (A] = A \cup A = A,
 \end{aligned}$$

and

$$\begin{aligned}
 (\Sigma B \cup \Sigma S^m B] \cup (\Sigma B S^n] &= ((\Sigma B] \cup (\Sigma S^m B]) \cap (\Sigma B S^n] \\
 &\subseteq ((\Sigma B] \cap (\Sigma B S^n]) \cup ((\Sigma S^m B] \cap (\Sigma B S^n]) \\
 &\subseteq ((\Sigma B] \cap (\Sigma B]) \cup (B] \\
 &= (\Sigma B] \cup (B] \\
 &= (B] \cup (B] = B \cup B = B.
 \end{aligned}$$

By Theorem 4.1.6,  $A$  and  $B$  have the ordered  $(m, n)$  intersection property.

**Proposition 4.1.8.** Let  $S$  be an ordered semiring and  $Q$  be an ordered  $(m, n)$ -quasi-ideal of  $S$ . If  $S^m Q \subseteq \Sigma Q S^n$  or  $Q S^n \subseteq \Sigma S^m Q$ , then  $Q$  has the ordered  $(m, n)$  intersection property.

*Proof.* Assume that  $S^m Q \subseteq \Sigma Q S^n$ . Then  $(S^m Q] \subseteq (\Sigma Q S^n]$ .

Since  $Q$  is an ordered  $(m, n)$ -quasi-ideal of  $S$ ,

we have  $S^m Q \subseteq S^m \Sigma Q \subseteq \Sigma S^m Q \subseteq (\Sigma S^m Q] \subseteq (\Sigma S^m Q] \cap (\Sigma Q S^n] = Q$ .

Thus  $Q$  is an ordered  $m$ -left ideal of  $S$ .

By Theorem 4.1.7, we have that  $Q$  has the ordered  $(m, n)$  intersection property.

Similarly, assume that  $QS^n \subseteq \Sigma S^m Q$ . Then  $(QS^n] \subseteq (\Sigma S^m Q]$ .  
 Since  $Q$  is an ordered  $(m, n)$ -quasi-ideal of  $S$ ,  
 we have  $QS^n \subseteq \Sigma QS^n \subseteq (\Sigma QS^n] \subseteq (\Sigma S^m Q] \cap (\Sigma QS^n] = Q$ .  
 Thus  $Q$  is an ordered  $n$ -right ideal of  $S$ .  
 By Theorem 4.1.7, we have that  $Q$  has the ordered  $(m, n)$  intersection property.

#### 4.2 Ordered $(m, n)$ -Quasi-ideal in Regular Ordered Semiring

We have investigated in the previous section that every ordered  $m$ -left ideal and ordered  $n$ -right ideal of an ordered semiring have the ordered  $(m, n)$  intersection property, but not for ordered  $(m, n)$ -quasi-ideals in ordered semiring. In this section, we will prove that every ordered  $(m, n)$ -quasi-ideal of a regular ordered semiring has the ordered  $(m, n)$  intersection property.

**Definition 4.2.1.** (Palakawong na Ayutthaya and Pibaljommee, 2016, pp.1-8)  
 An ordered semiring  $S$  is called *regular* if and only if  $x \in S$  there exists  $y \in S$  such that  $x \leq xyx$ .

**Lemma 4.2.2.** Let  $S$  be a regular ordered semiring and  $A$  be a nonempty subset of  $S$ . Then the following statements hold.

- (i)  $A \subseteq (\Sigma S^m A]$  for all positive integer  $m$ .
- (ii)  $A \subseteq (\Sigma A S^n]$  for all positive integer  $n$ .

*Proof.* (i) Let  $x \in A \subseteq \Sigma A$ . Since  $S$  is regular, there exists  $y \in S$  such that  $x \leq xyx$ . Since  $xy \in S$ , we have  $x \leq xyx = (xy)x \in S \Sigma A \subseteq \Sigma SA$  and so  $x \in (\Sigma SA]$ . Thus  $A \subseteq (\Sigma SA]$ .

Let  $m$  be a positive integer such that  $A \subseteq (\Sigma S^m A]$ .  
 Then  $\Sigma SA \subseteq \Sigma S(\Sigma S^m A] = \Sigma(S](\Sigma S^m A] \subseteq (\Sigma S](\Sigma S^m A] \subseteq (\Sigma S \Sigma S^m A] \subseteq (\Sigma S^{m+1} A]$ .  
 Hence,  $A \subseteq (\Sigma S^{m+1} A]$ .

Consequently,  $A \subseteq (\Sigma S^m A]$  for all positive integer  $m$ .

(ii) Let  $x \in A \subseteq \Sigma A$ . Since  $S$  is regular, there exists  $y \in S$  such that  $x \leq xyx$ . Since  $yx \in S$ , we have  $x \leq xyx = x(yx) \in \Sigma AS$  and so  $x \in (\Sigma AS]$ . Thus  $A \subseteq (\Sigma AS]$ .

Let  $n$  be a positive integer such that  $A \subseteq (\Sigma A S^n]$ .  
 Then  $\Sigma AS \subseteq \Sigma(\Sigma A S^n]S \subseteq (\Sigma A S^n S] = (\Sigma A S^{n+1}]$ .

Hence,  $A \subseteq (\Sigma AS^{n+1})$ .

Consequently,  $A \subseteq (\Sigma AS^n]$  for all positive integer  $n$ .

**Theorem 4.2.3.** Every ordered  $(m, n)$ -quasi-ideal of a regular ordered semiring has the ordered  $(m, n)$  intersection property.

*Proof.* Let  $Q$  be an ordered  $(m, n)$ -quasi-ideal of a regular ordered semiring  $S$ . By Lemma 4.2.2, we have  $Q \subseteq (\Sigma QS^n]$  and so  $(\Sigma Q \cup \Sigma QS^n] = (\Sigma Q] \cup (\Sigma QS^n] = (Q] \cup (\Sigma QS^n] = Q \cup (\Sigma QS^n] \subseteq (\Sigma QS^n] \cap (\Sigma QS^n] = (\Sigma QS^n]$ .

Thus,  $(\Sigma S^m Q] \cap (Q \cup \Sigma QS^n] = (\Sigma S^m Q] \cap (\Sigma QS^n] \subseteq (Q] = Q$ .

By Theorem 4.1.6, we have that  $Q$  has the ordered  $(m, n)$  intersection property.

**Theorem 4.2.4.** Let  $S$  be a regular ordered semiring and  $A$  be a nonempty subset of  $S$ . Then  $A$  is an ordered  $(m, n)$ -quasi-ideal of  $S$  if and only if  $A = (\Sigma S^m A] \cap (\Sigma AS^n]$ .

*Proof.* Assume that  $A$  is an ordered  $(m, n)$ -quasi-ideal of  $S$ . Then  $(\Sigma S^m A] \cap (\Sigma AS^n] \subseteq A$ .

By Lemma 4.2.2, we have  $A \subseteq (\Sigma S^m A]$  and  $A \subseteq (\Sigma AS^n]$  and so  $A \subseteq (\Sigma S^m A] \cap (\Sigma AS^n]$ .

Therefore,  $A = (\Sigma S^m A] \cap (\Sigma AS^n]$ .

Conversely, Assume that  $A = (\Sigma S^m A] \cap (\Sigma AS^n]$ .

By Lemma 4.1.2, we have  $(\Sigma S^m A]$  is an ordered  $m$ -left ideal and  $(\Sigma AS^n]$  an ordered  $n$ -right ideal of  $S$ . By Theorem 4.1.4, we have that  $A$  is an ordered  $(m, n)$ -quasi-ideal of  $S$ .

## 5. Discussion and Conclusion

In this paper, we have that every ordered  $m$ -left ideal and ordered  $n$ -right ideal of an ordered semiring have the ordered  $(m, n)$  intersection property, but not for ordered  $(m, n)$ -quasi-ideals in ordered semiring. Moreover, we have that every ordered  $(m, n)$ -quasi-ideal of a regular ordered semiring has the ordered  $(m, n)$  intersection property.

## 6. Recommendations

In this paper is explain the concept and content knowledge in the field of semirings to achieve to new knowledge and extends the research content in the semihyperring and ordered semihyperring.

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health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being. People in the World Health Organization (WHO) South-East Asia (SEA) Region have a long history of using traditional medicine for a wide range of health conditions. In some areas, traditional therapies are the main or even only source of health care, particularly in remote areas.

The majority of Member States in the SEA Region have integrated traditional medicine into their national health-care delivery systems to varying degrees. Following the Delhi Declaration on Traditional Medicine in 2013, and endorsement of the WHO Traditional Medicine Strategy 2014–2023, a regional action plan on traditional medicine was developed in October 2015. Myanmar, a tropical country, has a dramatic history of traditional medicine system and a great source of medicinal plants. The Myanmar Government's National Health Policy has incorporated traditional medicine within the realm of treatment while also encouraging service and research in the field (<http://mohs.gov.mm/main>). The four-year Health Plans have also included traditional healthcare services into the mainstream of the health program (<http://mohs.gov.mm>).

*Calotropis procera* R.Br belongs to the family Asclepiadaceae and is known as Ma-yo, in Myanmar. *Calotropis* species generally have similar uses. The whole plants is used for skin diseases, boils and sores and as a tonic purgative in small doses, as an emetic in larger doses. The leaves are applied on burns, headaches and rheumatic pains, and as a tincture for intermittent fever. Leaves are used as a cardiotonic, and a decoction of leaves is applied in asthma.

Several reports in the literature indicate therapeutic activities of *C.procera* including analgesic, anti-inflammatory, anti-diabetic, cytotoxic, anti-cancerous, hepatoprotective effect (Dewan, *et.al.*). In one study, Shetty VG has examined antibacterial properties of *C.procera* R.Br. leaves and the results suggest that since the leaves of *C.procera* possess significant antibacterial properties and contain phytoconstituents, it can be potentially exploited for the development of novel chemotherapeutic agents (Shetty, *et.al.*).

Resistant of pathogenic microorganisms to conventional antibiotics has reached an unacceptable level in developing countries and that trends show further increases (Okeke, *et.al.*). According to World Health Organization fact sheet, there is also a serious threat to global public health that requires action across all government sectors and

society (WHO, 2017). This study was done to evaluate some bioactivities of leave of *C.procera* in effect of certain micro-organisms in *vitro*.

## 2. Research Objectives

This research consisted of three objectives:

2.1.1 To investigate the acute toxicity of ethanol and watery extracts of sample.

2.1.2 To investigate the antimicrobial activities of various extracts of sample.

2.1.3 To test wound healing properties of ethyl acetate and ethanol extracts by *vivo* (an albino rats) method against *staphylococcus aureus*

## 3. Research Methodology

### 3.1 Plant Material

The leaves of *Calotropis procera* R.Br (*Ma-yo*) were collected from the Yangon Township. The collected plant was identified as *Calotropis procera* R.Br by the authorized botanist at Department of Botany, Yangon University. The dried samples were cut into pieces and pulverised into powder using a grinding mill. The dried powdered samples were then stored in the air tight container.

### 3.2 Preparation of Plant Extract

The dried powder(100g) of *C. Procera*. was extracted with 70% EtOH at R.T(3 x 300 ml) for one week and filtered. The filtrate was evaporated by rotatory evaporator to get 70% EtOH extract. The dried powdered of the plants was also boiled with water to get watery extract. The dried powdered samples (300 g) were extracted with methanol (500 ml) for one week by maceration followed by filtration. This procedure was repeated three times. The total combined filtrate was concentrated by rotatory evaporator the one-third volume and further partitioned between pet-ether and water to get the particular soluble extract. The aqueous layer was further dry over water bath to get dry methanol extract. The resulting extract was partitioned with ethyl acetate and ethyl-acetate soluble portion was concentrated by rotatory evaporator and dried over water-bath to get ethylacetate extract. The dried extracts obtained were then stored and kept in the refrigerator for the isolation of phytochemical organic constituents and for screening of bioactivity.

### 3.3 Acute Toxicity

The acute toxicity test was done according to Litchfield & Wilcoxon, 1949 and OECD fixed dose method with 95% EtOH and watery extracts of the plants, using 50 albino rats (25-34 g body weight). Mice were randomly assigned to 5 groups with 10

animals in each group. The animals were housed in standard cages with food and water at air conditioned room of  $20 \pm 5$ C temperature. First group was administered 0.1 ml/kg distilled water with normal food and water and considered as control. The groups (Groups II-V) were treated with different doses of 95% ethanol and watery extract. By oral route using intragastric needle in increasing dosages 2, 4, 8, 10 g/kg body weight were carried out. After administration of the extract, each group of mice was housed separately in a cage with free access to food and water. Observation for number of death was made in 24 hours after the administration of the extract and survivors were also observed for a total of 14 days. Then, the mice were observed for gross behavioral, neurologic, automic and other toxic effects continuously for two hours and then at six hours interval for 24 hours. To detect the delayed toxicity, the survivors were observed daily for weeks as described in Loomis (1968).

### 3.4 Antimicrobial Activity

The microorganism and yeast, namely *Pseudomonas aeruginosa*, *Shigella flexneri*, *Escherichia coli*, *Escherichia coli* EPEC, *proteus vulgaris*, *Bacillus subtilis*, *Bacillus pumalis*, *Staphylococcus aureus*, *Candida albicans*, *Vibrio cholerae*01, using agar disc diffusion method.

#### 3.4.1 Agar Disc Diffusion Method

##### 3.4.1.1 Preparation of Agar Medium

Trypticase soy agar (40 g) from Difco, U.S.A was suspended in 1 dm<sup>3</sup> of distilled water in a sterile conical flask and covered with aluminium foil. (Finegold *et.al.*, 1978). Then suspension was mixed thoroughly and heated to completely dissolved the powder on a hot plate stirrer (Mackie and Macartney, 1960; Finegold, *et.al.*, 1978). The Trypticase soy agar solution was sterilized in an autoclave at 121C for 15 minutes. The temperature of agar solution was reduced to 50C on a constant temperature bath. Trypticase soy agar medium was 4 then poured into the sterile petridishes near the flame of spirit burner. The agar medium was allowed to solidify and sealed tightly in a pathogene plastic bag. After checking the media by incubating at 37C over night, the solidified agar medium was dried in an incubator before it was used.

##### 3.4.1.1.1 Agar Slant Medium

Triple sugar iron agar (65g) from Becton, U.S.A, was suspended in 1000 ml of distilled water in a sterile conical flask, covered with aluminium foil and mixed thoroughly and heated to completely dissolved the powder on a hot plate stirrer (Finegold, *et.al.*, 1978). The triple sugar iron agar solution was transferred into the test

tubes (4 cm<sup>3</sup> for each) and sterilized by autoclaving at 121C for 15 minutes. After sterilization, the test tubes were placed in a slant position and allowed to solidify.

#### 3.4.1.1.2 Broth Medium

Trypticase soy broth (30 g) was suspended in 1000 ml of distilled water in a conical flask, covered with aluminium foil, mixed thoroughly and heated to completely dissolve on a hot plate stirrer (Finegold, *et.al.*, 1978). The broth solution was transferred into the test tubes (3 cm<sup>3</sup> in each tube) and sterilized by autoclaving for 15 minutes at 121C (Mar Mar Nyein, 1976).

#### 3.4.1.2 Culture of Bacteria

A few colonies of the organism to be tested were inoculated into the triple sugar iron agar and incubated at 37C for 24 hours in an incubator (Mar MarNyein, *et al*; 1991). A few colonies of the organisms from triple sugar iron agar were introduced into the trypticase soy broth and incubated for 3 hours at 37C to obtain the bacterial suspension of moderate aloudness. This contained approximately 10<sup>5</sup> to 10<sup>7</sup> organisms per ml plates the discs were allowed to dry at 42C incubator.

#### 3.4.1.3 Procedure

In this method P.E, ethylacetate, ethanol and 70% ethanol water extracts of *C.procera* used as the sample. The bacterial species used were obtained from the Department of Medical Research (Lower Myanmar). This method is used for the detection of antibacterial activity in eight crude from two plants. The test procedure is as follow. At first the extracts (1 g each for testing 10 species of bacteria) were introduced into sterile viz, PE<ethylacetate, ethanol and 70% ethanol. Discs obtained by filter paper (Toyo NO. 26, Japan) punched to 6 mm diameter were used to impregnate the extracts to obtain approximately 20 ug/disc, and prior to adherence on to the culture plates, the discs were allowed to dry at 42C incubator. The bacterial suspension from trypticase soy broth was streaked evenly into three planes on the surface of the trypticase soy agar plates with sterile cotton swab (Puritan, U.S.A). After the inoculum had dried (5 mins), the dried disc impregnated with extracts were placed on the agar with flamed forceps and gently pressed down to ensure proper contact. The plates were incubated immediately or within 30 mins after inoculation. After overnight incubation diameter including 6 mm discs were measured by means of a thin transpired ruler or by a divider.

### 3.5 Test for Wound Healing Properties of *Calotropis procera* R.Br

#### 3.5.1 Preparation of Muller-Hinton Agar Medium

Muller-Hintonagar (40 g) front India, was suspended in 1000 cm<sup>3</sup> of distilled water in a sterile conical flask and covered with aluminum foil. Then suspension was

mixed thoroughly and heated to completely dissolve the powder on a hot plate stirrer. The Muller-Hinton agar solution was sterilized in an autoclave at 121C for 15 mins. The temperature of agar solution was reduced to 50 C on a constant temperature water bath. The Muller-Hinton agar was then poured into the sterile Petri-dish near the flame of spirit burner. The agar medium was allowed to solidify and sealed tightly in a polyethene plastic bag and solidify agar stored in a refrigerator until it was used. The medium was dried in an incubator at 37C before it was used.

### 3.5.2 Procedure

Fifteen albino rats were taken and divided into five groups (3 in each group) (I, II, III, IV & V). All albino rats were then anaesthetized. Anaesthetized rats were shaved on the back area of about 3 cm diameter with blades. Incised wound about 1 cm in length was made on shaved area of rats. 8 CFU of *staphylococcus aureus* were subcutaneously injected to the incised wound of each rat in each group.

The inflammatory and exudates was found within one day. No treatment was taken in control group (1). The wounds were treated with ethanol extract, ethylacetate extract observation for possible as wounds of rats were treated with 20 mg, 15 mg and 10 mg of ethanol extract respectively. In case of isolated compound 10 mg was supplied. The dose used and observation of wound healing of the rats before and after treated with samples are described in Table 3.

## 4. Results

### 4.1 Preliminary Phytochemical Screening on the leaves of *Calotropis Procera*

The phytochemical examination of leave of *Calotropis Procera* was tested by usual method. In accordance with phytochemical tests, the leaves of *Calotropis Procera* contains glycoside, terpene, steroid. Flavonoid, alkaloid, phenol, polyphenol, saponin, tannins and carbohydrate are absent. These results are shown in table (1).

**Table 1** The Result of Phytochemical Screening for Leave of *Calotropis Procera*

No.	Constituent	Reagent used	Observation	Result
1	Flavonoid	Mg turning, Conc: HCl	Pink color	-
2	Alkaloid	Dragendroff's reagent	Orange ppt	-
3	Glycoside	10% Lead Acetate	Cream ppt	+
4	Terpene	CHCl <sub>3</sub> , Conc: H <sub>2</sub> SO <sub>4</sub> , Acetic Anhydride	Pink color	+









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## Asparagus: A Small-Scale Agriculture Alternative in Myanmar

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### Abstract

Asparagus (*Asparagus officinalis*) is a member of the lily family. It is grown as a perennial crop and is sold to the fresh market. A planting may remain productive for 12 to 15 years, but needs time for establishment. Asparagus has potential in both the domestic and export markets. Asparagus is a deep-rooted crop, needing deep, well-drained soils with a pH of 6.0 to 7.0. Sandy soils are preferred and areas with heavy clay sub-soils and high water tables should be avoided. Sandy soil is better because it warms up faster and it is important to avoid wet soil. Asparagus tolerates salinity but not acidity. To find out the utilization of Asparagus, medicinal asparagus which are commercially cultivated in many places of Upper Myanmar have been investigated. *Asparagus officinalis* L. (Kanyut) (Family Asparagaceae) has been much developed in Pyin Oo Lwin, Kyauk Mae and Thi Paw Townships. Easy to plant and care for, asparagus comes back every year with minimal labor except for harvesting. Its high value brings early income to direct marketers before harvest of other vegetables. Asparagus, native of temperate regions, succeeds best where either low temperatures or drought stops plant growth for a 'rest.' In Myanmar context, Asparagus should not be considered for commercial production where warm conditions result in the plant's growth all year. Asparagus grows and yields best in deep, well-drained sandy loam soil. However, it tolerates heavier soils as long as the water table does not come within 4 feet of the surface. The soil should be free of perennial weeds. Successfully processes are effect in these areas. The present research has been attempted to explore the cultivation and uses of the growers in Myanmar context. Nowadays Asparagus shoots are very popular in most of the countries for export because of their distinctive taste and medicinal value. Myanmar Asparagus is found as a delicate-tasting vegetable. The taste of asparagus essentially depends on the type of soil and organic matter content. Clay and loamy soils will give it a rather bitter taste. To taste them at their best, we should eat them quickly after they've been cut. Although the different varieties are called early or late, asparagus

are usually eaten in summer, when the shoots sprout from the ground. To examine the cultivation of Asparagus shoots in Myanmar, it has been found that there are 2 types of asparagus, white asparagus and green asparagus. Both are grown in the same manner. It has been also recorded that during the months of February to April, it is important to plant asparagus in rows, preferably aligned with dominant winds. As for watering, asparagus needs water on a regular basis but hates "sitting water". The best time to harvest asparagus is from April to June. According to the growers, shoots are harvested with a long blade-tipped tool called an asparagus knife. This vegetable has high vitamin C levels, but its delicate and subtle taste and its fine flesh are what make it delicious. Thus, Asparagus is a particular plant as vegetables for Myanmar society.

**Keywords :** Asparagus (*Asparagus officinalis*), Cultivation, Uses,

## 1. Introduction

Asparagus is a herbaceous, perennial plant growing to 100 - 150 cm (39 - 59 in) tall, with stout stems with much-branched, feathery foliage. The "leaves" are in fact needle-like cladodes (modified stems) in the axils of scale leaves; they are 6 - 32 mm (0.24 - 1.26 in) long and 1 mm (0.039 in) broad, and clustered four to 15 together, in a rose-like shape. The root system is adventitious and the root type is fasciculate. The flowers are bell-shaped, greenish-white to yellowish, 4.5 - 6.5 mm (0.18 - 0.26 in) long, with six tepals partially fused together at the base; they are produced singly or in clusters of two or three in the junctions of the branchlets. It is usually dioecious, with male and female flowers on separate plants, but sometimes hermaphrodite flowers are found. The fruit is a small red berry 6 - 10 mm diameter, which is poisonous to humans.

Plants native to the western coasts of Europe (from northern Spain north to Ireland, Great Britain, and northwest Germany) are treated as *Asparagus officinalis* subsp. *prostratus* (Dumort.) Corb., distinguished by its low-growing, often prostrate stems growing to only 30 - 70 cm (12-28 in) high, and shorter cladodes 2-18 mm (0.079 - 0.709 in) long. It is treated as a distinct species, *Asparagus prostratus* Dumort, by some authors.

The origin of Asparagus is believed to be the Eastern Mediterranean region. Asparagus is a popular vegetable of the countries. Asparagus has a large bunch of fleshy roots which are perennial. In spring new shoots sprout, which are used as vegetable. Once grown the sprouts are harvested for 10 - 12 years. Asparagus growing

has been much developed in Anesakhan village, in Pyin Oo Lwin Township and Kae Mon village, in Kyauk Mae Township, both for canning and for consumption fresh.

Asparagus is a perennial garden plant belonging to the Family Asparagaceae. While approximately 300 varieties of asparagus have been noted, only 20 are edible (Siemonsma & Piluek, 1994). Asparagus, its fleshy spears topped with bud-like compact heads, is often thought of as a luxury vegetable, prized for its succulent taste and tender texture. It is harvested in the spring when it is 6 to 8 inches tall. The most common variety of asparagus is green in color. It is usually dioecious, but sometimes hermaphrodite flowers are found. The fruit is a small red berry (Lawrence, 1969).

Thorough land preparation is required as asparagus occupies the same area for many years. The chosen area must be free from problem grass weeds such as nut grass or Johnson grass. Deep ripping may be necessary to break any hard pan layer. This should be followed by deep cultivation to 30 cm. Planting furrows should have a broad V-shape to prevent rain washing soil into the bottom and burying young plants. The furrows are progressively filled in as the plants grow. Planting methods include direct seeding, transplanting container-grown seedlings, and transplanting one-year-old crowns.

Crowns are grown from seed in a nursery and dug up a year later while dormant. They are either transplanted directly into the soil or held in cool storage (but should not be allowed to freeze). Crowns should be planted so that the top is about 15 cm below the undisturbed soil surface. Depth is important - if too shallow, the spears will be numerous, but small; if too deep, the spears will be large, but very few. Crowns should be covered with about 5 cm of soil initially and the rest of the furrow gradually filled in as the plants grow. These cultivations can also aid weed control. If crowns are used, they must be disease-free before planting. Crowns have the advantage of a partially established root system.

To produce transplants, seeds are sown in trays and seedlings of transplant size will be available within two to three months. Container-grown seedlings provide an easy establishment method and guarantee the required plant density. Seedlings should be transplanted in single rows at 20 to 30 cm spacing. At a 1.6 m row spacing and a 20 cm plant spacing, about 30,000 plants are required per hectare.

Without a rest period, food reserves in the storage roots may be depleted, reducing the vigour of the plant. In areas where year-round growth occurs, the number of years a planting will remain productive is likely to be reduced. Asparagus planted in Myanmar has a true dormancy period of 8 to 10 weeks during June/July.

Fertiliser applications are aimed at maintaining strong, vigorous crowns. Fertilising during harvest is not recommended. A nitrogen (N), phosphorus (P), potassium (K) mixture can be applied in July. Rates and N:P:K ratios will vary according to soil type and a soil analysis is recommended to determine the correct application amounts. Phosphorus is important for establishment and root growth. Immediately after harvest, 100 kg/ha of nitrogen should be applied to promote fern growth.

The vegetable known as Asparagus is the species *Asparagus officinalis*, of the *Asparagus* genus, which has many other species. This is a very reliable, long-term perennial that will produce crops year after year. It takes 2 - 3 years for plants to reach full production. After that period a good spring crop should be produced for the next 10 - 15 years. On the stems of asparagus are fine, needle-like growths which are actually modified branches and not true leaves. The actual leaves are little scales.

## 2. Research Objectives

This research consisted of three objectives:

- 2.1 To find out the utilization of Asparagus;
- 2.2 To examine the cultivation of Asparagus shoots in Myanmar;
- 2.3 To investigate the Asparagus, a particular plant as vegetables for Myanmar society.

## 3. Research Methodology

Asparagus shoots (n=21) are collected from Anisakan village (n=7), in Pyin Oo Lwin Township, Mandalay Division, Thi Paw Township (n=7) and Kae Mon village (n=7), in Kyauk-Mae Township, Northern Shan State. The collected specimens were identified by the whole plants, fruits and seeds and carried out by referring to the book which was written by Dassanayake (2000) and Hooker (1964). Cultivation and uses of Asparagus was recorded by visiting and asking with growers (n=15) and traders (n=14). A survey was carried out during 2016 - 2017 to collect plants and information on cultivation and utilization of Asparagus shoots.

## 4. Research Results

The results were presented according to the research objectives as follows:

### 4.1 Description

Dioecious perennial herb with erect stems, rhizomes fibrous. Stems densely branched; branches finely dissected, needle-like, green and leaf-like. True leaves reduced

to minute, bract-like, triangular, prickly scales. Inflorescences axillary racemes. Flowers unisexual, small; pedicels long. Tepals 6, campanulate; male flowers with 6 stamens, free; filaments filiform; anthers dithecous and a rudimentary ovary; female flowers trilocular, two ovules in each locule on axile placenta; style short; stigma 3-lobed and rudimentary 6 stamens. Berries globose, red. Seeds rounded, black.

**Table 1** Informations of the Asparagus

No.	Location Information	Anisakan village, Pyin Oo Lwin Township	Thi Paw Township	Kae Mon village, Kyauk-Mae Township
1.	Utilization	1 salad, pickled, decoctions, cooked, canning, coffee substitute, stews and soups, boiled or steamed 2 medicine,	1 raw, pickled, decoctions, cooked, canning, stews and soups, boiled 2 flower arrangements,	1 raw, salad, decoctions, cooked, coffee substitute, stews and soups, boiled or steamed 2 medicine,
2.	Cultivation	1 Asparagus seeds are sowed. 2 " Crowns" are planted in winter.	1 Asparagus seeds are sowed. After that, germinating seedlings are transferred in row.	1 "Crowns" planted in January or February.
3.	Land	Saline, deep, well- drained soil	Saline, deep, well- drained soil	Deep, well-drained soil
4.	Uses of fertilizer	Nitrogen fertilizer, wastes, cow manure, urea, super phosphate etc.	Nitrogen fertilizer, cow manure, urea, super phosphate, organic matters, etc.	Nitrogen fertilizer, wastes, cow manure, urea, organic matters, etc.

#### 4.2 Cultivation Method

Since asparagus often originates in maritime habitats, it thrives in soils that are too saline for normal weeds to grow. Thus, a little salt was traditionally used to suppress weeds in beds intended for asparagus; this has the disadvantage that the soil cannot be used for anything else. Some places are better for growing asparagus than others. The fertility of the soil is a large factor. "Crowns" are planted in winter, and the first shoots appear in spring; the first pickings or "thinnings" are known as sprue asparagus. Sprue has thin stems.

In Myanmar, Asparagus are systematically cultivated as row in land. These plants are about 3-4 feet in high and about 1 inch in width. Asparagus are the same to Anise plant. In cultivate the plant, asparagus seeds are sow on nursery containing the humus about 3 month. Germinating seedlings are transferred in row. Lateral branches and leaves are spread out and reach about 3 feet high in 10 month. And then, young shoots of asparagus (spears) are arising from the bottom of plant root. The spears are about 1 inch width and 10-15 inches long. There are creamy color in bottom and green in apex. The spears are arises from May to November. Plants take some elements as food for their growth and development from the soil and atmosphere. The food elements are absorbed with water from soil. Asparagus is propagated by seed. About 200 gm of seed is required for an acre of land. Asparagus is grown from 1-year-old plants or "crowns" planted in January or February. Crowns grow from seed planted in flats or peat cups in October for January transplanting, or they are transplanted from an existing asparagus bed. To get healthy, vigorous plants buy 1-year-old crowns from a nursery. It takes 1 year to grow a good crown. It requires 3 years the crown is planted until the bed is in full production. Buds arise from the crown when conditions are favorable and develop into edible spears. These spears are not harvested and are allowed to continue growing. They develop into the mature plant. Asparagus does best in a deep, well-drained soil with full sunlight.

Seeds planted in October become strong plants in the first season, but most people buy roots. Seedlings as well as plump (storage) roots bought from the store should be planted either in August or September. Plant in 1 feet wide, 8 - 10 inches deep trenches, with them trenches 4 - 6 inches apart. Manure-enriched compost or soil should be heaped loosely at the bottom of the trench, and watered in well. Plant roots or seedlings tops are 6 - 8 inches below trench top. Roots should be evenly spread, and covered with 2 inches of soil and given more water. Fill in trenches as plants grow, being careful not to cover growing tips. Enough water with a deep soaking whenever



soil near roots starts to dry. Any spears are not harvest the first 2 years to allow the plants to gain strength. Stems are cut in July when they die. The third year, some of the shoots can harvest during the first 4 - 6 weeks of production, but be very careful to stop if they begin to get noticeably thinner. After plant harvesting, the plants are allowed to grow and gather strength for the next year's crop. Cultivate and feed during the year, and water regularly. After the third year, can harvest for 8 - 10 weeks, when the spears are 5 - 8 inches long. The stems are sliced with a knife at ground level at a 45 degree angle.

Since an asparagus planting lasts many years, good seedbed preparation is essential. The soil should be free of trash, soil insects and weeds like grasses before planting. Mature plants have a high tolerance to salinity, but seedlings are very sensitive to salt. In September, spread a 3 inches layer of organic matter such as manure, rotted sawdust or compost over the beds. All organic matter is covered to a depth of 10 to 12 inches the soil with till or spade. Asparagus grows well in high pH soils but does not well if the soil pH is below 6.0. The beds are tested the soil before planting and add lime if needed to adjust the pH to 6.5 to 7.0.

Propagation is primarily by seed. The weight of 1000 seeds is 25 - 40 gm. Method of planting asparagus is by direct seeding, seedling transplants, or crowns. Since asparagus will be in the same place several years, it is important to select the right spot. Asparagus plants make a good border around the edge of a garden or along a fence. After asparagus beds are tilled, mark rows 4 to 6 feet apart. Dig a furrow 4 inches wide and 6 to 12 inches deep. The crowns are placed in the furrow, cover with 2 to 3 inches of soil and firm the soil around the roots. The entire furrow did not filled at once. Plant crowns 6 to 12 inches deep in loose soils and 4 to 6 inches in heavier soils. Crowns are placed 12 to 14 inches apart. Planting too closely can cause small spears. Wider planting results in larger spears but lower total yield. Weeds are controlled but did not injured the crowns. The furrows are filled gradually as the shoots grow. Small weeds are covered, and they die from lack of light. By the end of the first season, the furrow reaches its normal level. Deep planting of the crowns allows cultivation with garden tools or tiller without damage to crowns.

#### 4.2.1 Uses of Fertilizers

Before planting new asparagus beds, till in 2 to 3 lbs of 10-20-10 or a similar analysis fertilizer per 20 feet of row or as directed by a soil test report. For established beds scatter 1 to 2 lbs of 10-20-10 fertilizer per 20 feet of row before growth begins in the spring, late January or early February in most areas. Add an additional 1

to 2 lbs per 20 feet of row after the last harvest. If available, use a nitrogen fertilizer such as 21-0-0 at this time. Water the fertilizer into the soil. Low fertility can cause fibrous spears. All organic matters, dead or excreted or obtained as wastes, when decomposed can supply plant nutrients. Therefore organic matters must undergo decomposition before it can be used as manure. Leaves, barks, twigs, fruit peels, seeds, straws and grasses become manure on decomposition. Dung from many other animals is also used as cow manure on decomposition. Many chemical substances contain plant nutrients. Certain compounds are however commercially manufactured in bulk for use as fertilizers. Such products are urea, super phosphate etc.

#### 4.2.2 Care during the Season

The weeds were pulled from the beds. Asparagus beds require little care after the first 2 years. Weeds were controlled without damaging the spears. In early season, fertilizer is applied before the spears begin growth. Weeds were controlled during the season by raking lightly or mulching. After the last harvest, all top portions were cut back. Fertilizer applied and tilled lightly 1 to 2 inches to kill weeds. The bed is covered with a 3-inch layer of clean straw, compost or other mulch material, water thoroughly and allow to growing the rest of the year. A good harvest helps insure the next year.

#### 4.2.3 Harvesting

The buds are allowed to grow five or six inches out of the soil before they are cut; a chisel knife is pushed well down so that the cut is made six inches below the surface. Asparagus spears were harvested from established beds for about 8 weeks. Spears were harvested when they are 4 to 10 inches long. Spears were prevented from becoming fibrous, harvest at least every other day. The fibrous condition is caused by over maturity or inadequate fertility. Spears with loosely formed heads are over mature. Asparagus spears were cut 1 to 2 inches below the soil level. At least one-half the length of the spear should be above the ground. The spears were not cut within 2 inches of the crown to avoid damage to the developed buds. Asparagus spears were not cut above the ground and allow stubs to remain. Spears were not harvested when spear diameter becomes less than 3/8 of an inch. Asparagus can be stored up to 3 weeks in plastic bags in the refrigerator.

#### 4.3 Uses

Only young asparagus shoots are commonly eaten: once the buds start to open ("ferning out"), the shoots quickly turn woody. Water makes up 93 % of asparagus's composition. Asparagus is low in calories and is very low in sodium. It is a good source



It is also used in the treatment of cancer. The roots are said to be able to lower blood pressure. An infusion is used in the treatment of jaundice and congestive torpor of the liver.

## 5. Discussion

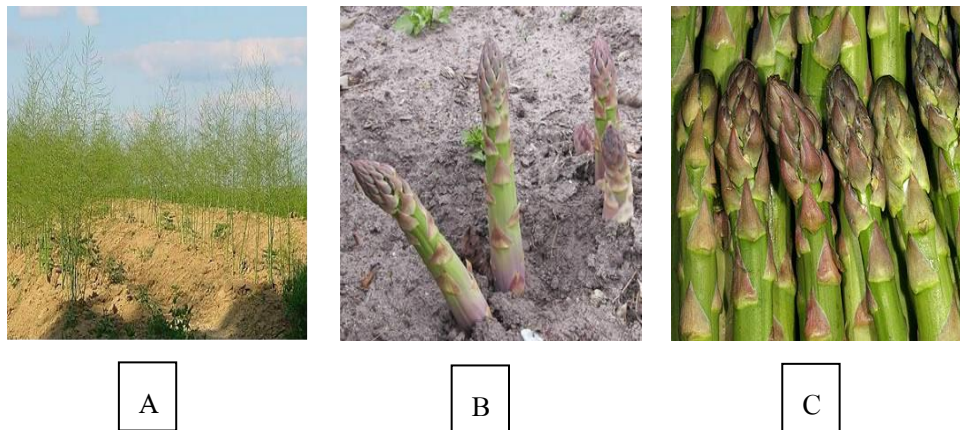
The following points based on the research results were discussed:

The fleshy green spears of asparagus are both succulent and tender and have been considered a delicacy since ancient times. The vegetable contains plenty of fibre which is hardly found in other food article excepting whole wheat. Fibre has important role in preventing many deadly diseases. Vegetables supply us vitamins and minerals in the main. The spears are actually the shoots from an underground crown. It takes up to 3 years for crowns to develop enough to begin producing shoots; they can produce for up to 20 years. Eaten as a vegetable, *Asparagus officinalis* has been widely cultivated for its young shoots since ancient Greek times. The species is naturalized in many temperate climates. Mature asparagus has caused poisoning in cattle. Young plants can cause dermatitis, and the red berries are suspected of poisoning humans.

Asparagus rhizomes and roots are used ethno-medically to treat urinary tract infections, as well as kidney and bladder stones. In Ayurvedic medicine (a traditional medicine of India) asparagus is widely used as a tonic, and for women's problems (Vincent, E. R. 1997). Asparagus is very deep rooted and draws water from a large volume of soil, allowing it to withstand periods of dry weather. Dry weather during the harvest season appears to have little effect on yield. Asparagus is a very good source of potassium and quite low in sodium.

## 6. Conclusion

Some wild *Asparagus* species are used in a similar way as *Asparagus officinalis*. Flowering starts already in the first year and is continuous. The asparagus is a perennial, forming a matted rootstock or crown. The rootstock produces numerous underground stems or rhizomes. Each new bud formed on the rootstock or crown is accompanied by two or three new rhizomes which feed and develop it. These rhizomes function for two years (possibly for three) and then die.



**Figure 1** Asparagus cultivation in Pyin Oo Lwin Township

A. Habit of *Asparagus officinalis* L.

B. Shoot arises from ground

C. Shoots (spears) of green asparagus

## 7. Recommendation

Asparagus has been used for thousands of years and has a solid reputation as a medicinal and otherwise useful plant. One thing that cannot be disputed however is that asparagus is a wonderful treat for the taste bud: leafless shoots that are earthed up in the spring are delicious with nothing more than melted butter. Asparagus also looks wonderful in the garden: it yields a crop for a couple of weeks in the spring, after which it should be allowed to grow undisturbed; the African relatives of our asparagus are much more useful for leaf greens. Asparagus's red berries also look very decorative, but they are poisonous. The seed contains high amounts of bitter asparagin however, so nobody is likely to ingest more than a few seeds. Birds can however eat as many as they like-thus spreading the seeds which pass through their digestive tract intact. Moreover, Asparagus is an excellent source of vitamins, folate and copper. It is a very good source of dietary fiber zinc and protein.

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## Bamboo Diversity and Traditional Uses in Myanmar

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### Abstract

Bamboo is a giant grass that takes on tree-like functions in forest ecosystems. Around 75 genera and 1250 species of bamboo are known to exist throughout the world. Five hundred species in 40 genera are recorded in Myanmar, mostly in the monsoon areas of central Myanmar, south and southwest of Myanmar. Of these, 250 species in 29 genera grow naturally in the mountainous areas, in the Bago and Tanninthayi regions. Bamboo has a long history of being used for multiple purposes by various mountain communities in Myanmar. Among others, bamboo has served- and still serves-as construction material, fiber, food, material for agricultural tools, utensils, and music instruments, as well as ornamental plants. Myanmar as a landlocked mountain province in southwest part holds a great number of species in its natural bamboo forests. This research presents the diversity of bamboo species and of their utilization in Myanmar. Bamboos were studied for their valuable economic products and importance in daily life of the local peoples from Central Myanmar. Interviews with local inhabitants provided an important source of information on distribution, habitat, ecological conditions, and regeneration of bamboo, as well as on indigenous knowledge systems concerning classification, utilization, management, and conservation of bamboo. The species selected for study were *Bambusa tulda* Roxb. (Thaik-wa), *Bambusa polymorpha* Munro. (Kyathaung-wa), *Cephalostachyum pergracile* Munro. (Tin-wa), and *Dendrocalamus strictus* (Roxb.) Nees. (Hmyin-wa). The uses of bamboos in foods, building materials, household utensils, containers, agricultural tools, fishery utensils, religious uses, musical instruments, transport matter, miscellaneous, ornaments and toys were recorded. The various uses of bamboos depend on the unique properties of its culm. Use value method is used to analyze the local importance of each bamboo species. According to the methods of use value, *Dendrocalamus strictus* (Roxb.) Nees. were the most useful in study area.

**Keywords :** Bamboo Diversity, Traditional Uses, Myanmar

## 1. Introduction

Bamboo is the natural resources of forest which have the characteristics of being fast-growing, high yields, regenerating continuously and multiple uses. It has very important effects in economics and culture of minority nationalities in Myanmar. The use of bamboo over a long period of time had built up confidence in its performance, treatment and construction techniques (Aikawa, 1998).

Man is using plants and their products to meet his basic needs for food, clothing and shelter since his appearance on the earth. Plants also cater medicines and various purposes needed for man's daily life (Samapuddhi, 1980). Bamboos belong to the family Poaceae have a tree-like habit and can be characterized by the presence of having woody hollow or solid culms, complicated rhizome and branching systems, petiolate leaves and prominent sheathing organs (Casin & Mosteiro. 1970) Bamboo culms provide the raw material for hundreds of implements of daily necessity in the home and in the pursuit of a livelihood, as well as musical instruments and countless sorts of toys. (Koretsky & Koretsky, 1991). It plays a vital role in the daily life of the rural and tribal people in Myanmar, from house construction to food.

The data of Bamboo forests ownership was collected by State and Divisional Forest Department, however small amount of private owned bamboo forest in inaccessible areas may not be documented by the Forest Department. The private owned bamboo forest area including natural bamboo forests and planted bamboo forests for each state and division is shown in the following table:

**Table 1** Informations of the bamboo

Sr.	State/Division	Private owned bamboo forest (ha)	
		Year 1990	Year 2000
1	Kachin	0	0
2	Kayah	0	0
3	Kayin	15	20
4	Chin	0	0
5	Shan (South)	346	378
6	Shan (North)	Nil	Nil
7	Shan (East)	Na	Na
8	Mon	372	350
9	Mandalay	Na	Na

**Table 1** (Continue)

Sr.	State/Division	Private owned bamboo forest (ha)	
		Year 1990	Year 2000
10	Yakhine	Na	Na
11	Tanintaryi	0	0
12	Sagaing	Na	Na
13	Bago (East)	Na	Na
14	Bago (West)	0	0
15	Yangon	11487	11487
16	Ayeyarwady	58	66
17	Magwe	0	0
<b>Total</b>		<b>12278</b>	<b>12301</b>

**Source:** Global Forest Resources Assessment (2005)

Bamboo is an important, cheap and plentiful forest resource in Myanmar. Bamboo products have gradually changed with many improvements. It has been put to use for traditional as well as modern purposes. People eat young bamboo shoot of certain species by boiling or preserving or drying as vegetable (Dransfield & Widjaja, 1995). Bamboos are cultivated in decorative or protective hedges in homes and villages in Myanmar. With colorful culms and evergreen leaves bamboos are cultivated as landscaping plants.

In recent year bamboos have entered the highly competitive world market in the form of pulp for paper, parquet, charcoal and ply-bamboo. Although bamboo is a raw materials of great versatility and forms society's culture and also plays an important role on scio-economy of people in Myanmar, a careful survey of literatures, has shown that the study on the anatomical and chemical characters which are controlling the bamboo quality has not yet been done in Myanmar so far. (Kywe & Kyi, 1999).

## 2. Research Objectives

This research consisted of four objectives:

2.1 To explore the life style and culture of Myanmar people regarding bamboo utilization;

2.2 To investigate the bamboo, a particular plant group as basis material culture for Myanmar society;



2.3 To find out the quality of four bamboo species related to uses;

2.4 To examine the use values among the bamboo species in Myanmar.

### 3. Research Methodology

Bamboo resources in Myanmar show rich species diversity and diversity of vegetative types; they are therefore highly significant for the social, ecological, and economic development of the area: 250 bamboo species belonging to 29 genera are found in Myanmar, which accounts for half of all bamboo species and three quarters of all bamboo genera recorded in Myanmar. Myanmar's vast bamboo forests provide a source of important economically and ecologically desirable raw material. Traditional bamboo uses are also very important for the cultural diversity of the ethnic minorities in Myanmar. Over centuries, various peoples have been using bamboo for a variety of purposes and have gained rich experience and knowledge. Their lives are closely related with bamboo, which has a strong influence on their history, art, handicrafts, music, religion, customs, architecture, and agricultural production. This understanding has hoped preserve traditional cultural knowledge systems in this mountainous region of Myanmar. The diversity of species and uses of bamboo resources in Myanmar are the basis of a stable and sustainable system. Bamboo resources have a great development potential as an important non-timber forest resource.

A survey was carried out during 2017 - 2018 to collect plants species and information on utilization of bamboo found in Zigon township (Sagaing Division), Singu township, Pyinmana township and Bagan township (Mandalay Division). Identification of the collected specimens was carried out by referring to the book which was written by Brandis, 1906; Hundley & Ko Ko, 1961; Tint, 2004.

Information's were taken mostly through personal interview and questions with the people who uses the bamboo utensils. While collecting information on bamboos and their utilization, information have been gathered from local man and woman and commercial producers using semi-structured questionnaires.

Analysis of data was made with the help of group discussions among different age classes of studied area. A total of 742 villagers (388 men and 354 women) participated in this study, but only 360 (or 48.52 % of the total) provide information for all the methods of making bamboo processes. Interviews and discussions with local inhabitants were conducted in 3 phases:

Phase 1: Collection of information on bamboo from local villages, to obtain general information on species that are being used and on the various uses. Personal interviews were employed.

Phase 2: Semi-structured interviews and discussions were conducted to cross check data and information obtained during phases 1.

#### 4. Research Results

Information about the plants were recorded with regard to their vernacular names, plant part used, process of preparation of utensil either individually or in combination with paper or cloth. Bamboo utilization may be classified into two groups, namely utilization of bamboo shoot and bamboo culm.

**Table 2** Results of Sample

No.	Variety Utilization	<i>Bambusa tulda</i> Roxb.	<i>Bambusa polymorpha</i> Munro.	<i>Cephalostachyum pergracile</i> Munro.	<i>Dendrocalamus strictus</i> (Roxb.) Nees.
1.	Vegetables	-	-	-	+
2.	Building materials	++	++	++	++
3.	Household utensils	++	++	+++	++++
4.	Containers	++	-	++	+++
5.	Agricultural tools	++	++	+++	++++
6.	Fishing utensils	++	+	+++	++++
7.	Religious uses	+	+	++	++++
8.	Musical instruments	++	+	+++	++++
9.	Transport materials	++	++	+++	++++
10.	Miscellaneous	++	+	+++	++++
11.	Handicrafts	+	-	-	-
12.	Medicinal uses	++	+	+++	++++

Zigon township, Singu township, Pyinmana township, Bagan township (++++)

Singu township, Pyinmana township, Bagan township (+++)

Pyinmana township, Bagan township (++)

Bagan township (+)

#### 4.1 Utilization of Bamboo Shoots

Bamboo shoots from *Dendrocalamus strictus* (Roxb.) Nees. are edible and are used as fresh vegetables, in the dried or fermented form. Relating to utilization of bamboo resources, so far bamboo shoots are produced and processed using local knowledge for domestic use only. Due to lack of advanced technical know-how, Myanmar bamboo shoot products still cannot penetrate into international markets. If technical assistance on the utilization of bamboo and bamboo shoot processing are available, Myanmar has high potential to earn foreign exchange from the bamboo products. Moreover establishment of bamboo plantation is essential for mass production and to meet the requirement of the international market. Non-wood bamboo product such as sheaths and branches are used for making hat, groom and utensil etc. however, data is not available for the whole country.

#### 4.2 Utilization of Bamboo Culms

The culm of bamboo is hard, tough and flexible. But it is easy to cut into strips for weaving. Bamboo strips are produced by cutting, node removing, scraping and slicing. Using these strips, craftsman can weave in various bamboo implements by hand. In Central Myanmar, bamboo utilization are varied greatly from village houses, containers, agricultural tools, fishery utensils, religious uses, musical instruments, transport matter, miscellaneous, medicinal uses, ornaments and toys (Figure 1). Among the bamboo species, four species mostly used are *Bambusa tulda*, *Bambusa polymorpha*, *Cephalostachyum pergracile* and *Dendrocalamus strictus*. Bamboo is used as building materials in the villages. Houses were built entirely with bamboo. People can use corrugated iron roof but mostly a house roof is built with bamboo called hmout hlan amoe. Bamboo is still used for scaffolding in modern construction. Even the materials for ceiling are made from bamboo.

The kind of materials used to build a house, its design and size, differ from town to town and from family to family. Bamboo was used in making walls, floors, roofs and ceiling. Occasionally thick bamboo posts were used instead of hardwood posts. The floors of houses are still made up of split bamboo culms. Walls were made with thin strip bamboo matting; bamboo doors and windows are usually constructed with split bamboo strips or flattened bamboo culms are woven together. The curtains made of bamboo are hung in front of the house to shelter from heat and to prevent the entry of outsiders. Bamboo fences, constructed of cut poles are commonly found in some villages for a long time. In addition, the fences were either with cut bamboo or with the whole bamboo is made to prevent the other animals. A variety of bamboo fences serve to

mark boundaries, protect plants, pen animals and secure privacy. The round bamboo pole was divided into two halves with a knife then the inner portion of the nodes is removed. After bamboo removing those halves are flattened and crushed use a small axe. The inner surface of the crushed bamboo was planed level with a hammer and was smoothen and then weave into wall matting which in used as building materials.

For household utensils, various types of bamboo mats were manufactured commercially. Long bamboos were cut into several parts according to the required length of the mats to be woven. Then each part was splitted into several thin pieces. But in some places, only the outer parts of bamboo culms were selected for weaving mats. Bamboo poles were cut to the required lengths and splitted frames of seats and legs of sling chair. Strips of bamboo were covered with paper to make the many fans found in some places.

In containers group, huge round bamboo baskets namely Pout are used for storing paddy in rural area. Special baskets were also made for domestic purposes and for gifts of honor. The long strips of bamboo are weaving around the moulds to form various kinds of baskets. Baskets were favorable in shopping carry things. The baskets used for measuring in some houses. The sieve tray called zaga was used for sifting rice and other materials. Big tray and round bamboo tray are useful traditional sieve trays in Myanmar. Hats also made from the culm sheaths of bamboo. Baskets with various designs are attractive feature in the market. Culms of *Cephalostachyum pergracile* Munro. were used to bake glutinous sticky rice.

For agricultural tools, since bamboo culms were strong, slender, tall, straight, and light, they make excellent poles that were ideally suited to be used in many ways, especially in agriculture. They are also used as include arbors for growing vines and other weak-stemmed plants; cages for young trees in order to protect from the danger of animals. After removing the cross walls at the node and dividing into two halves. Bamboo culm can be served as water pipe especially in hilly regions. By matting bamboo, it is used in carrying rice on a cart.

Making of fishing utensils, there has been less important of bamboo for fishing. Fishermen use bamboo in making floats to search for the location of fish pots. To catch the fish and prawn, a floating bamboo basket with openings surrounded by an inward-pointing fringe of sharp split bamboo spikes. The bamboo points prevent them from escaping them. Various sizes and shape of fish traps and fishing rods are made from many kinds of bamboo species. Nowadays, we can rarely find fishing utensils which are made of bamboo. Fishermen still use bamboo nets and markers in making floats to

search for the location of fish pots. Fish are trapped when some small streams are dammed up water is allowed to flow through bamboo nets. Strong bamboo poles are used as rat-traps in paddy fields. In ancient time and even up to now, hunters make bows and arrows from bamboo.

In religious uses, Buddha images were woven by thin strips of 84000 pure bamboo poles. As an ancient craft, bamboo has been traditionally used in making gold beater sheets. In making it, the pulp has to be squeezed, dried and pressed into paper. Bamboo is also occasionally used to scaffold. Scaffolding was a temporary bamboo framework for supporting workmen and materials during the erecting, repairing, painting in pagodas and for construction. Incense sticks are made by split bamboo. The sticks are adhered with pulp of *Naringia crenulata* (Roxb.) Nicolson. (Thanakha) and are used for offering to Buddha images. Bamboo mats are used for covering the sunlight and wind when gold leaf is being stuck.

In musical instruments group, bamboo with its strong, hollow, tubular culms and branches was ideally suited for making a variety of musical instruments. Mostly bamboo flute, one of the simplest instruments is made of thin bamboo tube perforated with 6-7 pores. Bamboo clapper was made by chopping the bamboo into rather available sizes with a node.

Bamboo was made into rafts which are used as water vehicles for transporting people and goods. Usually 1000 to 5000 culms approximately 18m in length are bound together to form a raft.

Temporary stands, stalls and booths are also built with bamboo in special occasions such as sports events, weddings, fairs, parties, and school activities. Bamboo poles were also used as clothes line props. It cannot be stock-piled because it can rot easily, and it is useless for charcoal.

Bamboo tobacco pipe is used by people of rural areas. To make the pipe, two holes are cut, the joint is half-filled with water, and a slender bamboo culm is then inserted into the lower hole, half-way along the joint. Tobacco pipe is placed in this and lighted. When the smoker inhales through the hole which is perforated in the upper cross-wall, smoke from the tobacco is cooled as it passes through the water. Bamboo container for seedlings made by splitting the culm and constructing it is called a "Bamboo basket". The hollow culm was also traditionally used to make cups, vases and flower pots. Small decorative bamboo combs are used as presents. The extremely fine teeth of the comb straighten and arrange nearly every single streak of hair. Bamboo curtain is used to divide and barricade rooms. In modern times, it is used instead of

fabric curtains for doors and windows in summer. The frames of various kites are made of bamboo split and shaved to size, covered with a 'skin' of grease paper (wax paper), and decorated with colorful kite paper.

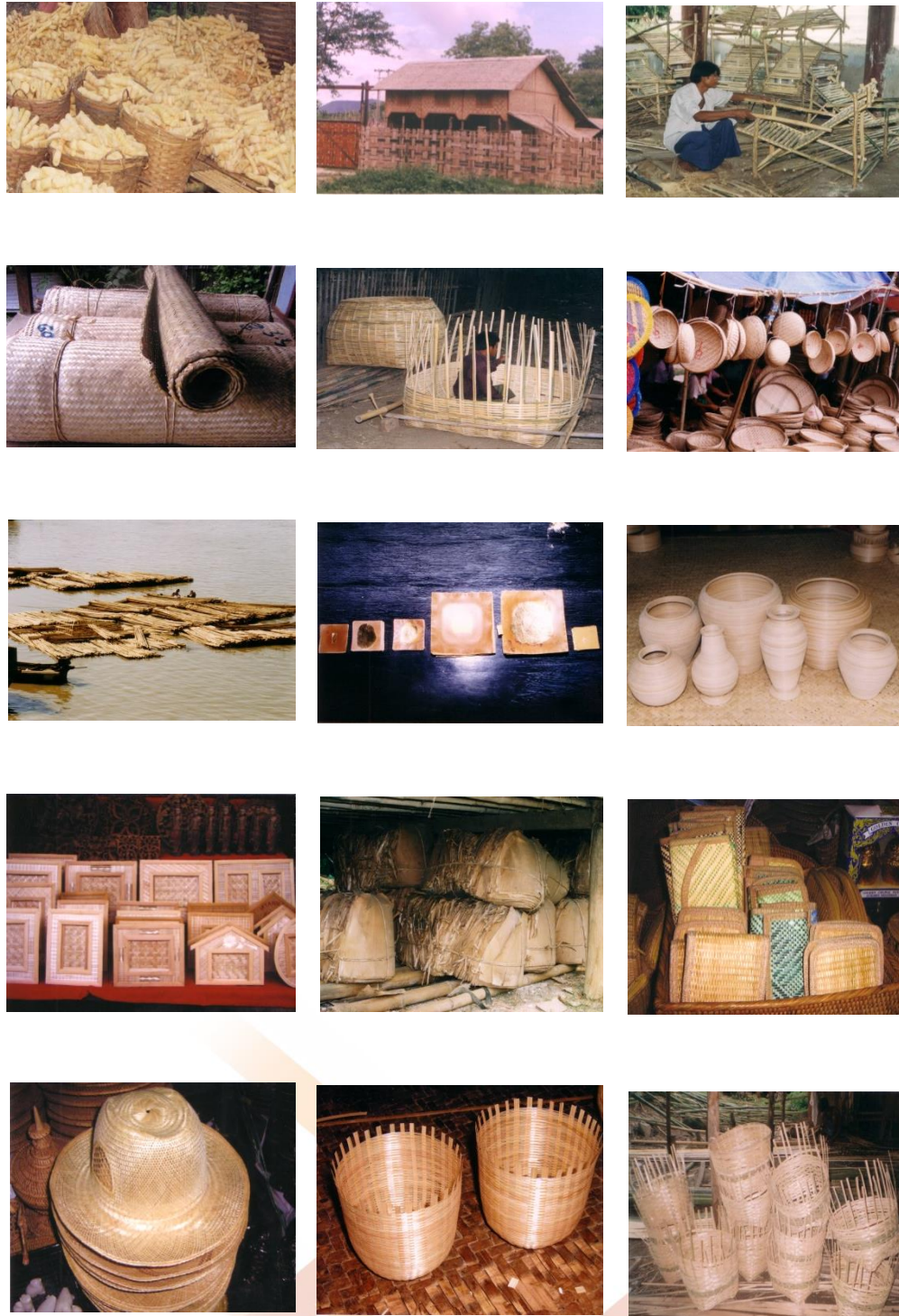


Figure 1 Various Materials Obtained from Bamboos

For weaving fancy articles such as photo stand, bag, vase, flooring and tissue box, etc. only the inner part of the culms is selected and then split into thin strips of amazing uniformity and fineness. Another kind of bamboo basket is served as an outer shell for large bottles to protect them from breaking.

For ornaments and toy group, the best handicrafts made from bamboo can earn much income for the country. A wide variety of baskets, the light and elegant lacquer boxes, trays, pots and ornaments produced in Kyaukka and Bagan are often based on fine woven bamboo only or with combinations of materials. For example, forms for bowls can be made of bamboo strips. Once the frame has been made, several layers of lacquer are built up over it, and then sand-down to produce a perfectly smooth surface. Lacquer is traditionally made from the sap of the lac (*Melanorrhoea usitata* Wall. Thit-si) which dries well in hot humid conditions but caused skin rashes. Bamboo was fashioned into lacquer ware products because it was easy to work and can be beautifully decorated by cutting, carving, splitting in the design, painting, polishing or varnishing.

For medicinal uses, bamboo rhizomes are boiled to make; making a poultice for healing the wounds. Green portion of the bamboo culm is grounded into paste for application over the wound. It usually serves as an antiseptic and acts fast in the wound healing process. Decoction of leaves is rinse out the mouth for tongue disease. Toothache is relieved by heating young bamboo twigs and applying over it.

*Bambusa tulda* is mostly used in lacquer ware processing in Bagan township and *Bambusa polymorpha* is especially used only for construction and water carrying materials in Pyinmana township. In addition, *Cephalostachyum pergracile* can be used for various kinder playing toys.

#### 4.3 Use Value of Studied Species

To estimate the utilization of each species using with use-value method by Phillips, O. (1995).

The formula for use-value method is indicated as follow:

$$UV = \frac{\sum U_i}{n}$$

UV = Use Value

U<sub>i</sub> = the number of uses mentioned by each informant for a given species

n = the total number of informants

To estimate the utilization of *Bambusa tulda* Roxb. it is calculated as follow:

The use-value of *Bambusa tulda* Roxb. is equal to summation of the number of uses mentioned by each informant for *Bambusa tulda* divided by the total number of informant.

The summation of the number of uses mentioned by each informant for *Bambusa tulda* is  $a+b+c+d+e+\dots = U_i$

a, b, c, d and e are the kinds of items mentioned by each informant respectively.

The total number of each informant (people interviewed about *Bambusa tulda*) = n

$$\begin{aligned} \text{To yield the use-value of } Bambusa tulda &= \frac{\sum U_i}{n} \\ &= \frac{378}{90} \end{aligned}$$

Use-value of *Bambusa tulda* = 4.2

Use-value of *Bambusa polymorpha* Munro. = 4.0

Use-value of *Cephalostachyum pergracile* Munro. = 9.2

Use-value of *Dendrocalamus strictus* (Roxb.) Nees. = 10.8

***Dendrocalamus strictus* > *Cephalostachyum pergracile* > *Bambusa tulda* > *Bambusa polymorpha***

From the resulting data it can be concluded that the use – value of *Dendrocalamus strictus* (Roxb.) Nees. is the highest (10.8), followed by *Cephalostachyum pergracile* Munro. (9.2), *Bambusa tulda* Roxb. (4.2) and *Bambusa polymorpha* Munro. (4.0) respectively.

### 5. Discussion

Bamboos were the most important nonwood forest product of the studied area. Bamboos were utilized intensively for a wide range of purposes. The most important uses in study area were for construction materials, utensils and handicrafts.

Bamboos are versatile renewable resources, with a high potential for socio-economic development and for environmental improvement. The values of bamboo are being satisfactorily utilized by tropical Asian countries.



Bamboo is one of the most important minor forest products. Bamboo culms are used for making a variety of lacquer ware which brings additional income to the rural people. The bamboo culms are the most economically important part of the plant. It provides food, raw material, shelter and even medicine for a good part of the world's population. Bamboo products are utilized in daily life by people throughout the country. In addition bamboo is used as a construction material and also used in the production of household utensils, containers, agricultural tools, fishery utensils, religious uses, food, transport matter, miscellaneous, medicinal uses, ornaments and toys.

Moreover, many kinds of musical instruments such as flutes and clappers are very common and mostly found in rural area. Some utensils such as the bamboo flooring of the chairs, various kinds of hats (both from the woven thin strips and culm sheath), tissue box, sling bags and photo stands are now producing only for the local consumption and they can be modified, and improved for beauty and durability for export.

Bamboo shoots are used as food and culms as building material and also for making handicrafts. The various products from bamboos are found. Many utensils were mostly produced from *Dendrocalamus strictus* (Roxb.) Nees. And then *Cephalostachyum pergracile* Munro., *Bambusa tulda* Roxb. and *Bambusa polymorpha* Munro. were also produced various utensils.

From the data collection it is found that 24 kinds of bamboo products are economically produced without other materials like paper and clothes. Among them broom, dumpling steamer, tray, sieve, measure basket, tissue box, seedling basket, bamboo ruler, photo stand, and caps are economically important products. Most of the utensils are prepared and sold according to the local needs but few are for regular income. The women, children, and some old men can work and get some regular profits for daily needs.

*Cephalostachyum pergracile* is especially used for producing tray, sieve and basket because of their thin wall. *Dendrocalamus strictus* is used in making bamboo ruler, basket, sling chair and mat.

The collected bamboos are transported from Khanti, Kalawa, Shweli and Mezar by rafting in Chindwin and Ayeyarwaddy River to Monywa, Kyauk-myaung, Bagan and Nyaungoo and then transported by car or train to the villages. Bamboos by regional train from Nam-kan and Wun-tho are transported.

The culms in fresh condition are cut and sinked in flowing for 2 to 3 months and then dried to sun. This increases the resistance of bamboo which against from

insect but not from termites and fungi. Bamboos are cut at the base and store them upright position in the dry places. Bamboos are never store open field or not to expose it to rain or damp, it may rot or be eaten by insects. The bamboo products last for one year to ten years depending on handling and utilization. Moreover, these products are applied with thit-si (oleoresin) for beauty and durable use.

In Zigon area the bamboo products are produced especially in winter. During the period of severe rains and winds the local workers do not produced any materials.

*Dendrocalamus strictus* (Roxb.) Nees. forest is found naturally in the some area of southern part of Kantbalu township. Local foresters estimated that the number of bamboos is up to 100,000 poles in that forest. The various uses of bamboos provide better employment opportunities and income distribution to the rural people.

The collected four specimens belong to family Poaceae. Among the four species of bamboo, *Dendrocalamus strictus* (Roxb.) Nees. is mostly used for diverse purposes such as gold beater sheet, sling chair, sieve, tray, mats, flooring and various baskets.

The people from Assam and Manupure used bamboo mats and baskets for measure (IGNCA, 1999). The findings agree with the present investigation.

The present study shows that bamboos are important role for local people and the culms, young shoots are used for the preparing traditional cuisine (sticky rice). These findings agree with Moe, M. (2007).

The people from Mizoram and Tripura used bamboo traps and fishing baskets for catching fish in lakes, creeks, streams (IGNCA, 1999). These are also agreeing with the present investigation.

According to the dendrogram, the results indicate that, *Cephalostachyum pergracile* Munro. are mostly used in making of tray, sieve and various baskets and followed by *Dendrocalamus strictus* (Roxb.) Nees., *Bambusa polymorpha* Munro. and *Bambusa tulda* Roxb. From the present study it is concluded that the bamboos are very important for the study areas, for the construction and for the economic producing of bamboo products, and also for local needs of various utensils.

## 6. Conclusion

The present study 4 species of the most useful bamboo are selected. Among these, the internodes of *Bambusa polymorpha* are the longest. Size and shape of culm sheaths differ in species. The culm sheaths are broadly triangular in *Bambusa tulda*, ovate in *Cephalostachyum pergracile*, elongate-triangular in *Dendrocalamus strictus*, and long and persistent in *Bambusa polymorpha*.





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**Acute Toxicity, Hypoglycemic Activity and Isolation of Spiro Compound  
from the root of Myanmar Indigenous Medicinal Plant,  
*Tribulus terrestris* L. (Tsu-le)**

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**Abstract**

In this research paper, one of the Myanmar medicinal plants, the root of *Tribulus terrestris* L., locally known as Tsu-le, which belongs to Zygophyllaceae family was selected for the investigation of the acute toxicity and hypoglycemic effect on experimental animals. On the other hand, isolation of pure bioactive organic compound (spiro compound) had been reported. The preliminary phytochemical test of the crude extract of root of *Tribulus terrestris* L. informs the presence of alkaloid, flavonoid, glycoside, reducing sugar, saponin, steroid, terpene, polyphenol and phenolic compound, respectively. Furthermore, the antimicrobial activities of ethyl acetate crude extract of root of Tsu-le responded high activities on all tested organisms. The acute toxicity test has been determined in *vivo* models. The confidence dose of ethanolic extract of root of Tsu-le was investigated with Institute of Cancer Research (ICR) mice. It was found that the median lethal dose (LD<sub>50</sub>) was more than (10 g/kg) when administered orally. In addition, the antihyperglycemic activities of ethanolic extract were investigated in Wistar Strain Albino Rats. The animals treated with the ethanolic extract could show significant decrease in blood glucose levels at 1 hr, 2 hr, 3 hr and 4 hr when compared with negative control group. Ethanolic extract 0.25 g/kg dose significantly reduced in blood glucose levels at 1 hr (p<0.01), 2 hr (p< 0.05) and 4 hr (p< 0.01). Ethanolic extract 0.5 g/kg dose was observed at 1 hr (p <0.01), 2 hr (p<0.05), 3 hr (p<0.01) and 4 hr (p< 0.01) after treatment of drug extracts respectively. Since, there is no such scientific studies conducted previously in Myanmar, this will be the first research paper on the acute toxicity, hypoglycemic activity and the isolation of pure spiro compound from the root of *Tribulus terrestris* L. (Tsu-le).

**Keywords :** Acute toxicity, hypoglycemic activity, antimicrobial activities,  
*Tribulus terrestris* L.



### 3.2 Instrumentation

(i) The FT-IR spectrum was measured at the Department of Chemistry, University of Mandalay.

(ii) Analytical and preparative Thin Layer Chromatography was performed by using percolated silica gel (Merck Co. Inc, Kiesel gel 60F<sub>254</sub>).

(iii) Common laboratory apparatus and equipment were used throughout the research work.

### 3.3. Materials

(i) Commercial grade reagents and solvents were used.

(ii) Iodine-vapour and UV lamp were used for location of the spots.

(iii) Silica gel G-60, (70-230) mesh was used for column chromatography.

### 3.4 Study of Acute Toxicity (Litchfield & Wilcoxin, 1949)

#### 3.4.1 Site of Study

These experiments were done at Pharmacology Research Division, Department of Medical Research (DMR), Upper Myanmar (UM).

#### 3.4.2 Materials

(i) 50 Institute of Cancer Research (ICR) mice of both sexes (body weight 20 – 30 g)

(ii) mouse cages ; (iii) Animal balance

(iv) Different concentrations of ethanol extract of root of *Tsu-le*

(v) Distilled water; (vi) Drinking water bottles

(vii) Surgical gloves and masks; (viii) Picric acid for marking

(ix) Cannula and (x) Feeding nozzle

#### 3.4.3 Method

A total of 50 (ICR) mice of both sexes (body weight 20 – 30 g) used in this study were randomly divided into five groups with 10 animals in each. Four were test groups and one was control group. 10 (ICR) mice in each group were fasted overnight before administration of the ethanol extract of *Tsu-le* root and distilled water. The acute toxicity study was carried out with an oral single administration of ethanol extract of *Tribulus terrestris* Linn. root at increasing doses of 4 g/kg, 8 g/kg, 10 g/kg and 16 g/kg on the four test groups and 10 ml/kg of distilled water on control group. After administering of the test extract and vehicle orally, mice were kept in individual cage with free access to food and water and were observed toxic effects daily for two weeks. The median lethal dose (LD<sub>50</sub>) was determined from the number of animals surviving at the end of two weeks period.

### 3.5. Test of Hypoglycemic Activity of *Tribulus terrestris* L. Root Extracts on Albino Rats (Tiwari, Rao, 2002)

#### 3.5.1 Selection of Experimental Animals

Both sexes of Wister Strain Albino Rats weighing between (170 – 230g) were selected from Laboratory Animal Service Division, Department of Medical Research (DMR), Upper Myanmar (UM). Animals were fed laboratory standard food and drinking water before the experiment. Then, they were kept in clean and dry cages and maintained in a well-ventilated animal house.

#### 3.5.2 Screening of Adrenaline Induced Diabetic Rats

Screening of experimental animals was done two weeks before starting experiment. Albino rats (170 – 230 g) were made fasting for 18 hours (overnight) and tails were cut about 1 mm length. Blood was collected on the test strip by tail nipping and blood sugar level was measured by glucometer which was expressed in mmol/l. Then, they were given subcutaneous injection of adrenaline 0.2 ml/kg body weight. Post injection, fasting blood sugar levels were measured at 1 hr, 2 hr, 3 hr and 4 hr. Rats with fasting blood sugar level equal and above 8 mmol/l were included in this study and animals that did not raise hyperglycemia were rejected.

#### 3.5.3 Experimental Design for Hypoglycemic Activity

After resting of two weeks, a total of 24 adrenaline induced hyperglycemic albino rats were randomly allocated into four groups of six animals in each. They were fasted 18 hours prior to drug administration but allowed free access to drinking water. Before the drugs and vehicle administration, baseline fasting blood sugar levels were measured onto all four groups by using Ominitest<sup>®</sup> ez glucometer and strips.

In this experiment, the dosage of ethanol extract of *Tribulus terrestris* L. was calculated on the body weight basis for each animal. Before giving the extract to the animals, the extracts were dissolved in vehicle. All the drugs were administered in an oral single dose.

Group I received 10 ml/kg of vehicle only and served as negative control group

Group II received 0.5 mg/kg of glibenclamide and served as positive control group

Group III was tested with ethanol extract of *Tribulus terrestris* root 0.25 g/kg body weight and served as tested group

Group IV was given with ethanol extract of *Tribulus terrestris* root 0.5 g/kg body weight and served as tested group



The time of administration of drugs precisely recorded and it will be noted as 0 hour. One hour after giving the corresponding drugs and vehicle, all rats in four groups were induced adrenaline 0.2 ml/kg body weight subcutaneously. Then, the blood glucose levels were recorded at 1 hr, 2 hr, 3 hr and 4 hr intervals after injecting adrenaline. Food and water withheld during experiment.

#### 3.5.4 Statistical Analysis

The results were expressed as Means standard Error (SE). The mean difference among the blood glucose levels of negative control, positive control and tested groups were analyzed by unpaired *student "t" test*. Differences between groups were considered as significance when  $p < 0.05$ .

## 4. Research Results

### 4.1 Botanical Description of *Tribulus terrestris* L.

Family name	- Zygophyllaceae
Botanical name	- <i>Tribulus terrestris</i> L.
Local name	- Tsu-le
English name	- Goathead, Puncture vine, small caltrops
Part used	- Root
Flowering time	- April to September



**Figure 1** The Plant and Root of *Tribulus terrestris* L. (Tsu-le)

### 4.2 Extraction and Isolation of Pure Bioactive Spiro Compound from the Root of *Tribulus terrestris* L. (Tsu-le) (Mc Murry, 1999 and Stable, 1965)

The air-dried root sample (700 g) of Tsu-le was percolated with 95% ethanol (2.8 l) for two months. During percolation, the crude extract was frequently shaken to achieve maximum extraction of sample. The ethanol extract was filtered and the resulting ethanol soluble solution was evaporated to obtain the concentrated residue. Then, the residue was extracted with ethyl acetate (300 ml). The ethyl acetate soluble





**Table 2** The Result of Phytochemical Screening for Root of Tsu-le

No.	Constituent	Reagent used	Observation	Result
1	Flavonoid	Mg turning, Conc: HCl	Pink color	+
2	Alkaloid	Dragendroff's reagent	Orange ppt	+
3	Glycoside	10% Lead Acetate	Cream ppt	+
4	Terpene	CHCl <sub>3</sub> , Conc: H <sub>2</sub> SO <sub>4</sub> , Acetic Anhydride	Pink color	+
5	Steroid	Pet ether, Conc: H <sub>2</sub> SO <sub>4</sub> , Acetic Anhydride	Green color	+
6	Phenol	10% FeCl <sub>3</sub>	Deep color	+
7	Polyphenol	10% FeCl <sub>3</sub> + 1% K <sub>3</sub> Fe(CN) <sub>6</sub>	Greenish blue	+
8	Saponin	Distilled water	Frothing	+
9	Reducing Sugar	Benedict's solution	Brick red ppt.	+

(+) = presence of constituents (-) = absence of constituents

#### 4.5 Acute Toxicity of Ethanolic Extract of Root of *Tribulus terrestris* L.

The institute of Cancer Research (ICR) mice administered with 4 g/kg, 8 g/kg, 10 g/kg and 16 g/kg doses of ethanolic extract of *Tribulus terrestris* L. root were kept under observation for two weeks. After two weeks, all mice in (4 g/kg, 8 g/kg and 10 g/kg) were alive and did not show any toxic symptoms such as body weight loss and restlessness. So it was found that 10 g/kg dose of ethanolic extract of root of Tsu-le showed confidence dose and considered as safe.

**Table 3** Lethal activity of 95% Ethanol Extract of *T. terrestris* L. root.

Group No.	Treatment (g/kg)	No. of mice used	No. of mice death	No. of mice survived	% death
1.	4 g/kg	10	0	10	0
2.	8 g/kg	10	0	10	0
3.	10 g/kg	10	0	10	0
4.	16 g/kg	10	8	2	80
5.	10 ml/kg (vehicle)	10	0	10	

#### 4.6 In vivo Hypoglycemic Activities of *Tribulus terrestris* L.

The blood glucose levels of individual rats receiving either vehicle or glibenclamide or ethanol extracts at two different doses (0.25 g/kg and 0.5 g/kg) after administration of adrenaline at 1 hr, 2 hr, 3 hr and 4 hr are tabulated in APPENDIX I (Table I, II, III and IV).

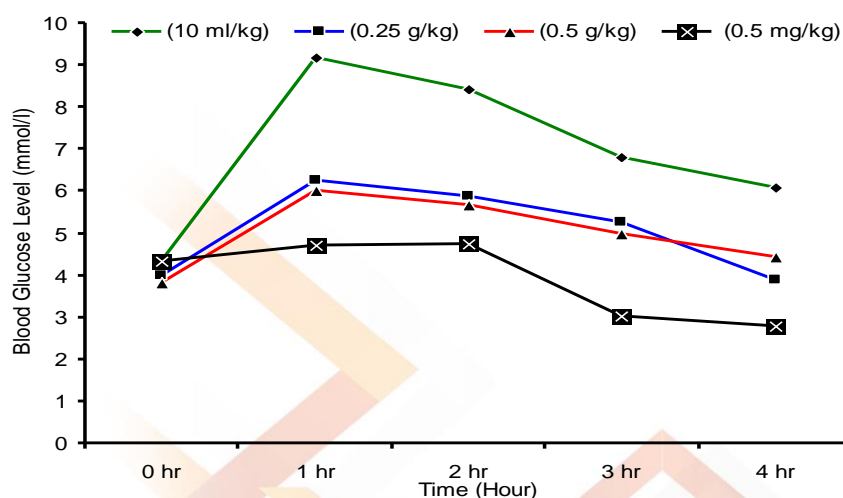
#### 4.7 Effect of Ethanol Extract of *Tribulus terrestris* L. on Blood Glucose Levels in Adrenaline Induced Hyperglycemic Rats

The mean blood glucose levels of adrenaline induced hyperglycemic rats in negative control group, positive control group and ethanolic extract treated groups are shown in Table (4). According to this table, the animals treated with the ethanol extracts showed decrease in blood glucose levels when compared with negative control group.

**Table 4** Hypoglycemic Effect of Ethanolic Extract of *Tribulus terrestris* L. Roots on Blood Glucose Levels (Means SE) of Adrenaline Induced Hyperglycemic Rats Models

Group (n = 6)	Blood Glucose Level (m mol/L)				
	0 hr	1 hr	2 hr	3 hr	4 hr
Vehicle Negative control (10 ml/kg)	4.32 0.30	9.18 0.57	8.43 0.62	6.82 0.35	6.08 0.34
Ethanol Extract (0.25 g/kg)	4.00 0.29	6.17 0.64**	5.88 0.62*	5.25 0.77	3.88 0.61*
Ethanol Extract (0.5 g/kg)	3.93 0.17	6.03 0.76**	5.87 0.63*	5.05 0.39**	4.45 0.23**
Glibenclamide Postive control (0.5 mg/kg)	4.32 0.18	4.72 0.37	4.73 0.26	3.03 0.48	2.77 0.37

Results were expressed as Mean SE \* p<0.05 \*\* p<0.01



**Figure 3** Hypoglycemic Effect of Negative Control Group, Ethanol Extracts of *Tribulus terrestris* L. and Positive Control Group

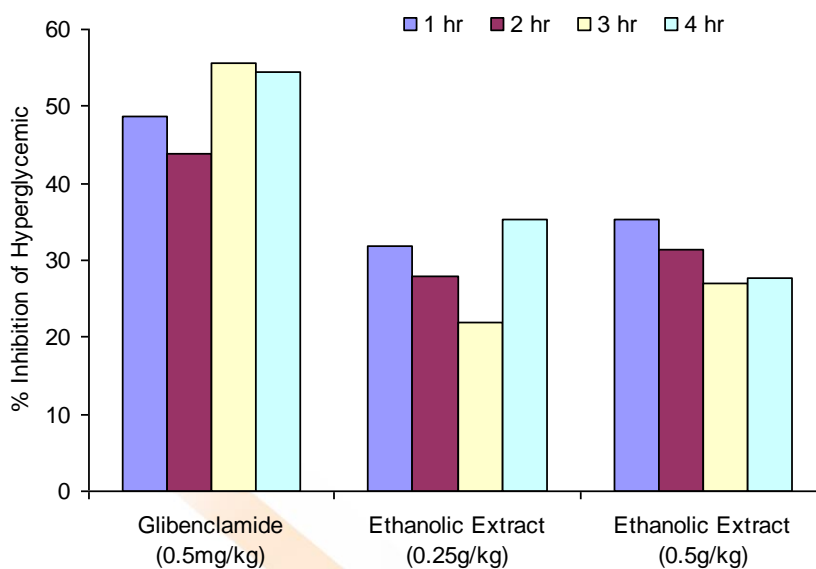
#### 4.8 Comparison of Percent Inhibition Effect of the Glibenclamide and Ethanol Extracts of *Tribulus terrestris* L. Roots

Present inhibition was calculated by the following formula.

$$\text{Percent inhibition of tested drug} = \frac{\text{Mean blood glucose level of (negative control - test drug)}}{\text{Mean blood glucose level of negative control}} \times 100$$

**Table 5** Percent Inhibition of Glibenclamide and Ethanolic Extracts (0.25 g/kg and 0.5 g/kg)

Type of drugs	Percent Inhibition			
	1 hr	2 hr	3 hr	4 hr
Glibenclamide (0.5 mg/kg)	48.6	43.9	55.6	54.4
Ethanol Extract (0.25 g/kg)	32.8	29.3	23	36.2
Ethanol Extract (0.5 g/kg)	34.3	30.4	26	26.8



**Figure 4** Time Course of the Percent Inhibition of Glibenclamide, Ethanolic Extracts (0.25g/kg) and Ethanolic Extracts (0.5 g/kg) on Adrenaline Induced Hyperglycemic Rat Models

#### 4.9 Antimicrobial Activities of Isolated Spiro Compound

The antimicrobial activities of isolated spiro compound were tested by using Agar well diffusion method. These results were shown in Table (6). According to this table, ethyl acetate extract of isolated compound responds medium activities on *Staphylococcus aureus* and *Bacillus pumalis* and low activity on *Bacillus subtilis*, *Candida albican* and *E. coli*, respectively.

**Table 6** Antimicrobial Activities of the Isolated Spiro Compound

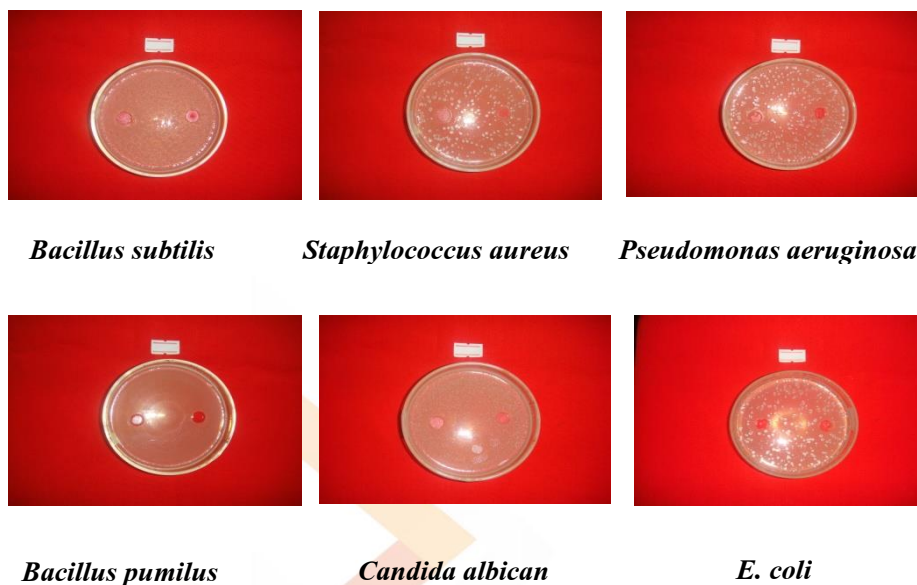
Sample	Solvent	Organism					
		(1)	(2)	(3)	(4)	(5)	(6)
Isolated Compound	EtOAc	12 mm (+)	19 mm (++)	(-)	18 mm (++)	14 mm (+)	14 mm (+)
Control	EtOAc	-	-	-	-	-	-

Agar well – 10 mm: 10 mm ~ 14 mm(+) : 15 mm ~ 19 mm(++) : 20mm above (+++)

Organisms : (1) *Bacillus subtilis* : (2) *Staphylococcus aureus*

(3) *Pseudomonas aeruginosa* : (4) *Bacillus pumilus*

(5) *Candida albican*: (6) *E. coli*



**Figure 5** Antimicrobial Activities of Isolated Spiro Compound

## 5. Discussion

According to the antimicrobial activities of root of Tsu-le, ethyl acetate extract responds high activities on all selected organisms. Information from phytochemical results, the sample consists of flavonoid, alkaloid, glycoside, terpene, steroid, phenol, polyphenol, saponin and reducing sugar respectively. Moreover, occurrence of acute toxicity of ethanolic extract of root of Tsu-le was concluded that the median lethal dose (LD<sub>50</sub>) was more than 10 g/kg when administered orally and the root of (Tsu-le) is practically non-toxic.

Furthermore, ethanol extract at (0.25 g/kg) dose decreased in blood glucose levels at 1 hr (6.17 ± 0.64), 2 hr (5.88 ± 0.62), 3 hr (5.25 ± 0.77) and 4 hr (3.88 ± 0.61) compared with that of negative control group. The prominently decrease in blood glucose levels were 1 hr (p<0.01), 2 hr (p<0.05) and 4 hr (p<0.05) respectively.

Ethanol extract at (0.5 g/kg) dose also decreased in blood glucose levels at 1 hr (6.03 ± 0.76), 2 hr (5.87 ± 0.63), 3 hr (5.05 ± 0.39) and 4 hr (4.45 ± 0.23) compared with that of negative control group. The significantly decrease in blood glucose levels were 1 hr (p<0.01), 2 hr (p<0.05), 3 hr (p<0.01) and 4 hr (p<0.01) respectively.

The two ethanol extracts have almost as nearly effective as positive control group and between the two test groups, 0.5 g/kg dose was found to be more potent anti-hyperglycemic activity than that of 0.25 g/kg dose in adrenaline induced hyperglycemic albino rats. Therefore, the two test groups have medium hypoglycemic activity and can be used in the treatment of diabetes mellitus.

According to the result of percent inhibition effect, the percent inhibition of glibenclamide was higher than that of ethanol extracts. The ethanol extract (0.5 g/kg) dose was observed to possess more pronounced percent inhibition effect than that of (0.25 g/kg) dose at 1 hr, 2 hr and 3 hr, respectively.

Antimicrobial activities of isolated spiro compound respond medium activity on *Staphylococcus aureus* and *Bacillus pumilus*.

## 6. Conclusion

In this research, the ethyl acetate extract of Tsu-le gives rise to high activities on all tested organisms. Furthermore, acute toxicity study of 10 g/kg of ethanol extract of Tsu-le root showed confidence dose and considered as safe and the root of Tsu-le is practically non-toxic. Hypoglycemic activities of ethanol extract of sample were investigated on experimental animals. The animals treated with ethanol extracts dose at (0.25 g/kg and 0.5 g/kg) could show significant decrease in blood glucose levels as



shown in Figure (4). The results of ethanol extracts with ( $p < 0.05$ ) were statistically significant. Therefore, ethanol extract of root of *Tsu-le* have medium hypoglycemic activity and can be used in the treatment of diabetes. There is no scientific report of acute toxicity and hypoglycemic effect of root of *Tribulus terrestris* L. in animal models. The IUPAC name of isolated spiro compound is 3', 5', 5', 6', 10a-pentamethylcosahydrospiro [naphtho [1, 2-h] isochromene-2, 2'-pyran] -4', 8-diol.

## 7. Recommendation

The two ethanol extracts (0.25 g/kg and 0.5 g/kg) have almost as nearly effective of blood glucose levels as positive control group. Therefore, the two test groups have medium hypoglycemic activity and can be used in the treatment of diabetes mellitus. It is also recommended that 12 g/kg and 14 g/kg dose of ethanolic extract of root of *Tsu-le* should be studied for acute toxicity. Moreover, hypoglycemic activities and acute toxicity of another medicinal plant should be conducted for the treatment of diabetes mellitus.

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## APPENDIX I

### Blood Glucose Level

**Table I** Blood glucose levels (m mol/l) of individual rats in negative control group at 1, 2, 3 and 4 hours after adrenaline injection.

Rat No.	Blood Glucose Level (m mol/l)				
	0 hr	1 hr	2 hr	3 hr	4 hr
1	5.2	8.2	8	6.1	6.3
2	4.9	8	8	6.6	6.7
3	4.2	10	9.2	7.7	7.3
4	4	9.1	8.4	5.8	5.5
5	3.1	8.2	6.2	6.7	5
6	4.5	11.6	10.8	8	5.7
Sum	25.9	55.1	50.6	40.9	36.5
Mean	4.32	9.18	8.43	6.82	6.08
S.E	0.30	0.57	0.62	0.35	0.34

**Table II** Blood glucose levels (m mol/l) of individual rats in positive control group (glibenclamide) at 1, 2, 3 and 4 hours after adrenaline injection.

Rat No.	Blood Glucose Level (m mol/l)				
	0 hr	1 hr	2 hr	3 hr	4 hr
1	4.8	4	3.6	2.5	1.3
2	4.7	4.5	4.6	1.2	2.1
3	4.3	3.8	4.8	3.6	3.6
4	3.9	4.5	5.3	4.5	3.2
5	3.7	5.2	4.8	3.8	3.6
6	4.5	6.3	5.3	2.6	2.8
Sum	25.9	28.3	28.4	18.2	16.6
Mean	4.32	4.72	4.73	3.03	2.77
S.E	0.18	0.37	0.26	0.48	0.37

**Table III** Blood glucose levels (m mol/l) of individual rats in tested group (ethanolic extracts 0.25 g/kg of *Tribulus terrestris* L.) at 1, 2, 3 and 4 hours after adrenaline injection.

Rat No.	Blood Glucose Level (m mol/l)				
	0 hr	1 hr	2 hr	3 hr	4 hr
1	4.4	7.6	7.8	8.7	5.8
2	4.8	7.3	7.1	5.3	3
3	4	4.6	3.9	3.3	2
4	2.7	3.8	4.3	3.8	2.8
5	4.1	6.7	6	5.3	5.2
6	4	7	6.2	5.1	4.5
Sum	24	37	35.3	31.5	23.3
Mean	4	6.17	5.88	5.25	3.88
S.E	0.29	0.64	0.62	0.77	0.61

**Table IV** Blood glucose levels (m mol/l) of individual rats in tested group (ethanolic extracts 0.5 g/kg of *Tribulus terrestris* L.) at 1, 2, 3 and 4 hours after adrenaline injection.

Rat No.	Blood Glucose Level (m mol/l)				
	0 hr	1 hr	2 hr	3 hr	4 hr
1	4.1	5.9	5.8	5.4	3.8
2	3.1	2.8	3	3.6	4
3	4.2	5.3	7.5	6.3	5.3
4	4	6.8	6.1	5.1	4.7
5	4	7.8	6	4.3	4.2
6	4.2	7.6	6.8	5.6	4.7
Sum	23.6	36.2	35.2	30.3	26.7
Mean	3.93	6.03	5.87	5.05	4.45
S.E	0.17	0.76	0.63	0.39	0.23

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## Acute Toxicity, Antimicrobial Activities and Structure Elucidation of an Isoflavonoid Compound Isolated from the Bark of *Mucuna macrocarpa* Wall. (Pauk net)

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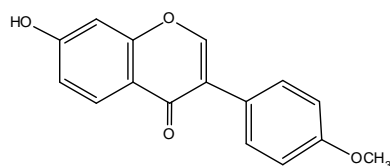
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### Abstract

In this research, *Mucuna macrocarpa* Wall. Pauk net was selected for chemical analysis. The preliminary phytochemical screening of the bark of Pauk net gave rise to the alkaloid, flavonoid, terpene, glycoside, phenolic compound, polyphenol and reducing sugar respectively. Moreover, pure compound was isolated as pale yellow crystal (37 mg) by thin layer and column chromatography separation methods. The yield percent was found to be (0.82%) based upon the EtOAc crude extract. According to the phytochemical test, this isolated compound gave rise to positive test for flavonoid. The melting point of isolated compound is 224-225°C. In addition, antimicrobial activities of this isolated compound were rechecked by using agar well diffusion method. The ethanol extract of this isolated compound responded medium activities on all selected organisms. Furthermore, the acute toxicity test was done by the method of Litchfield and Wilcoxon. The 90% EtOH extract of bark of *Mucuna macrocarpa* Wall. was tested for acute toxicity on albino mice. This extract showed no lethal effect when tested for acute toxicity (LD<sub>50</sub>) up to maximum dosage of 8 g/kg and so it was practically non-toxic. The molecular formula of this compound could be determined as C<sub>16</sub>H<sub>12</sub>O<sub>4</sub> (Hydrogen Deficiency Index = 11), applying some spectroscopic methods such as FT-IR, <sup>1</sup>H NMR (500 MHz), <sup>13</sup>C NMR (125 MHz), DEPT and EI-Mass spectral data respectively. The complete structure of this isoflavonoid compound could be elucidated by DQF-COSY, HMQC, HMBC and DEPT spectroscopic methods. The elucidated structure of isolated compound could be described as below.



7-hydroxy-3-(4-methoxyphenyl)-4H-chromen-4-one.

**Keywords :** *Mucuna macrocarpa* Wall, acute toxicity, antimicrobial activity, albino mice, isoflavonoid.

## 1. Introduction

The knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures are used by traditional medicine in the maintenance of health and in the prevention, diagnosis, improvement or treatment of physical and mental illness” (WHO, 2010). There are many different systems of traditional medicine, and the philosophy and practices of each are influenced by the prevailing conditions, environment, and geographic area within which it first evolved (WHO, 2005), however, a common philosophy is a holistic approach to life, equilibrium of the mind, body, and the environment, and an emphasis on health rather than on disease. Generally, the focus is on the overall condition of the individual, rather than on the particular ailment or disease from which the patient is suffering, and the use of herbs is a core part of all systems of traditional medicine (Engebretson, 2002; Conboy *et al.*, 2007; Rishton 2008; Schmidt *et al.*, 2008). Over the past 100 years, the development and mass production of chemically synthesized drugs have revolutionized health care in most parts of the world. However, large sections of the population in developing countries still rely on traditional practitioners and herbal medicines for their primary care. In Africa up to 90 % and in India 70 % of the population depend on traditional medicine to help meet their health care needs. In China, traditional medicine accounts for around 40 % of all health care delivered and more than 90% of general hospitals in China have units for traditional medicine (WHO, 2005). However, use of traditional medicine is not limited to developing countries, and during the past two decades public interest in natural therapies has increased greatly in industrialized countries, with expanding use of ethnobotanicals. In the United States, in 2007, about 38% of adults and 12% of children were using some form of traditional medicine (Ernst *et al.*, 2005; Barnes *et al.*, 2008).

In Myanmar, Pauk net grows in the valley area. This plant was distributing in Bago, Chin, Kachin, Mandalay and Shan area of Myanmar. The juice of bark of *Mucuna macrocarpa* Wall. is used for ulcer. Decoction or alcohol extract of the bark of Pauk net is used for injuries, rheumatism, alleviates muscle pain and back pain. The structure elucidation of isoflavonoid compound isolated from the bark of Pauk net was done by using spectroscopic spectral data such as <sup>1</sup>H NMR(500 MHz), <sup>13</sup>C NMR(125 MHz), DEPT, DQF-COSY, HMQC, EI-Mass and HMBC respectively.

## 2. Research Objectives

The Objectives of the present research work are;

- 2.1 To evaluate scientifically acute toxicity crude extracts of the bark of Pauk net
- 2.2 To isolate the pure bioactive organic compound
- 2.3 To elucidate the structure of isolated compound

## 3. Research Methodology

### 3.1 Apparatus and Materials

The sophisticated instruments which are used in the isolation and structure elucidation of isoflavonoid compound are presented as follows.

1. UV-lamp (Lambda-40, Perkin-Elmer Co., England)
2. FT-IR Spectrophotometer (Shimadzu, Japan)
3. <sup>1</sup>H NMR Spectrophotometer (500 MHz)
4. <sup>13</sup>C Spectrophotometer (125 MHz)
5. EI-Mass Spectrophotometer
6. Electric balance (Shimadzu, Japan)
7. Melting point mechine

### 3.2 Materials

Commercial grade reagents solvents were used after distillation. Analytical preparative thin layer chromatography was performed by using percoated silica gel (Merk Co. Inc, Kiesel gel 60 F<sub>254</sub>). Silica gel Merk Co.Inc, Kiesel gel 70-230 Mesh ASTM) was used for column chromatography. Iodine vapor and UV detector were used for visualizing the compound situated on TLC plates.

### 3.3 Sample Collection

The bark of *Mucuna macrocarpa* Wall. was collected from Kyaukme township, Shan State, Myanmar. The bark of collected sample was cut into small pieces and

allowed to air dry for one month. The dried sample was stored in a well-stoppered bottle and used throughout the experiment.



**Figure 1**  
Plant of *Mucuna macrocarpa* Wall.



**Figure 2**  
Bark of *Mucuna macrocarpa* Wall.

#### 3.4 Acute Toxicity Study of Plant Sample

Toxicological studies of a new drug or chemical in animals are necessary for any pharmaceutical intended for human use. Traditionally, the determination of drugs toxicity has included acute, sub-chronic, chronic and reproduction studies in young and mature animals (Ghosh, 1984).

#### 3.5 The Acute Toxicity Test (Litchfield & Wilcoxin, 1949)

The acute toxicity test on 90 % EtOH extracts of bark of plant materials were done by the method of Litchfield and Wilcoxon (1949). In this study, a total of 40 adult mice (ddy strain) of male sexes weighting (25-35 g) were used for ethanolic extract of *Mucuna macrocarpa* Wall. They are separated into 4 groups. Each contain on 10 mice.

On the experiment day, all groups of mice will be fasted overnight and only water will be given. Three doses (2 g / kg, 4 g / kg and 8 g / kg) of three test extracts will be administered orally. The ambient temperature was maintained at 26 ± 1°C. The mice were individually marked on the part of the body with picric acid staining for each group in different sites (e.g. head, neck, back, tail, head back and head tail etc.) administered orally with various concentrations of extract.

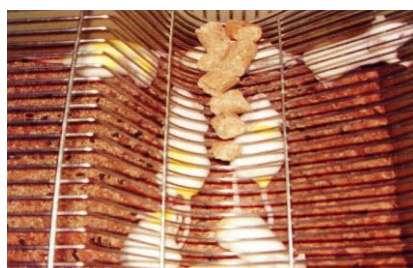
After administration of the drug, Figure (3), the mice were separately housed in standard aluminium cages in groups of three and allowed access to food and water, Figure (4). The remaining group served as control and will be given distilled water only. The mice were observed continuously for the first 6 hours for mortality, should it occurs, and then every 24 hours for 14 days. The mice were also closely examined for



signs of intoxication, lethargy, behavioral modification and co-morbid states as described in Table (3).



**Figure 3**  
Administration of Drug Suspension  
to the Mouse



**Figure 4**  
Albino Mice (ddy strain) House in  
Separate Cages for the Study

### 3.6 Materials

The 90% ethanolic extract of bark of *Mucuna macrocarpa* Wall., Balance (OHAUS, Corporation-CD 11, 2EO, 11-S.A), distilled water, beaker, disposable syringe (1 ml), dosing cannula, 2 straight (18 Guage intragastric dosing cannula), aluminium mice cages with water bottle.

### 3.7 Theory

Acute toxicity is the toxicity produced by a pharmaceutical when it is administered in one or more doses during a period not exceed 24 hours. After pharmaceutical administration animals should be observed for 14 days to detect possible delayed toxicity or death.

Test in which single doses of the drug are used in each animal on one occasion only for the determination of LD<sub>50</sub> or median lethal dose (MLD), ie., the dose which will kill 50% of the animals of a particular species, one rodent (mice or rat) and one no rodent usually rabbits and two routes of administration (one by intended route to be used subsequently). It is considered sufficiently adequate if LD<sub>50</sub> with confidence limit is established on one common laboratory species, such as mice or rats by the standard method.

Acute toxicity tested is used to establish an approximate or precise lethal dose of a compound in different species by different routes of administration. The test are carried out by giving progressively increasing dose of the compound to individual animals or groups of animals until an end point, usually death, is reached, or until an arbitrary large limit has been reached. All animals must be carefully observed during the test and of autopsy for any effects apparently associated with administration of the

compound. Limiting pharmacological effects may be manifested; they may indicate the target organs for toxic effects and the results may then give some guidance about the choice of dose or subsequent repeat-dose toxicity studies.

In any screening programmer, acute toxicity tests on mice are usually performed first. The compound is administered once orally at various dose levels to groups of five to ten mice of male sexes about equal in number which have been fasting overnight (about 18 hours). At least three or four dose levels causing less than 50 percent but not zero percent, and more than 50 percent but not 100 percent mortality should be used. The intravenous route is preferable to the intraperitoneal route because many drugs get detoxicated by the liver when given by the latter route. Whenever possible the solvent should be isotonic saline and the usual volume of intravenous injection should be 1 to 10 ml/kg and maximum 50 ml/kg.

3.8 Extraction and Isolation of Isoflavonoid Compound (Mc Murry, 1999 and Stable, 1965)

Air dried sample 800 g was percolated with 95% ethanol (2.8 L) for about two months. Percolated solution was filtered and concentrated to yield residue. It was extracted with ethyl acetate (400 mL) and evaporated. The ethyl acetate crude sample (4.5 g) was obtained. It was fractionated by column chromatography over silica gel (70-230 mesh) eluted by various solvent ratio of n-hexane and ethyl acetate from non-polar to polar. Totally (115) fractions were obtained. These fractions were combined according to same  $R_f$  values under UV lamp and iodine detector. Ten combined fractions (A – J) were obtained. The combined fraction H gave one spot on TLC in ( $R_f = 0.47$ ) with n-hexane: EtOAc (1 : 1 v/v) and UV active. The pure compound pale yellow needle shaped crystal (37 mg) was obtained. The yield percent was found to be (0.82%) based upon the EtOAc crude extract.

#### 4. Research Results

4.1 Preliminary Phytochemical Screening of the Bark of *Mucuna macrocarpa* Wall (Harbone, 1984)

Phytochemical screening was carried out by general methods to indicate the presence of general classes of phytochemical constituents. In accordance with phytochemical tests, the sample consists of alkaloid, flavonoid, terpene, glycoside, phenol, polyphenol and reducing sugar, respectively. These results are shown in Table (1).

**Table 1** Result of preliminary phytochemical tests

No	Constituents	Reagents used	Observation	Results
1	Alkaloid	Wagner's reagent Dragendroff's reagent	Reddish brown Orange ppt	+
2	Flavonoid	EtOH, Mg, conc. HCl	pink color solution	+
3	Steroid	Pet ether, conc. H <sub>2</sub> SO <sub>4</sub> , acetic anhydride	No Green color solution	-
4	Terpene	CHCl <sub>3</sub> , (CH <sub>3</sub> CO) <sub>2</sub> O, Conc: H <sub>2</sub> SO <sub>4</sub> ,	Red color solution	+
5	Glycoside	10% Lead acetate	White ppt	+
6	Reducing sugar	Benedict's solution	orange ppt	+
7	Phenol	1% FeCl <sub>3</sub> solution	Dark green solution	+
8	Polyphenol	1% FeCl <sub>3</sub> , K <sub>3</sub> Fe(CN) <sub>6</sub>	Deep blue solution	+

(+) = Present constituents (-) = Absent constituents

#### 4.2 Antimicrobial Activities of the isolated Compound

Antimicrobial activities of isolated compound were tested by using agar well diffusion method on six selected organisms with ethanol solvent. The results are described in Table (2) and Figure (5).

**Table 2** Results of Antimicrobial Activities of Isolated Compound

Sample	Solvent	Inhibition Zone					
		I	II	III	IV	V	VI
compound	EtOH	++	++	++	++	++	++
Control	EtOH	-	-	-	-	-	-

agar well ~ 10mm

Organisms

10 mm ~ 14 mm (+)

I. *Bacillus subtilis*

IV *Bacillus pumilus*

15 mm ~ 19 mm(++)

II *Staphylococcus aureus*

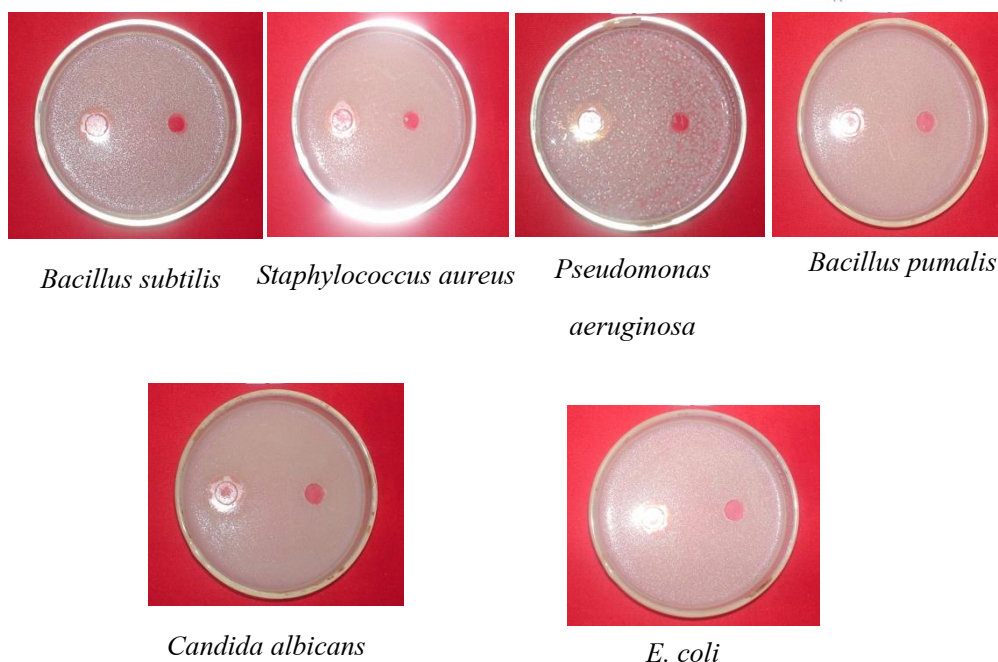
V *Candida albicans*

20 mm above (+++)

III *Pseudomonous aeruginosa*

VI *E. Coli*

According to this table, the ethanol extract of isolated compound gives rise to medium activities on all selected organisms.



**Figure 5** Antimicrobial Activities of Isolated Compound

#### 4.3 Determination of Melting Point of Isolated Compound

The compound was inserted into the capillary tube and melting point was determined by using SMP 30 ADV melting point apparatus (UK). Melting point of this compound was found to be 224-225°C.

#### 4.4 Phytochemical Test of Isolated Compound

Phytochemical test for isolated compound was carried out by general methods to classify the compound. It gives pink color solution with Mg coil and concentrated HCl solution. It is accordant with the structure of isolated compound.

#### 4.5 The Acute Toxicity Tests of *Mucuna macrocarpa* Wall.

The acute toxicity test was done according to the method described by Litchfield and Wilcoxon (1949). The acute toxicity test of *Mucuna macrocarpa* Wall. extract on albino mice was observed that even with the estimated maximal permissible dose (8g/kg b.w) of 90% EtOH and the mice were found to be alive and healthy during the observation period of two weeks. All the animals remained alive and did not show any visible symptoms of toxicity like respiratory disorders, convulsions and death etc. at the dosage tested Table (3). Therefore it was observed that 90% EtOH extract of *Mucuna macrocarpa* Wall. was free from acute toxic harmful effect. The median lethal dose (LD<sub>50</sub>) of plant extract may be more than 8g/kg body weight.

**Table 3** Acute Toxicity Study of 90 % EtOH Extract of Bark of *Mucuna macrocarpa* Wall. on Albino Mice

Parameter	Response	Remark
<b><u>CNS</u></b>		
Motor activity	NAD	Normal
Sedation	NAD	Normal
Screen grip	NAD	Normal
Respiration rate	NAD	Normal
Muscle spasm	NAD	Normal
Tremor	NAD	Normal
Convulsion	NAD	Normal
<b><u>Eyes</u></b>		
Lacrimation	NAD	Normal
Exophthalmos	NAD	Normal
Ptosis	NAD	Normal
Salivation	NAD	Normal
Pilomotor erection	NAD	Normal
Tail erection	NAD	Normal
Diarrhea	NAD	Normal
Micturation	NAD	Normal
Skin color, ear and oral mucosa	NAD	Normal
Blanching	NAD	Normal
Cyanosis	NAD	Normal
Redness	NAD	Normal

NAD = No Abnormalities Detected

CNS = Central Nervous System

**Table 4** Results of Acute Toxicity Test of 90% EtOH Extract of Bark of *Mucuna macrocarpa* Wall. on Albino Mice

Group No.	No. of animals tested	Diet	Dose g/kg	Final volume given ml/kg	Observed period	Ratio of death to tested animals	Death (%)
I (control)	10	stock diet and distilled water	Distilled water	10ml	Two weeks	0/10	0
II	10	stock diet and distilled water	2g/kg*	10ml	Two weeks	0/10	0
III	10	stock diet and distilled water	4g/kg*	10ml	Two weeks	0/10	0
IV	10	stock diet and distilled water	8g/kg*	10ml	Two weeks	0/10	0

Group I : Control

Group III : 90% EtOH extract

Group II : 90% EtOH extract

Group IV : 90% EtOH extract

\*weight of the extract (g) per body weight of albino mice (kg)

According to these results, this extract showed no lethal effect even with the maximum permissible doses of 8g/kg.

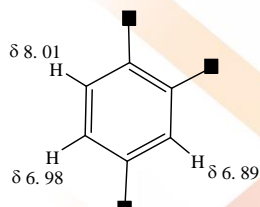
**Table 5** Commonly Used Terms for Toxicities

Commonly used terms	LD <sub>50</sub> Single oral dose per kg in rats/mice	Probable lethal dose for man
Extremely toxic	0.0015 g or less	0.065 g
Highly toxic	0.0015-0.075 g	4 g
Moderately toxic	0.07-0.7 g	30 g
Slightly toxic	0.75-7 g	250 g
Practically nontoxic	7-21 g	1 kg
Relatively harmless	21 g or more	>1 kg

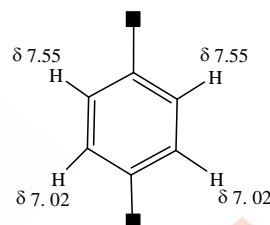
Table 5 presents commonly used terms for toxicities along with the dose equivalents both in rats and humans. In accordance with the experimental results of Table 3, 4 and 5, plant extract of *Mucuna macrocarpa* Wall. was practically non-toxic.

## 5. Discussion

Molecular Formula Determination and Structure Elucidation of Isolated Compound (Porter and Baldas, 1971, LeRoy, 1972, John, (2003, Silverstein, *et al.*, 2005) The molecular formula of isolated compound could be determined by some spectroscopic methods, such as FT-IR, <sup>1</sup>H NMR (500 MHz), <sup>13</sup>C NMR (125 MHz), DEPT, HMOC and EI-Mass spectral data respectively. According to <sup>1</sup>H NMR and <sup>13</sup>C NMR spectral data, there are eleven protons and sixteen carbons in this isolated compound. The kinds of carbons are confirmed by DEPT and HMOC spectral data. Hence, the partial molecular formula could be assigned as C<sub>16</sub>H<sub>11</sub>. According to the FT-IR spectrum, this compound should consist of at least one –OH and one carbonyl group due to the observing at 3419.6 cm<sup>-1</sup> and 1654.4 cm<sup>-1</sup>. On the other hand, 1166.8 cm<sup>-1</sup> and 1095.5 cm<sup>-1</sup> inform the presence of one ether group. Therefore, the partial molecular formula and partial molecular mass are C<sub>16</sub>H<sub>12</sub>O<sub>3</sub> and 252. Moreover, in EI-Mass spectrum, the molecular ion peak shows at m/z 268 which indicates the molecular mass of isolated compound. Therefore, the remaining partial molecular mass is (268 – 252 = 16). It may be one oxygen atom or one NH<sub>2</sub> group. According to the nitrogen rule, the even number of molecular mass must contain either no nitrogen or even number of nitrogen atom. Hence, the partial molecular formula becomes C<sub>16</sub>H<sub>12</sub>O<sub>4</sub>. The hydrogen deficiency index of isolated compound is 11. In FT-IR spectrum of this compound, the bands which appear at 1606.6 and 1581.5 cm<sup>-1</sup> informs the presence of aromatic rings. It confirms by <sup>1</sup>H NMR and DQF-COSY spectral data. According to these spectral data, the following aromatic rings, fragment **a** and fragment **b** could be assigned.

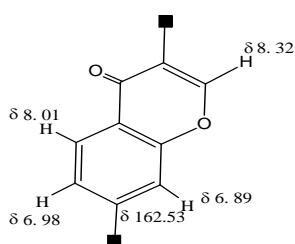


fragment **a**

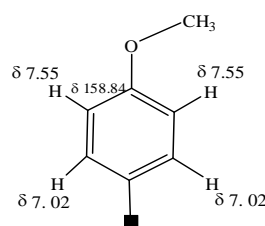


fragment **b**

These tri and di-substituted aromatic fragments could be confirmed by their splitting patterns and coupling constant ( $J$  values) of these  $sp^2$  methine protons in NMR spectrum in which the  $sp^2$  methine protons ( $\delta$  6.98 ppm, dd,  $J = 8.7$  Hz and 2.1 Hz), ( $\delta$  6.89 ppm, d,  $J = 2.1$  Hz) and ( $\delta$  8.01 ppm, d,  $J = 8.7$  Hz) in fragment **a** and two sets of equivalent protons ( $\delta$  7.02 ppm, d,  $J = 8.8$  Hz) and ( $\delta$  7.55 ppm, d,  $J = 8.8$  Hz) in fragment **b** are observed. The occurrence of  $\alpha$  and  $\beta$  proton carbon long range signal in HMBC spectral data gives rise to the following fragments **c** and **d**.

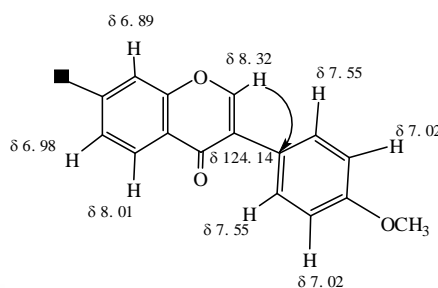


fragment **c**



fragment **d**

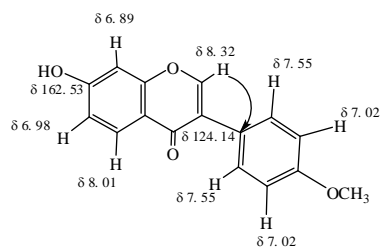
The fragment **e** could be assigned by connecting the fragments **c** and **d** in HMBC spectrum. In this spectrum, the  $sp^2$  methine proton ( $\delta$  8.32 ppm) in fragment **c** has  $\beta$   $^1H$ - $^{13}C$  long range coupling with  $sp^2$  quaternary carbon ( $\delta$  124.14 ppm) in fragment **d**.



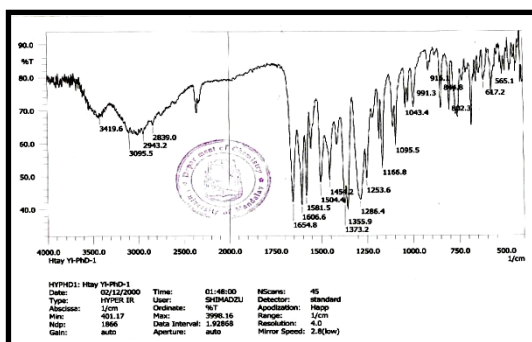
fragment **e**

The partial molecular mass of fragment **e** is 251. According to the information of EI-Mass spectrum, the remaining partial molecular mass is 17. It must be one OH group due to the occurrence of OH functional group in FT-IR spectrum. Therefore, the complete structure of isolated compound is as follow.

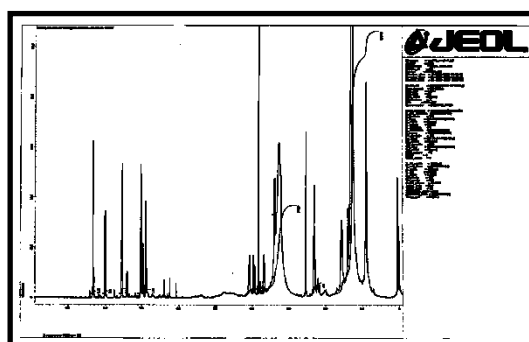




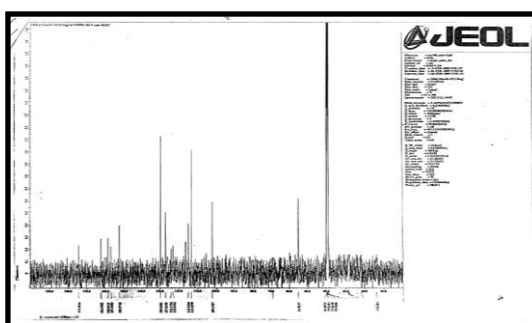
The IUPAC name of this compound is 7-hydroxy-3-(4-methoxyphenyl)-4H-chromen-4-one.



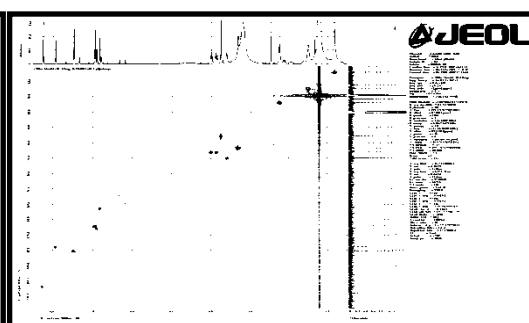
FT-IR Spectrum of Isolated Compound



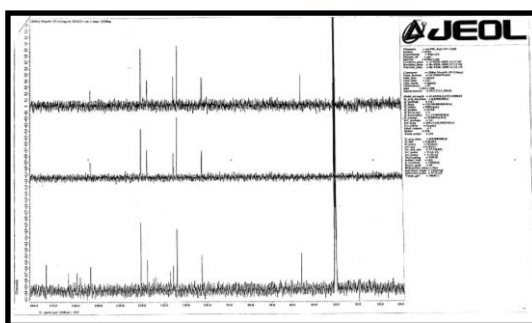
<sup>1</sup>H NMR Spectrum of Isolated Compound



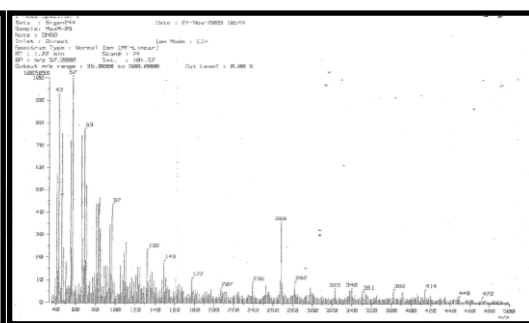
<sup>13</sup>C NMR Spectrum of Isolated Compound



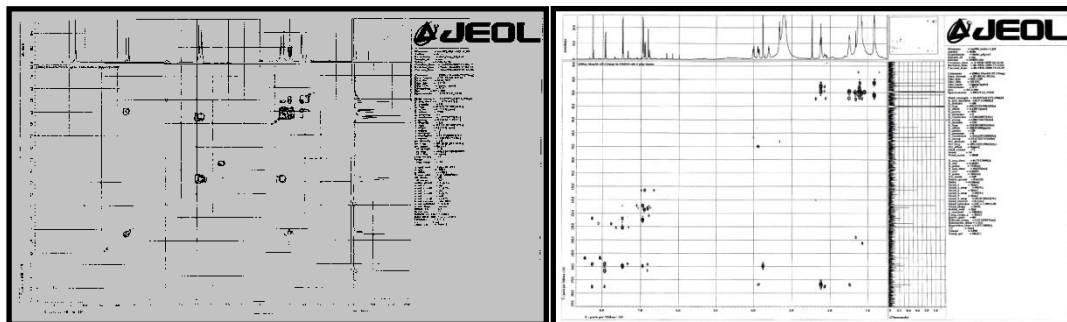
HMOC Spectrum of Isolated Compound



DEPT Spectrum of Isolated Compound



EI-Mass Spectrum of Isolated Compound



DQF-COSY Spectrum of Isolated Compound

HMBC Spectrum of Isolated Compound

## 6. Conclusion

In this research, the preliminary phytochemical screening of the bark of Pauk net gave rise to the alkaloid, flavonoid, terpene, glycoside, phenolic compound, polyphenol and reducing sugar respectively. Antimicrobial activities of ethanol extract of isolated compound respond medium activities on all selected organisms. In addition, the acute toxicity test was done by the method of Litchfield and Wilcoxon (1949). The 90% EtOH extract of bark of *Mucuna macrocarpa* Wall. showed no lethal effect when tested for acute toxicity (LD<sub>50</sub>) up to maximum dosage of 8 g/kg and so it was practically non-toxic. The complete structure of this isoflavonoid compound could be elucidated by applying some spectroscopic methods such as FT-IR, <sup>1</sup>H NMR (500 MHz), <sup>13</sup>C NMR (125 MHz), DEPT, DQF-COSY, HMQC, HMBC and EI-Mass spectral data respectively.

## 7. Recommendations

The 90% EtOH extract of bark of *Mucuna macrocarpa* Wall. showed no lethal effect when tested for acute toxicity (LD<sub>50</sub>) up to maximum dosage of 8 g/kg. It is also recommended that 12 g/kg and 14 g/kg dose of ethanolic extract of bark of Pauk net should be studied for acute toxicity. Moreover, acute toxicity of isolated isoflavonoid compound should be conducted for the treatment of many diseases.

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## Rice, fish and salt's field, way of life in Tung Kula Dimensions

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### Abstract

Tung Kula was originally a subdistrict of Phunkrok and Phrammatap subdistrict. Later, more populations were established. In 1984, it was named Tung Kula and it is still today. The village consists of 10 villages, namely, Ban Pao Man, moo. 2, Ban BuaKhao, moo. 3, Ban Tannop, moo. 4, Ban Nam Om, moo. 5, Ban Non raveang, Moo.6, Ban Ta Seau, moo. 7, Ban Taha, moo. 8, BanTa ek moo. 9, Ban Phom, moo. 10 . Study of methods: Using qualitative research and data collection through document research (literature reviewed, key informants and in-depth interview technique included snowball technique to find out the main informants were community leaders in the past, surname, Meshbud line, TermSuk line, and Pitspeng line, and used the oral history technique, which had the descendants of the Kamnan; subdistrict's leader. The first is Mr. Mao Meshbud, secondly of the village chief is Mr. Udom Trem Suk, the third is Mr. Banjong Pitspeng. Empirical content: It was found that Tung Kula field has heard the territory covers up to 5 provinces in the northeastern region of Thailand. Surin Province Roi Et Province, Yasothon Province, Maha Sarakham Province and part of Buri Ram Province. In the context of the five provinces, the government has a policy to develop the area to be sustainable, which is difficult. The area is divided into the Northeast, upper and lower provinces. There are also many agencies that are responsible but the development is not accessible to the context of the area. Anyway, the authors have developed their views on the management of a single agency area management to cover the development of complete contents with surrounding and access to the benefits of further development to be a province. That means the context of the five provinces in Thung Kula regions. It should have a policy that covers all aspects of development

and has a holistically integrated management structure. Maybe developed into an industrial estate in the center of Jasmine rice cereal world. In terms of a viewpoint in research and community development that focuses on the importance of rice and salt's field in the context of Thung Kula.

**Keywords :** Context of Thung Kula, Way of life

## 1. Introduction

Context and geography of Thung Kula, approximately 67 square kilometers or about 75013 rai, about 16 kilometers north of the district office of Tha Tum, which borders the district is north, adjacent to Suvarnabhumi and Kaset Wisai. Roi ed South contact with Mun River, Tha Tum district. Surin Province. East side of Pho Nakhon district, Tha Tum district, Surin province. West of Promthep Cape. Chumphon Buri District and Pracha Kha Subdistrict, Tha Tum District, Surin Province The area between Mun River and Phanom Dong Rak or Phanom Dong Rak. The nature of the soil is sandy loam. Covered by scrub (Atsak Chomdee, 2009, page 173), especially Tha Toom and Chumphon districts are located in the Mun River basin in the area of Thung Kula Rong Hai.

## 2. Study of methods and area of the study

Using qualitative research and data collection through document research (literature reviewed, key informants and in-depth interview technique included snowball technique to find out the main informants were community leaders in the past, surname, Meshbud line, TermSuk line, and Pitspeng line, and used the Oral history technique, which had the descendants of the Kamnan; subdistrict's leader. The first is Mr. Mao Meshbud, secondly of the village chief is Mr. Udom Trem Suk, the third is Mr. Banjong Pitspeng. Population and social context: As of September 2000, population data for Tung Kula District, Tha Tum District, Surin Province. As of December 2017, a total of 5275 people was classified as 2655 males and 2620 females, the majority of Cambodian dialects are Cambodian (8 Khmer). Less than 20% of the population speaks the Lao Language in Nam oom and Ta seau village.

### 3. Empirical content

#### 3.1 Economic and occupational status

The main occupation is farming in the Tung Kula subdistrict. Silk weaving and animal husbandry Cowboys make extra career. The majority of revenue comes from the sale of Hom Mali rice. Average yield of rice is about 450 kg / rai. The income of about 20,000 baht per household per rai. Overall, the economy of Tung Kula. Considered at a relatively low level. (Information in 2002) And the area of rice cultivation from the agricultural office in Tatum and Agriculture. Tung Kula subdistrict, the area of cultivation and rice field viewer Annual output produced per household. The number of households that fish is sold. And average daily income or monthly income during the fishing season.

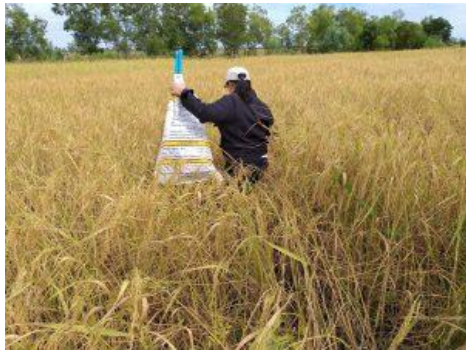


Figure1: rice field



Figure 2: rice productions



Figure 3: rice farmer



Figure 4: rice stock



**Figure 5:** fisherman boat



**Figure 6:** fish seller



**Figure 7:** fish selling



**Figure 8:** fish from Mun river



**Figure 9:** Mun river

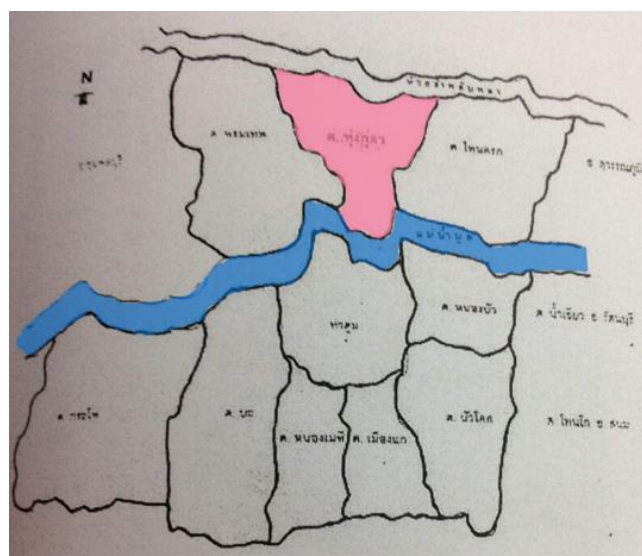
Males mainly do hard labor as a fisherman, a machine and equipment's were used for catching fish and vehicles such as boats in Mun river at Tatum district and females do light labor, fresh fish seller including the care of children or making meals.

According to the authors' survey, it was more common for men than women to inherit river and land.

### 3.2 History of geological features

The study and research of many scholars and folk wisdom especially about jasmine rice. From the question, why rice in this area is the most fragrant in the world? This is because the geology of this area. In the past, geology collapsed as a river or a central basin of the Mun River. The upper stream. In the mountains of Phanom Dong Rak. During the flood season, there will be plenty of flooding to flood the Tung Kula, caused large water, making this area looks like a flood. Traveling to and from the boat. Go to the neighborhood and travel from Roi Et. province connecting through Surin province will have to use the boat to travel almost. Before the road cuts through this area, Traveling, it has used to travel by boat in the past 100 years. The current is very different. Later, there was a road cut to facilitate transportation. Between Roi Et and Surin so the road number 226 and the road between Roi Et. and Maha Sarakham, it was made a waterway obstruction.

The upper Mae Mun River flows into the Mid Mun River, thus making the path of this waterway. Change direction and cause flood. The runoff from the Tung Kula area to the north flows into Tung Kula, and floods in the south make agriculture damaged. Since this area is a lowland area and retains its natural water content during the rainy season from ancient times. And from the geological evidence of submerged woods.



**Figure 10** Mun river as blue color and pink color is Tung Kula's area

**Source:** Kakarndee (2002, p. 16)



The authors are aware of the conservation of resources and environment. Focus on this issue. Therefore, it is interesting to study the relationship of ecology in Tung Kula area. Due to the geological characteristics. Relate to spatial geography. And the excavation has found that. The remains of the trees become many stones. It is estimated that from the surface down to the depth of 8 meters from the ground plane. The area of Phon Sai. Roi Et. and Kan Dong district, Buriram province. It looks like a curly ball which a depth is up to 8 meters before reaching the ground level. It is found that there are large trees lying on the front line full. If dig into the ground so can find it. This is an inorganic substance that lies close to the Earth at a depth of 8 meters beneath the ground.

From this inorganic deposition, geothermal gas is partially evaporated through coarse sandy soils. Partially and evaporated through sandy soils or sandy soil and then pass through the sandy loam that is suitable for agriculture, especially farmers have rice fields. Rice farming, in this area, the inorganic material has evaporated on the top soil. The root of the rice causes the smell of aromatic rice in the world. It is in line with the study of academics who mentioned organic matter in soils. Later, large trees were deposited for a long time. Rubber trees. Wood tree, the deposit is long underground, which may cause a flood or a natural tsunami. It takes a period of 10,000 years, and when it digs into any area, it is visible.

Because of this, it is the origin of the rice cultivar. If the jasmine rice is grown from this source to be cultivated in other areas, it will not smell like rice in the area of Tung Kula. It does not smell like fragrant because of the rice in this area. It is a source of rice is fragrant. The rock salt is seen. In this area it is a part of organic matter caused by the deposition of weeds. And the remains of the tree in the soil until the appearance of fine sand, fine sand, then became a rock salt. Rock salt is a biological fertilizer. It is a component of the chemical fertilizer. In the case of salt, if too much salt in the soil, it will cause death. The salt content must not be too high to prevent the rice from dying. This is due to the movement of the crust. The author has the view that if anyone lives for another 200 years, the area in Tung Kula will see this. All conditions are salt. No longer a rice field. Especially the boundary of Tung Kula adjacent to the border of Nakhon Ratchasima province at Dan Khun Thot district, Nakhon Ratchasima, the condition of the salt field instead of rice fields almost gone. Especially in the past 50 years, salt fields have not been found. As in today, in less than 50 years, the salt field will spread into Tatum district, Surin Province Because of the sliding of the crust. This is a threat to the jasmine rice fields of Tung Kula. It will become a rock salt field in not

more than 100 years because Tatum district is located in the Central Lam Mun. The lower Mun River in Ubon Ratchathani. Mae Mun central area consists of Surin, Sisaket, Roi Et. The Upper Mun River In the area of Buriram and Nakhon Ratchasima. And the area of Dan Khun Thod and Phimai, Nakhon Ratchasima All that is going to become a source of salt. From the shifting of the crust, which moves 1 centimeter per year (cited by the Center for World Scientific Learning and Astronomy, accessed 24 November 2011). Gradually, rice field becomes a salt field, which is formed. It is not likely that over 100 years will become a salt field in this area. In the context of here. Salt production, In the commercial part is also in the Baan Nong Kham Tao's village, Opposite to NongPhai's village, the district of Chumphon buri, Surin Province. On the side of Tha Tum, is a private home in Promthep district, the other side is Ban Prong Sub-district, Tha Tum district, Surin province. Three crescents, there are more than 100 wells in the basin that can bring salt water to the ground. Sandy loam, In the soil there is sodium and low silica.



**Figure 11:** rock salt



**Figure 12:** production of rock salt's method

In the past, the author has studied the history of Surin (Asadang Chomdee, 2009, p. 194). In the past, Surin province was the capital city of Khmer. The rainforest was located in the south-east of the lower part of the Mun River, which was a source of civilization. The history of the founding of Surin and the appointment of the governor or chiefdom of Surin. From, oral history and recording told that use of salt in this area for consumed was carry into Surin city area located in the north, it is the city of Surin in the era of the establishment of Khmer forests in the north. During the reign period under the rule of Ayutthaya and Ratanakosin (Suwat Kaew Suk, 2009, pages 193-198). And history tells about salt Caravans, and the love between men and women stories

happened during the caravan, salt people and the marriage of people who came to trade whether it is a noble in the past, the merchants and villagers. It also found that Khmer ethnic groups from the Thai-Cambodia border, coming the Tatum district married people in the area of salt, ancestors who settled in Tung Kula 200 years ago. First, let's use the " surname ". The relationship of Khmer people on travel to trade and connect to the marriage of people in Tung Kula with outsiders from other regions. From the traces of silk to embroidery. (Provincial Administrative Organization, DPF, pages 29 and 70), which is high-grade silk in the royal court or high-grade cloth for the boss. In the past Surin province. There are also fine silk weaving traces. In Khmer villages with traditional handicrafts, silkworm silk fabric is produced in the style of ancient silk. High class silk textile can see in the area of Chumphon buri district. Patterned of hand-woven silk was similar to (OTOP) fabric, Chan Saoma came from Tha Sawang village, Muang Surin district, Surin Province look like the pattern of the fabric designer named Mr. Veeraydham Trakulgaengthai, an ancient weaver's artist in Surin who designed a silk pattern woven with Indian silk.

Especially the Sompod or Sompad 'Sompod' is a sarong. There is a beautiful pattern which high silk fabric, it is called 'Silk handcraft' which produced high quality silk and was selected as the top product of Chumphon buri district, Surin province and exhibited at the product center of the Muang Thong Thani (OTOP with five stars), and became the heraldry of Dress in the TV movie about Naga. Later, earned a reputation and the fabric pattern. This reflects the natural and geographic resources of Tung Kula. It has a long history, especially as a valuable natural resource for the life of the people in the community. Four basic needs, the rice is the main food and farming. Mulberry growing for silk is used as a material for weaving, as clothing and as an expensive item because of the ancient patterns of cloth used in the royal court.



**Figure 13:** movie star silk decorated



**Figure 14:** silk textile

### 3.3 Way of life in cyclic year

The role and duties of the congregation, in addition to preaching the practice of Dharma and the practice of principles in Buddhism for the benefit of the people in the community. The monks in the district where in Tha tum still have responsibility for community development. Recognizing the conservation of natural resources and environment in the context of Tung Kula subdistrict, Tha tum district, Surin Province. It can be said that the conservation of natural resources and environment, which is the main factor in living and is essential in the community economy at the household level. Rice farming, farming, gardening, home cooking and trading, bringing home and community produce into the community market.

In view of the conservation, values, lifestyle and traditions of the ancestors, the activities of the monks have been supported. Encourage conservation and preservation of ecological environment in this area as: Merit Boat Racing, In the month 12<sup>th</sup> of the year, or in December and celebrate the end of the year, Loy Krathong festival... In month 11<sup>th</sup>. End of Buddhist Lent Day. In month 10<sup>th</sup>. Worship ceremony... In month 9<sup>th</sup>. In the month 8<sup>th</sup> and the Lenten season... In month 6<sup>th</sup>. Songkran Festival in the month 5<sup>th</sup> and the Thai New Year, Traditional worship Day in the month of Makha Bucha, or February Witches worship in the month 3<sup>rd</sup> for the Khmer ethnic group, and in January is celebrate New year day.

## 4. Summary

Linking the role of the Sangha to the community to the traditional culture of the year in Tung Kula, ThaTum district, Surin Province on February, there are folk-related activities related to beliefs, such as the worship of the goddess in the month of Khmer Surin. In April, Songkran festival and respect ceremony adults. There are weddings. In October, there are merit making Buddhist ceremonies. In November, there is a ceremony and a Loy Krathong ceremony. In December, and make a rice field merit. The role of the monks in the conservation of resources and the environment.

In the Loy Krathong festival, the community along the Mun River in Tung Kula area still inherits the tradition of the Loy Krathong to worship, which is a faith, a belief that is integrated with Buddhism. In the middle of the 12th, we have prepared Krathong, the fire of the ornamental offerings. Krathong is also called Loy Krathong.

"So today, we come to Loy Krathong, the spokesman announced that this year we have no floating lantern. Because it is dangerous. But today, according to the tradition of Loy Krathong, we float krathong in floating water with in floating canals in

the river, where we have the water lovers. But if the water must be clean as a bush.” The word “worship” means to show respect to a person or to respect something. There are many relics with flowers, incense, candles, etc.

Physical and sociological context links which is a broadly to be interpreted. To put it; Krathong in the river, it was flowing through as the serpent or the golden dragon purposing, will be worshiped to the Buddha and Loy Krathong Festival in the mid-12<sup>th</sup> month to worship of the footprints on the banks of the river. And worship making to the relics in the Lord Buddha. There are four the tooth of relics which compost of a bottom right tooth relics stayed in Kandy city, Sri Lanka, On the left side of Buddha relics located at China, it is in the Sinkong temple in Beijing, the lower left, it is stay in under water city. The relics part of buddha bone are located around the world and at the Chedi Pagoda, etc." (PhraBrahma vedi, Speechs, Loy Krathong Festival, November 24, 2018)

Loy Krathong is also hidden behind environmental management, "said the water in the canals of the world flow together." History tells the story goes far to the past, linked people traditions with the use of water. To conserve the canal, we worship the water with the float to the footprint. The riverside of India, although footprints. Mostly stamped on the mountain."Water flows through everywhere, (23 November, 2018: Loy Krathong preaching at Sanam Chandra Palace), “compared with the words as "Butterfly moves the wings so effected around the world” (Pinyo Rattanapan, 2011 page 8, from the theory of butterflies move the wings)

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## Health Science (Oral Presentation)

## Evaluating Laboratory Features and Prognostic Factors of Tuberculosis Meningitis : A Vietnamese Retrospective Study

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### Abstract

The main purposes of this study were: To describe the characteristics and the laboratory features of tuberculous meningitis (TBM) patients treated in Vietnam and to determine the relationship between cerebrospinal fluid (CSF) variations and microbiological test result in TBM patients. A total of 620 TBM patients were recruited in this study. Among these patients, 410 patients (66.8%) were male. The median age was 47.8 years. All the cerebrospinal fluids (CSF) parameters were found to be related to the bacteriological confirmed result with P-values < 0.01. Based on the univariate regression, TBM patients were more likely to have high level of protein concentration (OR (odd ratios): 2.93, 95% confidence interval (CI): 1.93,4.47), high total cell counts (OR: 3.03[95% CI: 1.46,7.05]). The low level of glucose in CSF and the low lymphocyte percentage were found to be indicators for TBM result (OR: 0.27 [95%CI: 0.18,0.42]) and (OR: 0.3 [95% CI: 0.2,0.45]), respectively. In multivariate logistic regression, Gene XPert MTB/RIF result test (adjusted odds ratio [aOR]: 9.82 [95% CI: 6.19,15.8], P-values <0.05), Protein level (aOR: 1.81 [95% CI: 1.09,2.98]) and length of stays (aOR: 0.97 [95% CI: 0.96,0.99]) were associated with an increased risk of developing TBM with P-values < 0.05.

**Keywords :** Tuberculous meningitis, diagnostic tests, risk factors, laboratory features, cerebrospinal fluids.



## 1. Introduction

Tuberculosis is one of the most health concern problems worldwide. According to WHO Tuberculosis Global Report 2017, tuberculosis (TB) is one of the ten leading causes of death all over the world. In 2016, TB caused 1.3 million deaths among non HIV people and about 374,000 deaths among people living with HIV (PLWH). Globally, in 2016, there were an estimated 10.4 million TB incident cases making the prevalence rate equal to 140 cases per 100,000 population. More than a half of the cases were diagnosed in the South East Asia and Western Pacific Regions (“WHO | Global tuberculosis report 2017,” n.d.).

Among TB manifestations, Tuberculous meningitis (TBM) is accounted for 1-5% TB cases. However, it is a deadly manifestation due to its impacts on the nervous systems.(Rock et al, 2008). The mortality rates of TBM was reported to be nearly 20% in the first month of treatments and also left 50% patients living with severe neurological sequelae such as blindness and paralysis (Heemskerk et al., 2016). Despite the lethality of this disease, the diagnostic process is still be struggled due to the non-specific clinical symptoms and the low sensitivity of diagnostic test. There is an urgent needed to have prompt diagnosis and treatment so that it can improve the outcome of TBM patients (Modi & Garg, 2013).

TBM is often diagnosed by using the combination of clinical scores and laboratory features. Two clinical scoring systems, Thwaites diagnostic score (GE Thwaites et al., 2002) and the Lancet score (Marais et al., 2010) are commonly used nowadays. These diagnostic scores are based on clinical characteristics and the cerebrospinal fluids (CSF) features. Studies found that the clinical scoring systems had high sensitivity but low specificity when used in non HIV groups (Saavedra et al., 2016; Vibha et al., 2012). On the microbiological field, the culture test has been considered as the reference test for TBM diagnosis. A cohort study conducted in Indonesia reported that the sensitivity of the culture test was nearly 50% when compared with the clinical diagnosis (Chaidir et al., 2018).

In 2012, WHO suggested to use the Xpert/MTB RIFB as an initial diagnostic test for TBM diagnosis, therefore, there have been studies about the accuracy of Xpert test in diagnosing TBM. A Vietnamese study in 2014 found that the sensitivity and specificity of Xpert in diagnosing *Mycobacterium tuberculosis* in CSF was 59.3% and 99.5% respectively (Nhu et al., 2014a).

However, there are still some questions and troubles remains. More details and information of TBM disease are needed to achieve well-understanding about this disease to have appropriate plan for prevent and treatment of TBM.

The main aims of this study were to describe the characteristics and the laboratory features of TBM and its associated factors in Vietnam, one among the 30 high burden TB and Multi-Drug Resistant (MDR) TB countries. Furthermore, the results of this study have the potential to give better and more precise understanding about the roles of CSF parameters in diagnosis TBM, which can help to improve the diagnosis and treatment process of TBM, a lethal disease.

## **2. Research Objectives:**

2.1 Describe the characteristic and laboratory features of TBM patients treated in Vietnam National Lung Hospital.

2.2 Evaluate the associated factors of TBM diagnosis.

## **3. Research Methodology**

### **3.1 Ethical statement:**

Ethical approval was obtained from the Human Research Ethics Committee, Faculty of Medicine, Prince of Songkla University, Thailand (project approval number 61236181). The study was conducted according to the principles expressed in the Declaration of Helsinki.

### **3.2 Study design:**

This study was designed as a cross-sectional retrospective study. It was conducted at Vietnam National Lung Hospital. This hospital is a major tertiary hospital located at Hanoi, providing care to tuberculosis and lung diseases patients of North Vietnam, and also take responsibility for the leader of Vietnam National Tuberculosis Program. This hospital has 800 beds and admits about 15000 in-patients and 20.000 out-patients per years. In 2016, there were nearly 1500 extra-pulmonary TB patients with 400 TBM patients treated in Vietnam National Lung Hospital. All the laboratory tests had been examined in this hospital right after the specimens were collected to ensure the accuracy of these diagnostic tests.

#### **1. Participants**

Data were obtained from the recorded medical data of Vietnam National Lung hospital. We retrospective data from of all patients admitted to hospital with the diagnosis of suspected tuberculosis meningitis (ICD 10 code A17.0) from November

2016 to November 2018. All the patients went through the lumbar puncture to get the cerebrospinal fluids to analysis. Collected data covered the patient's demographic information and laboratory features including the cerebrospinal fluids analysis, MGIT culture test result and the Gene Xpert MTB/RIF result.

Patients were excluded if they did not have the CSF data.

## 2. Procedures

### 2.1 Detection of Mycobacterium Tuberculosis on liquid medium technique (BACTEC MGIT 960 culture test):

A 100- $\mu$ l portion of the deposit was used to inoculate a MGIT tube containing 0.8 ml MGIT supplement (PANTA antibiotics [polymyxin B, amphotericin B, nalidixic acid, trimethoprim, and azlocillin] and growth supplements). MGIT tubes were incubated in a MGIT 960 machine until they were automatically identified as positive or for 56 days. All positive cultures were tested for susceptibility to rifampin, isoniazid, streptomycin, and ethambutol using a Bactec MGIT SIRE kit (Becton, Dickinson) according to the manufacturer's instructions (Hasan, Munshi, Banu Momi, Rahman, & Noor, 2013).

### 2.2 Gene Xpert MTB/RIF test

After collecting the specimen, the CSF will be centrifuged to improve the quality of result (Bahr et al., 2015)(if the amount of specimen is available) and be analyzed with the Cepheid GeneXpert system, based on the manufacturer's instruction. Briefly, 3 ml of sample reagent buffer containing NaOH and iso-propanol will be added to 1 ml of CSF sample at the ratio of 3:1 followed by incubation at room temperature for 15 min. Then, two milliliters of mixture will be transferred into each Xpert MTB/RIF cartridge containing the wash buffer, lyophilized reagents for DNA extraction and PCR amplification, fluorescent detection probes (five for the *rpoB* gene and one for an internal control, *Bacillus globigii* spores). After proper mixing, the cartridge will be loaded in Xpert MTB/RIF instrument. The automated instrument performs specimen mixing, sonication of the mycobacterial bacilli and internal control spores, DNA release and mixing with the PCR reagents. It is followed by hemi-nested real time-PCR amplification, target detection by five-color fluorescence molecular beacon probes with one color fluorescence for the internal control and then completed by an automatic process as per the Instrument standard protocol, all in-situ. Results will be generated in 2 hours and reported as MTB negative or positive with the semi-quantified bacillary load as high, medium, intermediate, low and RIF sensitive, resistant or indeterminate.

### 2.3 CSF analysis parameters:

In this study, the cerebrospinal fluids have been examined with standard procedures. These fluids have been tested for total cell counts, including the white blood cell counts and the percentage of WBC in CSF. Besides, we tested for CSF serums such as glucose level, protein level based on the standard instruction. We considered the cut-off values of these variables based on the Lancet score with the cut-off value of CSF protein was 1g/l to be positive and more than 2 mmol/l for the glucose level. About the lymphocyte percentage, the cut-off value to be positive was chosen to be 50%. (Marais et al., 2010).

### 3. Statistical analysis

Data was entered and analyzed using Microsoft Excel (2013) and EpiData version 3.0 (The EpiData Association, Odense, Denmark). Data analysis were done with R software version 3.4.3 with suitable packages (epicalc, tidyverse, epiR..).

Descriptive analysis was done using mean with standard deviation, median with interquartile range (IQR) and percentages was used for categorical variables. Data between the variables were compared using the Chi-square test. For continuous variable comparisons, the Manny Whitney and Kruskal Wallis test were used. Multivariate logistic regression was performed to define the associated factors of TBM bacteriological confirms. We considered the P-values < 0.05 as significant.

## 4. Result

### 4.1 Patient characteristics

A total of 620 patients suspected to TBM have been included in this study. Of these subjects, 410 patients (66.8%) were male (Table 1). The median age was 47.8 years. The baseline characteristics of the patients are shown in Table 1.

**Table 1** The baseline characteristic of TBM patients

Variables	Mean	S.D.
Age	47.82	20.41
Length of stays (days_	17.43	11.37
White Blood cell counts (G/L)	9.85	4.38
Blood Glucose level (mmol/l)	7.23	2.62
Blood Protein level ( g/L)	67.68	7.6

**Table 1** (Continue)

Variables	Mean	S.D.
CSF Glucose level ( mmol/L)	3.6	5.04
CSF Protein level ( g/L)	1.43	2.82
CSF Lymphocyte percentage (%)	64.3	25.35

Median of CSF lymphocyte percentage was 64.3. Only 14 cases (2.3%) had the CSF lymphocyte percentage lower than 10%. Ten percent of TBM patients 70.3% had the lymphocyte percentage range from 10% to 30%, between 30% and 50% in 91 cases (14.2%), and between 50% and 75% in 154 cases (24.8%). 282 cases, equal to 45.2% of total cases had the characteristic of CSF lymphocyte predominance (75%). Median CSF glucose level was 1.48 mmol/l (IQR: 0.76–2.55). CSF glucose level was < 1.1 mmol/l in 34 cases (5.5%), between 1.1 and 2 mmol/l in 106 cases (17.1%). Nearly eighty percent of patients had the glucose levels higher than 2 mmol/l.

#### **Culture test and Gene Xpert MTB/RIF test results**

A total of 147 (23.7%) patients were MGIT culture test positive, out of 620 suspected patients. The possibility obtained by the Gene Xpert MTB/RIF were 148 cases (23.9%) and the negative result were 472 cases (76.1%). Of these, 56 patients had only culture test positive, and another 91 patients had both culture and Xpert MTB/RIF positive result.

#### **The relationship between CSF parameters and TBM diagnosis**

When examining the odd ratios of CSF parameters to TBM diagnosis. The association between CSF features and TBM status were shown in Table 2. Table 2 compares the demographic variables and the laboratory features between in the two groups of TBM confirmed and non-TBM confirmed patients.

**Table 2** Comparison of baseline characteristics between non TBM group and definite TBM (using the culture test as the reference)

Variables	MGIT Negative	MGIT Positive	P value
Total	473	147	
Age			0.801
0-15 years old	30 (6.4)	11 (7.6)	
15-30 years old	64 (13.6)	21 (14.5)	

**Table 2 (Continue)**

Variables	MGIT Negative	MGIT Positive	P value
30-60 years old	232 (49.2)	74 (51)	
60-90 years old	146 (30.9)	39 (26.9)	
Sex			0.594
Male gender	319 (67.4)	95 (64.6)	
Female gender	154 (32.6)	52 (35.4)	
Length of stays( days)	15.4(8.8-23)	15.6 (11.6-21.3)	0.716
White blood cell counts (G/L)	9 (6.8-11.6)	6.8 (5.9,7.7)	0.494
Blood Glucose (mmol/L)	6.5 (5.7-7.9)	6.68 (7)	0.242
CSF Glucose (mmol/L)	3.3 (2.4-4.1)	2.4 (1.5,3.4)	< 0.001
CSF Protein (g/L)	0.8 (0.4-1.6)	1.6(0.8-2.4)	< 0.001
CSF Total cell counts (cells/uL)	115 (30-380)	316.7 (164.5-590)	< 0.001
CSF Lymphocyte(percentage)	77 (52.5-89)	50 (30.9-75.8)	< 0.001
Gene Xpert/MTB RIFF result			< 0.001
Negative	416 (87.9)	56 (38.1)	
Positive	57 (12.1)	91 (61.9)	

As observed, the two groups were not significantly different in terms of demographic factors and blood tests (age, genders, length, white blood cell counts, blood glucose levels )(P-values >0.05). On the other hand, comparison of the cerebrospinal fluids analysis (CSF) (CSF total cell counts, CSF lymphocyte percentage, CSF glucose, CSF protein level and Xpert MTB/RIFF test) between the two groups revealed that there were significant differences between non TBM group and TBM group with P-values < 0.01. Briefly, based on the univariate regression, TBM patients were more likely to have a high level of protein concentration (OR: 2.93, [95% CI: 1.93,4.47]), high total cell counts (OR: 3.03 [95% CI: 1.46,7.05]). The low level of glucose in CSF and the low lymphocyte percentage were found to be indicators for TBM result (OR: 0.27 [95%CI: 0.18,0.42]) and (OR: 0.3[95% CI: 0.2,0.45]), respectively.

**Table 3** Factors associated with definitive TBM

Factor	Crude odd ratios	95% confidential interval	P-values
CSF lymphocyte(% of white cell count)	0.3	0.2-0.45	0
CSF glucose( mmol/L)	0.27	0.18-0.42	<0.01
CSF total cell count (cell/mL)	3.03	1.46-7.05	0.002
CSF Protein (G/l)	2.93	1.93-4.47	0
Gene Xpert MTB/RIF test	11.86	7.52-18.7	0

In multivariate logistic regression, some variables had been excluded from the model due to the model fitting process. The final model with lowest Akaike Information Criterion (AIC) included the CSF lymphocyte percentage, CSF protein, CSF glucose level, Xpert MTB/RIF test and length of hospital stays. The adjusted odd ratios for each variables were shown in Table 4.

**Table 4** Multivariate logistic regression for the relationship between CSF parameters and culture test result

Factors	Adjusted Odd ratios	95% confidential interval	P-values
CSF lymphocyte percentage 50%	0.62	0.39-1.01	0.052
CSF glucose level > 2 mmol/l	0.6	0.36-1.01	0.05
CSF Protein level 1 g/l	1.81	1.09-2.98	0.02
Gene Xpert MTB/RIF test	9.82	6.19-15.8	0.001
Length of stays	0.97	0.96-0.99	0.04

Gene Xpert MTB/RIF result test aOR: 9.82 [95%CI: 6.19, 15.8], P-values <0.05), Protein level (aOR: 1.81 [95%CI: 1.09, 2.98]) and length of stays (aOR: 0.97, [95% CI: 0.96, 0.99]) were associated with an increased risk of developing TBM with P-values < 0.05.

## 5. Discussion

In this study, we have examined the characteristics and laboratory features of TBM patients. We also evaluated the associated factors of TBM diagnosis including the CSF parameters and the Xpert MTB/RIF test.

The length of stays in hospital of patients in this study were 15.4 days (8.8-23) among non-bacteriological confirm TBM patients and 15.6 days (11.6-21.3) in the bacteriological confirmed group. This result was similar to previous study due to the basis of TBM disease as a sub-acute disease (GE Thwaites et al., 2002). A cohort study conducted in China 2016 (He, Han, Chang, Wang, & Huang, 2017) also reported the median length of stays in hospital of TBM patients was 20 days ( IQR, 14-60 days).

There were no significant different between two genders or ages group with the P-values > 0.05. A half of definite TBM cases was found in patients age group 30 to 60 years old, like previous study (Huo, Zhan, Liu, & Wu, 2018). White blood cell counts and other blood serums were reported have no significant relationship with the TBM diagnosis (P-values > 0.05). All CSF parameters were found to be associated with TBM status (Table 2). The CSF lymphocyte percentage had associated with TBM confirmed (OR 0.3, 95 CI%: 0.2,0.45, P-values = 0), consistent with previous study(Torok et al., 2008).

In our study, the positive result of MGIT culture test was 147/620 cases (23.7 %) and the positive result of Gene Xpert MTB/RIF test among TBM patients was 148/620 (23.8 %), respectively. To compare with previous studies, our study had similar result. In a study in Vietnam 2014 (Nhu et al., 2014a), they found the MGIT positive was 121/379 and the Xpert MTB/RIF positive cases was 109/379 cases. Xpert performance can be enhance with the centrifuged specimen (Bahr et al., 2015). Another study in India examined the performance of XPert/MTB RIF and MGIT culture test in diagnosing TBM noted 52 cases ( 19.5%) was cultures detected positive by MGIT-960. On the other hand, Xpert MTB/RIF assay detected 38 (14.2%) as positive for MTB(Rufai et al., 2017).

The sensitivity of Xpert MTB/RIF test when considered the culture test as the reference was 61.9% and the specificity was 87.9%, respectively. However, there were 51 cases have the Xpert MTB RIF test result positive while the culture test result negative which equal to the false negative rate (FNR) was 38.1%. This result can be explained as the difference between Gene Xpert technique and the culture technique. Xpert MTB/RIF test can detect even the dead bacteria while the culture test was based on the growth of *Mycobacterium Tuberculosis* which takes long time to provide



the result (the usual duration is 4-6 weeks). However, this diagnostic test is still the most necessary diagnostic test for TBM diagnosis with its ability to find *Mycobacterium Tuberculosis* and drug-resistant types. On the other hand, the Xpert/MTB RIF<sup>r</sup> test is a rapid test which should be used to support the TBM diagnostic procedures along with the culture test. Other techniques can be used to improve the accuracy of Xpert MTB/RIF<sup>r</sup> test such as using the centrifuged specimen or increasing the CSF volume.(Bahr et al., 2015),(Nhu et al., 2014b)

About the relationship between CSF analysis and the result of culture test which confirms the definite diagnosis, our study found that, Gene Xpert MTB/RIF<sup>r</sup> test and CSF protein level higher than 1g/l and also the length of stays in hospital were associated with the culture test result. A high level of protein concentration in CSF increased the risk of being TBM with OR 1.81 ([95% CI: 1.09, 2.98], P-values <0.05). As expected, the result of Xpert test was consistent with the culture test result. A patient with Xpert MTB/RIF<sup>r</sup> positive had 9.8 times risk higher to have the culture test positive ( OR: 9.82 , [95% CI:6.19,15.8],P-values < 0.05) . This finding indicated that Xpert MTB/RIF<sup>r</sup> test was reliable and initial test for TBM diagnosis along with the culture test. The length of hospitalization also was an indicator to predict the risk of being TBM with OR: 0.97 [95%CI: 0.97, 0.99], P-values <0.05). Our result was similar to previous studies. In a China study, they found the length of stays in hospital predicted the risk of death in TBM patients.(He et al., 2017)

In our study, the CSF protein level were associated with risk of being TBM. The increasing CSF protein level suggested the appearance of TBM. This findings was consistent with previous study (Raberahona et al, 2017; Torok et al., 2008). On the other hand, based on the logistic regression, the decrease of CSF lymphocyte percentage and the glucose level was found to be a prognosis factors for the TBM diagnosis with OR 0.6 [95% CI:0.39,1.01] and OR 0.62 [95% CI: 0.36,1.01]. However, this result was not significant with P-values was 0.05. There are needed further studies to confirm about this finding. In a study published in 2009, Thwaites reported the role of white blood cell counts in CSF as a predictor to distinguish between TBM and other bacterial meningitis (Guy Thwaites et al., 2009). Moreover, previous studies found the lymphocyte predominance was consider as a predictor of TBM diagnosis. (Cresswell et al., 2018; Garg & Sinha, 2011). However, these studies were conducted in PLWH group in which the proportion and characteristics of TBM patients may not similar to non HIV group.

White blood cell counts was found to have no significant relationship with the TBM status. In previous study, white blood cell counts have been considered as one of the predictors for TBM diagnosis. (G. E. Thwaites, van Toorn, & Schoeman, 2013)

Our study had some limitations. This study has been designed as a retrospective study, so that we could only access the data records of laboratory features without the clinical symptoms. Further studies which including the combination of clinical symptoms characteristics and laboratory features is needed. Secondly, this study examined all the TBM patients treated in this hospital but not stratified them as HIV status or adult and children. Previous studies suggested the different prevalence and characteristic between the PLWH group and the non HIV group and also for the adult and children group. This result would be different from developed countries due to the complicated situation and high TB prevalence in Vietnam. However, we retrospective a large numbers of patients in order to give a clear view about the TBM situation in high prevalence countries. We also used the standard diagnosis process and examine the specimens with WHO recommends procedures, which can minimize the biases.

The Xpert MTB/RIF test and the culture test are two main diagnostic tests for determining *Mycobacterium Tuberculosis* bacteria in TBM disease. Both of them has been recommended as the initial TBM diagnostic tests (Marais et al., 2010). Therefore, it is crucial to have clear view about their performance in diagnosing TBM. Other parameters such as CSF lymphocyte percentage, CSF protein level and CSF glucose level should be considered as the predict factors for the TBM status.

## 6. Conclusion and Recommendations

Tuberculosis meningitis is still a troublesome disease. Despite of many advantage techniques have been developed in recent years, the diagnostic process still need to enhance to improve the TBM outcome(G. E. Thwaites, van Toorn, & Schoeman, 2013b). The Xpert MTB/RIF test has found to be a good and reliable diagnostic test in diagnosing TBM due to its rapid result with high sensitivity and specificity. However, the culture test still remain a necessary test to confirm the final TBM diagnosis. CSF protein level was found to be an indicator for TBM diagnosis. Besides, the roles of CSF lymphocyte and glucose level need further studies to confirm about their performance in diagnosing TBM.

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## Fish-borne Parasitic Infections in Northeast, Thailand

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### Abstract

Fish-borne trematode (FBT) ; *Opisthorchis viverrini* (OV) and *Minute Intestinal Fluke* (MIF) are continuous public health problem in Northeast Thailand. Despite continuous efforts for decades by healthcare organizations to overcome this problem. This survey research aimed to investigate fish-borne parasite metacercaria infections and identify morphology and characteristic of parasite in cyprinoid fish collected from six natural reservoirs within three provinces (Surin, Sri-saket, Kalasin), Northeastern Thailand during one year period from February 2016 to February 2017. The study was conducted, data being collected with pepsin digestion technique and stereomicroscope, respectively. The data were analyzed by frequency, percentage and mathematical means. The results found that a total of 665 Cyprinidae family fish including 15 species were collected from different study areas, and investigated for fish-borne parasites. The infection rate was 9.62% (59/665), predominantly in *Barbonymus altus* and *Puntius brevis*, respectively. The prevalence of Minute Intestinal Fluke (MIF) namely *H. taichui* was 58.33% (7/12). This findings suggested that natural fish species in rural communities are still a source of fish-borne parasitic infection and put local people at risk, therefore public awareness and prevention campaigns are urgently required.

**Keywords** : Fish-borne Parasites, Thailand.

## Alternative Medicine for Osteoarthritis in elderly patients, Phrapokklao Hospital Chanthaburi Province ; Trend and Health Promotion

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### Abstract

Osteoarthritis is the most common form of arthritis, affecting millions of people worldwide. It occurs when the protective cartilage on the ends of your bones wears down over time. The investigator will focused on the quality and quantity aspects of information gathering. Which is done by interviewing, observations, and focus group seminars of several Thai traditional medicine doctors and folk doctors in Chanthaburi city. The prospective outcome to be used as an alternative choice of treatment for either the health care provider and the patient who suffer from osteoarthritis of knee. 1.) Study a Thai traditional treatment to approach patients with osteoarthritis of knee. In Thai traditional medicine we called this disease “lom-jab-phong” which divided into lom-jab-phong-hang and lom-jab-phong-Nham. Treatment started from massage the effected area to help relaxed the muscle ,stimulate the circulation, and reduce pain. Follow by herbal steam to help relaxed and relief pain of the muscle and stimulate better circulation. Then use a herbal compress to helps reduce inflammation, swelling, bruises, and pain. 2.) Study the current situation and problems from Thai traditional medicine treatment used to treat patients with osteoarthritis of knee at Phrapokklao hospital in Chanthaburi city in a year period. There is 349 patients that undergone the Thai traditional medicine treatment processes as described in ‘1.’. Combine with herbal medicine taking orally such as Derris scandens extracts to help relief muscle pain and reduce muscle inflammation. 3.) Study how to approach osteoarthritis of knee in Thai traditional medicine today applying the knowledge of Holistic medicine to promote maximum health. Holistic medicine is a form of healing that considers the whole person : physical, mental and social . The body, using herbal compress, herbal medicine, and herbal wrap. The mental, advice to do meditation therapy to decompress stress, worries, and promote better sleep. The social, is to be able to reach out and ask for help and to

be able to follow through the treatment process. This is to be one of an alternative choice for treatment of Osteoarthritis of knee

**Keywords** : trend, health promotion, osteoarthritis, alternative medicine



## Helminthiasis in Remote Area in Northern Thailand

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### Abstract

Helminthes infections are a major health problem worldwide. The following estimates are based on those of the World Health Organization (WHO) between 1975-1986. Clonorchiasis and Opisthorchiasis: 19 million infected. Paragonimiasis: 3.2 million infected Fasciolopsiasis: 10 million infected Ascariasis: 1 billion infected Hookworm: 900 million infected Trichuriasis: 500-800 million infected Strongyloidiasis: 35 million infected, continue to be significant public health problems in Thailand. Ministry of Public Health has established a national plan to promote and coordinate interaction and intervention among provincial public health sectors. The purpose of the study were to investigate the prevalence and associated factors with helminthiasis. The investigator were observe and conducted on reliable information regarding the nature and prevalence of helminthiasis in remote area, Thailand. This study investigated the children and their parent for parasitic diagnostic techniques. The results showed the majority from stool sample was 63.2 % from children' age below 15 year old. The overall prevalence of helminthiasis among the Thai hill tribe people was 15.4%. The helminthiasis prevalence of *Ascaris lumbricoides*, *Taenia* spp. and hookworm were 11.10%, 2.60% and 1.70 % respectively. The study showed that the prevalence of helminthiasis is still high and require the health educational program in the remote area. The investigators would propose the health promotions and behavioral investigations can help to solve the problems based on learning ability for developmental and self-consciousness on the

individual level *and* community for the prevention and control of parasitic worms infection.

**Keywords :** Helminthiasis, Remote area, *Ascaris lumbricoides*

## Herbal Medicine for Chronic Liver Failure Treatment in Prapokklao Hospital Chanthaburi

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### Abstract

The Research and Development of Herbal Medicine Commercially Prepared for Chronic Liver Failure Treatment in Prapokklao Hospital Chanthaburi province focused on research and development of herbals medicines and extracts for chronic liver failure treatment, the analysis of raw material quality in “Phattapitta” formula based on the pharmacopoeia requirements found that all herbal materials have a moisture content not exceeding 10%. The results of the preparation of the “Phattapitta” formulation extracts found that 184 kg of raw material powder baked with 925 liters of water then evaporated it would get 10.80 kg of “Phattapitta” formulation extracts powder, meaning 65.38% of formulation extracts powder equal to 7.06 kg which came from the powder formulation of 170.25 kg, representing a yield of 4.15%. The qualitative analysis of extract which is consists of 3.96% polysaccharides and 0.64% of uronic acid, found galacturonic acid, neutral sugars- most of them are  $\alpha$ -D(+)-Glucose and Galactose, moreover it also found the other compounds such as Phenolic compounds, flavonoids and green fluorescent substances. In addition, this water extract does not detect heavy metal whether it is cadmium (Cd), lead (Pb), arsenic (Arsenic) nor aflatoxin G1 and B1, and microbial contamination. Phattapitta formula extract is preparing to be changed in form of capsule for having 4 capsules per meal. The results of hematological evaluation are in normal however clinical chemistry rate of rats especially creatinine, total bilirubin, and albumin are changed but still in the normal range. Therefore, the Phattapitta Formula extracts with does 60, 300 and 1500 mg per kilogram for 270 days does not cause chronic toxicity.

**Keywords :** Chronic liver failure, Chronic liver failure patients, Thai traditional medicine,

## Fish Borne Trematode Metacercariae Infection and Cholangiocarcinoma In Myanmar

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### Abstract

Opisthorchiasis associated Cholangiocarcinoma, CCA in Southeast Asia is an aggressive cancer with high mortality rates. It is known to cause a significant health burden in the opisthorchiasis region in Thailand and possibly throughout mainland southeast. The conventional diagnostic method for human fish-borne trematodes, including OV, is searching for eggs in fecal samples. Several methods have been used such as the modified formalin ether concentration technique, the modified thick Kato smear, and Stoll's dilution egg count technique and for the detection of trematode metacercariae in second intermediate host, it has been mostly used pepsin digestion method. Among the important fish borne trematodes *Haplorchis taichui* (the heterophyid fluke of the Heterophyidae family) and *Opisthorchis viverrini* (the liver fluke of the Ophisthorchiidae family) were the most common flukes in many parts of Southeast Asia including Thailand, Lao PDR, Vietnam and Cambodia. According to literature, the prevalence of the former species found at 6 times more than that of the latter. Since there are not so many reports for trematode metacercariae infections in the second intermediate host among the regions of Myanmar, a survey on metacercarial infections in the second intermediate host was conducted in some species of cyprinoid fishes collected from three locations from Myanmar. These regions were Location 1 -Kuzang Dam, Thangata, Bago Region, Location 2- Nyantate river, Mawlamyine, Mon State, Location 3- Kawgarate Hline Wa, Myawaddy, Kayin State. Collected cyprinoid fishes were investigated for trematode metacercariae by pepsin digestion techniques and identified under stereoscope. The invested findings show that metacercariae of minute intestinal fluke infection is contaminated in *Thynnichthys thynnoides* species of fishes from the Location 1 -Kuzang Dam, Thangata, Bago Region. *Opisthorchis viverrini* infection has not been detected in all three locations. These could be a useful index in

the trematode epidemiology in a particular area. Therefore, investigation of metacercarial infections in the second intermediate host can provide a more valuable information on the trematode epidemiology.

**Keywords :** Fish-borne trematodes, *Haplorchis taichui*, Cholangiocarcinoma,

## Traditional Medicine in Myanmar

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### Abstract

Myanmar, a tropical country, has a dramatic history of traditional medicine system and a great source of medicinal plants. The Myanmar Government's National Health Policy has incorporated traditional medicine within the realm of treatment while also encouraging service and research in the field. The four-year Health Plans have also included traditional healthcare into the mainstream of the health program. With the aim to extend the scope of health care services by traditional medicine, in this research work, the overview of Myanmar traditional medicine has been presented. The personal interviews are conducted with randomly selected 21 responsible persons by using structured questionnaires. The influencing factors on traditional medicine laws in Myanmar, herbal gardens and traditional medicine museums, manufacturing of traditional medicine in Myanmar and traditional medicine practitioners association have been presented in this research. It is found that, nowadays, traditional medicine plays an important role in Myanmar. In place of chemicals, natural raw materials are increasingly being used in medical treatment and pharmaceutical industries. Thus, upgrading the sector of traditional medicines can be of great benefit to the country and the people. Traditional medicine is being used more frequently in Myanmar. However most often these are choices made by the patient. Integrating traditional medicine into mainstream health care would require research to understand the efficacy, safety, and mechanism of action of traditional medicine systems. This research has been done through literature review, interviews and questionnaires. The last part of the report provides suggestions to make research on traditional medicine more acceptable and useful, with the ultimate goal of integrating traditional medicine into mainstream healthcare with sufficient knowledge about the efficacy, safety, and mechanism of action of traditional medicine systems.

**Keywords :** traditional medicine, Myanmar

## 1. Introduction

According to the World Health Organization atlas (2002), “traditional medicine (TM)” refers to health practices, approaches, knowledge, and beliefs incorporating plant, animal, and mineral based medicines, spiritual therapies, and manual techniques applied individually or in combination to treat, diagnose, and prevent illnesses or maintain wellbeing. It is worth noting that the description of TM given by the WHO in 2002 may have altered in some respects since then. Traditional medicine treatments have been followed in Myanmar for generations and continue to be popular even today. As for WHO’s definition, traditional medicine is "the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness". Research studies have been done on applying various herbal plants for such purposes by different investigators.

The Health Ministry has a separate Department of TM that looks into formal education in the field, has set up 14 Traditional Medicine hospitals and 237 clinics, and ensures distribution of traditional medicine kits in states and districts. There are over 9000 registered traditional medicine practitioners in the country, though only 1612 have degrees from public institutions. Mandalay has a full-fledged University of TM and eight herbal gardens have been developed, the largest being the 196-acre National Herbal Park in Naypyitaw that boasts of over 500 different species including some rare ones.

### 1.1. Traditional Medicine Laws in Myanmar

Traditional Medicine Council Law – The Myanmar Indigenous Medicine Act was enacted in 1953. The State Traditional Medicine Council, a leading body responsible for all the matters relating to TM, was formed according to that law. In the year 2000, the Myanmar Indigenous Medicine Act was replaced by the Traditional Medicine Council Law. One of the objectives of the law is "to supervise traditional medicine practitioners for abidance by the rule of conduct and discipline". At present there are 6752 registered traditional medicine practitioners under the Traditional Medicine Council Law.

### 1.2. Herbal Gardens and Traditional Medicine Museums

With the aims of perpetuation of medicinal plant species, sustainable development of herbal medicines and provision of quality raw materials for public and private pharmaceutical factories, the department developed eight herbal gardens around

the country. The largest one which is designated as the National Herbal Park is situated in Nay Pyi Taw covering 196.4 acres of land since its inception on 4th January 2008.

### **1.3. Manufacturing of Traditional Medicine**

The government is giving impetus to develop TM systematically up to international standard and to manufacture potent and efficacious Traditional Medicines based on scientific evidences and practices. Traditional Medicines have been manufactured by both public and private sectors. The Department of Traditional Medicine is responsible for manufacturing in the public sector and owns two pharmaceutical factories. Medicines are produced according to the national formulary and Good Manufacturing Practice (GMP) standards.

### **1.4. Myanmar Traditional Medicine Practitioners Association**

Myanmar TM Practitioners Association has been established in 2002 after unification of various TM groups of different disciplines. The objectives of the association are to: provide consolidated efforts and contribution of TM practitioners in implementation of National Health Plan; provide community health care through TM approaches; do research and strive for the development of TM; conserve the endangered species of medicinal plants and animals while revitalizing the almost extinct TM textbooks and therapies and uplift the dignity of TM profession and practitioners. The most important missions are to conduct continuing TM education programs, to provide quality services and to encourage the development of evidence based TM through systematic research.

## **2. Research Objectives**

Since over 2000 years ago, Myanmar has possessed and nurtured a civilization, high enough to set up city states and the traditional medicine was already flourishing significantly as a major part of the Myanmar cultural superstructure during this time. At the same time, traditional medicine is being used increasingly not only in Asia but also in the rest of the world including developed countries. It is indicating the important role of traditional medicine in public health care services at grass-root level. Thus the aim of this research is to investigate tremendous use of traditional medicines in Myanmar and whether it is also contributing primary health care needs of Myanmar people.



### **3. Research Methodology**

Nowadays, alternative medicine plays an important role internationally. In place of chemicals, natural raw materials are increasingly being used in medical treatment and pharmaceutical industries. Thus, upgrading the sector of traditional medicines can be of great benefit to the country and the people. In Myanmar, the general public places its trust in traditional medicine. Inexpensive and having few side effects, TM is used on a daily basis especially among the poor. However, the quality of traditional medicine and the qualifications of traditional medicine practitioners remain a significant problem.

#### **3.1. Traditional Medicine Drug Law**

According to the interview responses, the Government has promulgated the Traditional Medicine Drug Law in 1996, in order to supervise systematically the production and sale of traditional medicine in the country. One of the objectives of the law is "to enable the public to consume genuine quality, safe and efficacious traditional drugs". According to the law, all the traditional medicine drugs produced in the country have to be registered and the manufacturers must have license to produce their products. There are more than 10,000 registered TM drugs and the license for production is issued to more than 2000 manufacturers. Manufacturing of traditional medicine drugs must follow the good manufacturing practice. The department also supervises and monitors the advertisement of traditional medicine drugs.

#### **3.2. Herbal Gardens and Traditional Medicine Museums**

According to the data, thousands of medicinal plants of nearly 500 different species are grown and nurtured, and commonly used and valuable herbs according to regional habitat can also be studied. There are three TM museums run by the department: one in University of TM, Mandalay and two in National Herbal Park, Nay Pyi Taw. People from all walks of lives can study the roots and current situation of Myanmar TM at one sitting. The raw materials from animal, plant, mineral and aquatic sources used in TM drug formulations are also displayed colorfully. Hundreds of herbarium sheets are also prepared to disseminate the knowledge of medicinal plants.

#### **3.3. Manufacturing of Traditional Medicine**

The two factories manufacture twenty one kinds of Traditional Medicine powders which are provided free of charge to be dispensed in public TM facilities, and the factories also produce 12 kinds of Traditional Medicine drugs in tablet form for commercial purpose. The private Traditional Medicine industry is also developing and undertaking mass production of potent and registered medicines according to the GMP

standard. Some private industries are now exporting traditional medicines to neighbouring countries. Due to the encouragement and assistance of the government and the manufacturing of standardized traditional medicine, public trust and consumption of TM have greatly been enhanced. There is a progressive increase in demand for traditional medicine in both rural and urban areas.

### **3.4. Traditional Medicine Practitioners Conference**

In order to promote the development of Myanmar Traditional Medicine, Myanmar Traditional Medicine Practitioners Conferences has been held annually since the year 2000. TM practitioners from various parts of the country gathered and exchanged their knowledge at the conference, new policies and objectives are proposed, discussed and also reiterated the unity of TM healers for perpetuation and propagation of Myanmar Traditional Medicine. Myanmar practitioners of TM usually gather in Nay Pyi Taw to discuss promoting and improving traditional medicine. The leading committee and the working committee meet at the Ministry of Health and Sports in Nay Pyi Taw on convening the annual conference and seminar of Myanmar Traditional Medicine Practitioners, which is slated to be held during January as part of efforts for producing professionals in the TM field.

## **4. Research Results**

Under this research, a study was conducted of the present state of traditional medicine. Based upon the results, target areas were selected for collecting information on herbal medicine. The collected information and data was then analyzed. This research makes recommendations for improving pre- and post-graduate education and on-the-job training for TM practitioners.

It is also found that the innovative Myanmar traditional medicine manufacturer has high level of creativity. The determinants of creativity of manufacturers are in both personal and institutional nature. Those are personal traits of risk-taking and innovativeness, and the institutional capabilities of formal education on TM and cooperation with stakeholders. It is found that the idea generation for new medicine drugs generally stems from the combination of formal education, practical experience from giving treatment on patients, and manufacturer's creative thinking. Discussions and decisions which will come out of the research will be emphatically implemented and more research work will be carried out under the guidance of alternative medical practitioners in order to develop the field of alternative medicine.

Starting from 2000, conferences were convened annually. It is necessary for implementing the decisions which will come out from seminars. Concurrently, it is necessary to continually develop research work on Myanmar TM. Discussions and decisions which will come out of the research will be emphatically implemented and research work will be carried out under the guidance of alternative medical practitioners in order to develop the field of alternative medicine. It is necessary to continually develop research work on Myanmar TM.

## **5. Discussion**

The research demonstrated convincingly that there is the necessity for a new way to plan and conduct research on TM. Future directions include (i) policy making and standardization, (ii) training of researchers in TM with a combination of conventional research methods and those relevant exclusively to TM, (iii) financing research in TM and guidelines for writing and reviewing research grant proposals, and (iv) planning and designing studies in TM. Policy making and standardization are perhaps the most difficult challenge in TM systems. The Department of Traditional Medicine, Ministry of Health has formed a Technical Committee for the development of Myanmar Herbal Pharmacopoeia (MHP) in order to establish the quality specifications of Myanmar medicinal plants together with their traditional therapeutic uses.

## **6. Conclusion**

To make it possible for TM to be integrated into mainstream medical care it is essential that there be an attempt to have policies and specific nodal agencies to control and provide guidelines for this to be done properly. Training of researchers in TM in conventional research methods and those relevant to TM is an essential step to increasing research in TM. It is important to realize that many persons trained in using TM have a deep and abiding belief in the system of healing.

## **7. Recommendations**

Hence this research has attempted to provide an idea in the field of TM on the possible guidelines for future directions which could make research in Myanmar more authentic as well as more scientifically. The ultimate goal would be to arrive at standardized systems of TM which can be integrated into mainstream healthcare, after

having sufficient research-based information about their efficacy, safety, and mechanisms of action.

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## Education (Poster Presentation)

## A Study of Mathematics Learning Activities Management Using 7 Steps Problem-Based Learning Based on Action Research

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### Abstract

The objectives of this research were: 1) To study Mathematics Learning Activities with 7 steps problem-based learning in hopes that students could have mean score more than 70%. 2) To study student satisfaction towards a 7 step problem-based learning. The samples were composed of 36 students from primary 4, Roi-Et Rajabhat University Demonstration school during the first semester of the 2018-2019 school year. They were selected by purposive sampling method. The research instruments consisted of 13 lesson plans that included “a 7 step problem-based learning” format including 3 practices cycles, the End Cycle Test and the satisfaction assessment form. The research design was Action Research framework by Kemmis and McTaggart including 4 phases: 1) the Action Planning, 2) the Action, 3) the Observation, and 4) the Reflection. The statistics employed to analyze the data were percentage, mean and standard deviation. The results revealed that 1) The score of student’s learning achievement on first cycle was 76.67, the second cycle was 81.11, the third cycle was 86.53 and mean of all cycles was 81.44 who passed the setting score criterion. 2) Students’ satisfaction towards 7 steps problem-based learning ranked 1) Knowledge and benefits, 2) Teaching style, 3) Content and Understanding, and 4) Teacher.

**Keywords :** Problem-Based Learning, Primary, Mathematics, Learning Activities, Action Research

## 1. Introduction

Mathematics plays an important role in the success of learning in the 21st century. Mathematics helps individual's creativity, and allows to think logically, and systematically. Additionally, it can assist with analyzing problems or the situation can be carefully and thoroughly helping to anticipate, plan, and solve problems properly and can be used in real life. (Ministry of education, 2017, p.1). Good teaching and learning of mathematics should provide students with knowledge of the content and skills at the same time. Problem-solving skills are the heart of mathematics learning management but teaching and learning in mathematics today does not focus on teaching problem solving skills in addition to teaching various content. Today's math is mostly focused on knowledge, memory and application of mathematical formulas to solve problems in the textbooks alone. Problems in managing mathematics learning have occurred continuously for many years.

The result from Primary 6 O-NET examination in 2017 showed that most of the students in Thailand, 197,243 people, 27.99 percent, scored in the range of 20.01-30.00 points while students in the northeastern region received an average score of 34.96, which is lower than the national average. (National Institute of Educational Testing Service, 2018). The result from PISA 2012 indicated that students average score was far below the international average; it was lower by more than one level and half of students did not attain international basic level. (Klainin,K, 2015, p.19).

The tests show that the teaching and learning of mathematics in Thailand does not affect the potential development of students. There are many researchers and educators trying to design a good, quality mathematics teaching model (The Institute for the Promotion of Teaching Science and Technology, 2012, p.7, Clarke V., 2003, p.28, Khammanee, T., 2012, p.320). From the analysis of various tests and the study of experts from many sources, the researcher found that most questions or problems are applied to real-life mathematical content. The examiner must show reason together with the response and some questions cannot use a formula to solve the problems directly. Therefore, the teaching and learning of mathematics using real life situations is a matter that teachers must be aware of and use in the classroom. The method of teaching and learning that can be used in real situations is learning management by Problem-Based Learning.

Problem-Based Learning (PBL) is a way for students work in small learning teams, bringing together collective skill at acquiring, communicating, and integrating information. (Duch,B., Groh, S. & Allen,D.(Eds.), 2001, p.6). PBL is a method of organizing

a course to have learning activities by using real problems found in the workplace or profession. Walker, A. et al. (2015, p.8) said problems in the real world are ill-structured (or they would not be problems). A critical skill developed through PBL is the ability to identify the problem and set parameters on the development of a solution. When a problem is well-structured learners are less motivated and less invested in the development of the solution. The research of Na Nakhon, K. (2010) and Siribunsob, S. (2015) and other related research found that teaching by using problem-based learning enables learners to have better academic achievement and learners are satisfied with the teaching style at a good level.

The researcher is, therefore, interested in the researcher is, therefore, interested in exploring the relation between problem-based learning and mathematics activities. This research would be a study of Mathematics Learning Activities on 7 steps problem-based learning as well as looking at the satisfaction of students.

## 2. Research Objectives

This research consisted of two objectives:

- 2.1 To study Mathematics Learning Activities with 7 steps problem-based learning in hopes that students could have mean score more than 70%, and
- 2.2 To study student satisfaction towards a 7 steps problem-based learning.

## 3. Research Methodology

### 3.1 Samples

The samples were composed of 36 students from primary 4. They were selected from a total population of 80, upper elementary level at Roi-Et Rajabhat University Demonstration school during the first semester of the 2018-2019 school year. They were selected through a purposive sampling method.

### 3.2 Research Instruments

The research instruments were 13 lesson plans of 7 steps problem-based learning including 3 practices cycles: 1<sup>st</sup> cycle. The 1<sup>st</sup> – 4<sup>th</sup> lesson plan which teaching about writing and comparison amounts of money. 2<sup>nd</sup> cycle was 5<sup>th</sup> – 8<sup>th</sup> lesson plan which teaching about telling the value of money exchange and solving money problems. 3<sup>rd</sup> cycle was 9<sup>th</sup> – 13<sup>th</sup> lesson plan which teaching about writing notes for income. In each lesson plan, the instructional activities utilized the problem-based learning format. There are 7 steps from the synthesis of 18 expert steps by researchers as follows



- 1) Hello problems
- 2) Aim to understand
- 3) Plan for analyze
- 4) Try to study
- 5) Technically synthesis
- 6) Accredite the result
- 7) Reflecting the outcomes

The End Cycle Test consisted of each cycle using multiple-choice questions and subjective questions, each with 20 scores. Last, the satisfaction assessment form was used. The researcher constructed the satisfaction assessment form by experts' opinions. Improve the satisfaction assessment form based on expert recommendations. It is divided into 4 parts. Part 1 is Teaching style. Part 2 is Content Understanding. Part 3 is Teacher. Part 4 is knowledge and benefits.

### **3.3 Data Collection**

The research design was an Action Research: AR of Kemmis and McTaggart including 4 phases: 1) the Action Planning, 2) the Action, 3) the Observation, and 4) the Reflection. The following were the stages of data collection:

1. The Action Planning (P): study basic information Related documents, research, school context and student context Then analyze data and determine the research plan.

2. The Action (A): Create a learning unit, lesson plans, the end cycle test and the satisfaction assessment form then teach the students by using tools created.

3. the Observation (O): The researcher will observe and record changes during research. And then summarize the focus group to proceed in the next operating cycle.

4. the Reflection (R): After the end of each cycle, the operation will be evaluated for teaching and learning activities from the observation form. Various records, questionnaires, including tests for data to reflect the results of the researcher is the process of evaluating and examining the problem process or what is the limit is an obstacle to the practice by analyzing, evaluating, sharing with teachers, researchers and research consultants to bring the information to improve and plan in the next cycle.

### **3.4 Data Analysis**

The researcher analyzed the data at the end of each cycle by using the 20 scores of multiple choices and subjective tests by percentage, mean and standard deviation then comparing with the criteria of the research that no student scored less

than 70%. At the end of all cycles, the researcher gave the student satisfaction assessment form and analyzed the results by frequency distribution, mean, percentage and interpretation by using criteria of Srisaart (2011, p.121) as follows:

4.51 – 5.00	mean	Most satisfied
3.51 – 4.50	mean	Very satisfied
2.51 – 3.50	mean	Moderate satisfied
1.51 – 2.50	mean	Less satisfied
1.00 – 1.50	mean	Least satisfied

#### 4. Results

The results of the study of Mathematics Learning Activities using q 7 step problem-based initiatives were shown in table 1 below:

**Table 1** Test results at the end of each cycle

Cycle order	Full score	Lowest score	Highest score	Mean ( $\bar{x}$ )	Percentage (%)
1 <sup>st</sup>	20	12	20	15.33	76.67
2 <sup>nd</sup>	20	12	20	16.22	81.11
3 <sup>rd</sup>	20	15	20	17.31	86.53
<b>Mean (<math>\bar{x}</math>)</b>				<b>16.29</b>	<b>81.44</b>

As shown in Table 1, Test results at the end of 3 cycles has lowest score as 12, highest score as 20. In addition, it was found that the average and the percentage of the score increase steadily from cycle 1 to cycle 3. At the end of 3 cycles, the average score was 16.29, representing 81.44 percent, which pass the criteria as least all of them could have mean score not less than 70%

Student satisfaction based on the satisfaction assessment were shown in Table 2 below:

**Table 2** The average, Standard deviation and the level of satisfaction towards PBL model.

Satisfaction list	Mean ( $\bar{x}$ )	Standard deviation	Satisfaction level	Average Satisfaction
<i>Teaching style</i>				
1. Teaching styles allow students to participate in activities.	4.89	0.39	Most satisfied	Most satisfied (4.74)
2. The teaching style makes students responsible for themselves and the group.	4.92	0.36	Most satisfied	
3. The teaching and learning style makes students enthusiastic about learning.	4.78	0.58	Most satisfied	
4. Teaching styles allow students to freely do activities.	4.53	0.96	Most satisfied	
5. The teaching style makes students think of a variety of ideas.	4.58	0.86	Most satisfied	
<i>Content understanding</i>				
1. Is a study in which learners develop problem solving skills.	5.00	0.00	Most satisfied	Most satisfied (4.71)
2. Is a study in which students learn new knowledge and information on their own	4.94	0.23	Most satisfied	
3. Understand the content learned.	4.64	0.85	Most satisfied	
4. Learning activities make students dare to think and answer.	4.17	1.01	Very satisfied	
5. Is a study that focuses on the problem-solving process rather than the correct answer	4.81	0.57	Most satisfied	
<i>Teacher</i>				
1. Teachers are supportive of student learning.	4.14	0.89	Very satisfied	Most satisfied (4.19)
2. Teachers join discussions with learners.	3.94	0.91	Very satisfied	
3. Teachers show students the role to return to issues when discussing topics other than topics or objectives.	3.81	1.24	Very satisfied	

**Table 2** (Continue)

Satisfaction list	Mean ( $\bar{x}$ )	Standard deviation	Satisfaction level	Average Satisfaction
4. Stimulate learning by using problems as a base.	4.81	0.57	Most satisfied	
5. Assign appropriate tasks.	4.28	0.84	Very satisfied	
<i>Knowledge and benefits</i>				
1. Learning management enables students to apply learning methods in other subjects.	4.81	0.40	Most satisfied	Most satisfied (4.83)
2. Learning management helps students to create knowledge and understanding by themselves.	4.78	0.53	Most satisfied	
3. Learning management makes the content remember for a long time.	4.89	0.39	Most satisfied	
4. Learning management makes content easy to understand.	4.72	0.61	Most satisfied	
5. Learning management makes understanding and getting to know more friends.	4.97	0.16	Most satisfied	
<b>Average satisfaction</b>	<b>4.62</b>	<b>0.62</b>	<b>Most satisfied</b>	

As shown in Table 2, Students' satisfaction towards 7 steps problem-based learning has mean score as 4.62, standard deviation as 0.62 and the overall satisfaction level at the most satisfied. The satisfaction of each criteria was ranked from highest to lowest as

1) Knowledge and benefits which has mean score as 4.83 and students are most satisfied with topic 5: Learning management makes understanding and getting to know more friends.

2) Teaching style has mean score as 4.74 and students are most satisfied with topic 1: Teaching styles allow students to participate in activities.

3) Content Understanding which has mean score as 4.71 and students are most satisfied with topic 1: Is a study in which learners develop problem solving skills.

4) Teacher has mean score as 4.19 and students are most satisfied with topic 4: Stimulate learning by using problems as a base.

## 5. Discussion

A study of Mathematics learning activities on 7 steps problem-based learning found that the score of student's learning achievement on first cycle was 76.67, the second cycle was 81.11, the third cycle was 86.53 and mean of all cycles was 81.44. This satisfied the researcher's criteria that students would not score below 70%. From the research results, the scores in each cycle are increasing because students have adapted to the teaching style by using PBL which is a teaching and learning that focuses on stimulating learning, emphasizing thinking, promoting confidence and the assertiveness of students related with Roh (2003) Problem-Based Learning (PBL) describes a learning environment where problems drive the learning. That is, learning begins with a problem to be solved, and the problem is posed in such a way that students need to gain new knowledge before they can solve the problem. Another is the use of an action research model that divides the unit of learning into 3 units of sub-learning which allowing teachers to know the student's performance periodically. The teachers have observed, made notes and asked the opinions of the students studying in each sub-unit allowing them to use the information to improve the next sub-unit. A Bradbury Huang asked "what is good action research?" and "why the resurgent interest?" as action research is an orientation to knowledge creation that arises in a context of practice and requires researchers to work with practitioners (2010, p.93-109). Unlike conventional social science, its purpose is not primarily or solely to understand social arrangements, but also to effect desired change as a path to generating knowledge and empowering stakeholders.

The satisfaction towards 7 steps problem-based learning based on action research found that students' satisfaction was ranked from highest to lowest as 1) Knowledge and benefits 2) Teaching style 3) Content Understanding 4) Teacher. Students are most satisfied with topic learning that makes understanding and that students like to study in groups, like learning that happens to exchange knowledge between friends. This can include activities that can be shared with friends in class to help students understand and learn mathematics contents well. Learning by using PBL, students need to help each other think and solve problems and exchange ideas with classmates to find the best and most appropriate solution in the student's perspective. Chapakia (2014) study on effects of Problem-based learning on Biology achievement and instructional satisfaction of grade 12 students, sample were 38 students at Phatnawitya school, Thailand. The results about satisfaction were shown at a high level and students know, analyze and solve problems by themselves under team work. Assertive comment,

enthusiasm, responsibility, able to find information themselves and a summary of what was learned. As a result, students to learn deeply and happily.

## 6. Conclusion

The score of student's learning achievement on first cycle was 76.67, the second cycle was 81.11, the third cycle was 86.53 and mean of all cycles was 81.44 who passed the setting score criterion. Students' satisfaction towards 7 steps problem-based learning were ranked from highest to lowest as 1) Knowledge and benefits 2) Teaching style 3) Content Understanding 4) Teacher. The overall satisfaction level at the most satisfied.

## 7. Recommendations

The following are some recommendations based on the research results:

7.1 Applying the 7 steps problem-based learning teaching model to compare between the learning unit or use in other courses to see the effectiveness of teaching styles.

7.2 Applying the 7 steps problem-based learning model to apply the latest innovation and technology.

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## Question-Answer-Relationship(QAR) strategies and Mind Mapping technique to develop Reading Comprehension Skills of Mattayomsuksa 6 Students

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### Abstract

This research aimed to find out if the use of QAR strategies and Mind Mapping can develop reading comprehension. The purposes of this research were : 1) to determine the effectiveness of learning organization by using QAR strategies and Mind Mapping to improve the reading comprehension of Mathayomsuksa 6 students with the effectiveness 80/80 standardized criteria, 2) to compare the ability of English reading comprehension before and after learning by using QAR Strategies and Mind Mapping technique and 3) to study Mattayomsuksa 6 Students' satisfaction toward learning activities through QAR Strategies and Mind Mapping technique. The samples were 51 Mattayomsuksa 6 students studying in the first semester of academic year 2014 at Phayakhaphumwittayakarn School, Phayakhaphumpisai District, Maharakham Province, Thailand chosen by purposive sampling method. The research instruments included lesson plans for Foundation English subject to improve reading comprehension skill by using QAR strategies and Mind Mapping technique. The data were collected through the achievement test in reading comprehension and satisfaction questionnaire. The statistics employed to analyze the data were percentage, mean, standard deviation and dependent sample t-test. The result were 1) The effectiveness of learning organization by using QAR strategies and mind mapping to improve the reading comprehension of Mathayomsuksa 6 students was 84.37 / 81.08, which is higher than the assigned criteria 80/80 2) The students' achievement after learning through learning organization by using QAR strategies and mind mapping to improve the reading comprehension was higher than before with the significance at the .01 level and 3) The students' satisfaction toward learning through learning organization by using QAR strategies and Mind Mapping to



improve the reading comprehension was at the highest level with the mean of 4.74. The results found that after using QAR strategies and mind mapping technique, the effectiveness of students reading comprehension was higher than assigned criteria. It could be summarized that after learning by using QAR strategies and Mind Mapping, students improved their reading skill and this strategy could be used in an instructional process by the teachers who are interested in improving the effectiveness of their instruction.

**Keywords :** QAR , Mind Mapping , reading strategy, reading comprehension

## 1. Introduction

Reading is an important skill for learning in every education field. When we learn inside or outside the classroom or even in daily life we have to use modern technology which use English language. We have used English to communicate by reading for career , connect with others, doing contracts, trading and even in reading the instructions on goods' label. Practicing English reading in the correct way will make the reader recognize what they read (Aksaranukror,1989). Observing English classroom in Phayakkaphumwittayakarn school, the researcher found that the English proficiency level of Mattayomsuksa 6 students was at the low level, especially in the reading comprehension part. Without comprehension, reading will be just like going through the words on a material from left to right without interpretation. The words on the page will hold no significance at all. Despite the fact that people read for various reasons, the top most objective of reading is and will always be to derive understanding or to comprehend what the writer or author of a reading selection wants to convey. Once the information has been processed, putting the information into action comes next. This is why reading for comprehension is very important. So in order to learn how to read with comprehension, there is a need for readers especially students to strategize or find ways on how they can instantaneously process text and meaning from a reading material or article. Thus the researcher reviewed the research about how can students improve their comprehension reading .The review found that there are two powerful reading techniques which can improve reading comprehension skill. They are Question-Answer-Relationship technique (QAR) and Mind-Mapping technique. The Question-Answer Relationship or QAR is a reading strategy which describes how can student access to the reading texts and answer the questions. This strategy includes 4 levels of questions namely : Right There; Think and Search; Author and Me; and On My Own

questions. Some studies reported that QAR strategy has positive effect on students' reading skill. The research findings of Dara Wansanit (2006) identified that the achievement result test of Mattayomsuksa 2 students who got the learning activity by using DR-TA and Ex-QAR was higher than regular class with the statistical significance level of 0.01. Mind mapping technique is one of the techniques that can improve the English ability of the students. Mind-map is the chosen instrument that could help a person to develop a sharp the memory. It is a useful technique that helps the students learn more effectively and improves the way that we record information using. This issue was consistent with the previous studies such as; Dolehanty (2008), found that the students who were taught by using Mind Map could answer the questions after learning more than the students who were taught with regular class. The study result of Lui,Chen, and Chang (2008) found that the students could improve their reading comprehension after they took the class by using Mind Mapping technique and CAI for the first year students who were at low level of English. The various research reviewed above served as a catalyst for the following research study exploring the effectiveness of learning organization by using QAR strategies and Mind Mapping to improve the reading comprehension of Mattayomsuksa 6 students with the hope of solving the students' problem in the reading comprehension skill.

## **2. Research Objectives**

2.1 To determine the effectiveness of learning organization by using QAR strategies and Mind Mapping to improve the reading comprehension of Mattayomsuksa 6 students with the efficiency of 80/80 standardized criteria.

2.2 To compare the ability of English reading comprehension before and after learning by using QAR Strategies and Mind Mapping technique.

2.3 To study Mattayomsuksa 6 Students' satisfaction toward learning activities through QAR Strategies and Mind Mapping technique.

## **3. Research Methodology**

### **3.1 Population and Samples**

The population of the research was 450 Mattayomsuksa 6 students studying in the first semester of academic year 2014 at Phayakkhaphumwittayakarn School, Phayakkhaphumpisai district, Mahasarakham Province. It consists of nine classes.

The samples used in this research consisted of 51 Mattayomsuksa 6/8 students studying in the first semester of academic year 2014 at Phayakkhaphumwittayakarn

School, phayakkhaphumpisai district, Mahasarakham Province. They were selected from the total 450 mattayomsuksa 6 students chosen by purposive sampling.

### 3.2 Research Instruments

The research instruments used in the experiment included lesson plans for Foundation English subject to improve reading comprehension skill by using QAR strategies and Mind Mapping technique. The instruments used to collect data were 1) the achievement test in reading comprehension that considered of 40 items. The test had been qualified in terms of validity, reliability, difficult level, discriminatory power, and facility value and 2) the 25 items satisfaction questionnaire.

### 3.3 Data Collection

Data of the study were collected by means of the following techniques. The testing technique was used when recording data of students' reading comprehension. The test was given on pre-test before the exposure to treatment, and on post-test after the exposure to treatment. The researcher collected the data as the following steps :

3.3.1 By using the research instrument , The researcher administered pre-test which was the multiple choice with 40 items instrument, 40 scores achievement test in reading comprehension for the samples before the treatment.

3.3.2 The treatment was given after the students completed the pre-test. In this part, the researcher taught the students follow the learning organization by using QAR strategy and Mind Mapping techniques to improve comprehension of students. The researcher carried out the treatment for twenty-one hours meeting using seven different texts.

3.3.3 The post-test was given to students after learning by using QAR strategy and Mind Mapping technique. The number of post-test was the same as the pre-test. The use to intend to measure the students' comprehension in reading and to know whether the treatment is effective or not.

3.3.4 After the process, the satisfaction questionnaire was given to students for finding out the satisfaction of students toward learning activities though QAR strategies and Mind Mapping technique.

### 3.4 Data Analysis

The process to figure out the research objectives were :

3.4.1 Compute mean of pre-test and post-test score of students

3.4.2 Finding the efficiency of the lesson during learning process

(E1) and the performance efficiency after learning (E2)

3.4.3 For the calculation to compare the achievement test scores before and after learning by using QAR strategies and Mind Mapping technique by counting the dependent t-test score with the statistic significance at the 0.01 level.

3.4.4 The statistics, mean and standard deviation, were employed to analyze the form in order to find the samples' satisfaction with the learning techniques.

#### 4. Research Results

The results are presented according to the objectives of the research as follows :

4.1 The effectiveness of learning organization by using QAR strategies and mind mapping to improve the reading comprehension of Mattayomsuksa 6 students with the efficiency of 80/80 standardized criteria.

The efficiency of learning lessons using QAR strategies and mind mapping from the trial of 51 Mattayomsuksa 6 students revealed in Table 1.

**Table 1** The efficiency of learning lesson by using QAR and Mind Mapping techniques

Score	Total scores	Average $\bar{X}$	Efficiency (E)
Scores during learning	35	29.53	84.37
Post learning scores	40	32.43	81.08

Table 1 shows the results for the effectiveness of learning organization by using QAR strategies and mind mapping to improve the reading comprehension of Mattayomsuksa 6 students. Efficiency of lessons during the learning process (E1) is equal to 84.37 and the performance efficiency (E2) is equal to 81.08, so the efficiency of the lesson E1/E2 is 84.37/81.08 over the threshold setting of 80/80.

4.2 Comparison of the ability of English reading comprehension between before and after learning by using QAR strategies and mind mapping technique.

To figure out the objectives with independent t-test formula were shown in Table 2 below :

**Table 2** The comparison of the achievement test score before and after learning by using QAR strategies and Mind Mapping of 51 mattayom6 students

Learning outcome	n	$\bar{X}$	S.D.	df	t	Sig.
Before	51	18.67	2.066	50	12.79**	.01
After		32.43	2.830			

\*\* p 0.01    df = 50    t = 12.79

Table 2 shows the results of achievement test scores before and after learning by using QAR Strategies and Mind Mapping techniques. From Table 2, it shows that the learning achievement of students who learned by using QAR strategies and mind mapping techniques with the achievement test scores after learning process had an average of 32.43, higher than the previous test which had an average of 18.67, which is significantly more important at the significance level of 0.01.

4.3 Assessment of learner satisfaction towards the learning activities through QAR Strategies and Mind Mapping technique.

A survey of students' satisfaction assessment is presented in Table 3.

**Table 3** Learners' satisfaction toward the learning activities through QAR strategies and mind mapping technique

Statements	$\bar{X}$	S.D.	Satisfaction Level
<u>Contents</u>			
1. The content is suitable with students' level.	4.67	0.47	The highest
2. Languages and format used in lesson suit with their needs.	4.63	0.50	The highest
3. The content is fashionable.	4.42	0.49	The high
4. The quantity of content suits with time.	4.59	0.50	The highest
5. The content is consistent with students' experience.	4.82	0.38	The highest
<u>Learning activities</u>			
6. There are clear steps for setting up learning activities.	4.52	0.50	The highest
7. The duration of learning activities suits with the time.	4.71	0.46	The highest
8. Learning activities is consistent with learning outcomes.	4.67	0.47	The highest

**Table 3** (Continue)

Statements	$\bar{X}$	S.D.	Satisfaction Level
9. Learning activities provide opportunity for students to take part in the activities.	4.92	0.27	The highest
10. Learning activities give a chance for students to exchange their comment.	4.67	0.47	The highest
<u>Instructional Media</u>			
11. Instructional media is fashionable.	4.75	0.44	The highest
12. Instructional media is consistent with content.	4.67	0.47	The highest
13. Instructional media is attracted to students	4.98	0.14	The highest
14. Instructional media enables students easy understand the content.	4.88	0.32	The highest
15. Instructional media encourages the students set up questions	5.00	0	The highest
<u>Instructor</u>			
16. Instructor describes the learning activities to students before teaching.	4.90	0.29	The highest
17. Instructor divides students into groups with mixed ability level.	4.75	0.44	The highest
18. Instructor advises, suggests and well monitors students.	4.90	0.29	The highest
19. Instructor uses the techniques to make students easy to understand the lesson.	4.90	0.29	The highest
20. Instructor promotes the students to be enthusiastic in learning.	5.00	0	The highest
<u>Evaluation Assessment</u>			
21. The evaluation assessment covers the learning content.	4.88	0.32	The highest
22. The evaluation assessment can measure the learning outcomes.	4.67	0.47	The highest
23. Difficulty of The evaluation assessment is at the suitable level.	4.52	0.50	The highest

**Table 3** (Continue)

Statements	$\bar{X}$	S.D.	Satisfaction Level
24. Number of items in the evaluation assessment is suitable.	4.71	0.46	The highest
25. There are various methods of measuring in the evaluation assessment	4.28	0.64	The high
<b>Average</b>	<b>4.74</b>	<b>0.38</b>	<b>The highest</b>

Table 3 shows that the students are satisfied with the learning activities through QAR strategies and mind mapping techniques to develop their reading comprehension. Overall, it is highest level on an average of 4.74 and a standard deviation of 0.38. According to the results above it can interpret that the students in Mattayomsuksa 6 of Phayakkaphumwittayakarn school are satisfied with learning activities using QAR Strategies and Mind Mapping techniques to develop reading comprehension at the highest level.

## 5. Discussion

The findings are discussed below:

5.1 The effectiveness of learning organization by using QAR strategies and Mind Mapping to improve the reading comprehension of Mathayomsuksa 6 students was 84.37 / 81.08, which is higher than the assigned criteria set at 80/80. The success of this research may be caused by the researcher had a systematic instrument making. The instrument had been qualified by the experts in each field. This result is similar to the research of Khampichit (2009) who studied the learning activities though Mind Mapping to improve comprehension reading and found that the performance 20 out of 23 students got the achievement test score of 86.95 / 80 which is higher than the defined criteria 80 / 80 , indicating that learning activities though QAR and Mind Mapping has good efficiency for teaching. This finding also is consistent with the study of Siriprom (2004) who found that the efficiency of the SQ3R English Reading Comprehension Exercise by using Mind Map technique was 87.50/83.33 higher than the assigned criteria 80/80 and is consistent with the research of Blank and Convington (1965) who developed the achievement test score of students by having them set up

their own questions in lesson and the research result found that their scores after learning was higher than before learning.

5.2 The students' achievement test scores deriving from learning activities by using QAR strategies and Mind Mapping to improve the reading comprehension of Mathayomsuksa 6 students. The studies showed that their score on post-test was higher than pre-test at the significance level of 0.01. It can be conclude that learning activities by using QAR strategies and Mind Mapping enable learners to improve their comprehension reading. The learning activities by using QAR empowers students to think about the text they are reading and beyond it, too. It inspires them to think creatively and work cooperatively while challenging them to use literal and higher-level thinking skills. Soontornroj (2002) stated that for using Mind mapping in learning process helps learners to focus on key words and concepts which often become hidden in linear notes. It can help learners to store related facts together and also helps in problem solving because it encourage learners to think of all possible aspects of a problem and various potential solutions. These things affect the optimization in the learning for the students which results in higher student achievement. This finding is also consistent with the findings of Suriya, (2011) which reported that students who were taught by using QAR strategy had improvements in their reading comprehension compared to the ones who were not immersed in the strategy. The finding also corresponds to the research of Premboon(2012) who stated that the efficiency of the improvement of comprehension reading by using Mind Map technique was as 88.18/86.67 higher than the assigned criteria set at 80/80.

5.3 In terms of students' satisfaction towards toward learning through learning organization by using QAR strategies and Mind Mapping to improve the reading comprehension was ranked at the highest level with the mean of 4.74. This means learners are satisfied with the learning activities, and the lessons are interesting because the contents are fashionable, easy to understand and provides opportunities for students to take part in the activity. Students can also share their comments in lesson.

## 6. Conclusion

Learning organization using Question-Answer-Relationship (QAR) strategies and Mind Mapping to improve the reading comprehension is effective in improving the reading comprehension of Mathayomsuksa 6 students. The samples strongly agree that they became better and feel confident at answering comprehension questions after learning though QAR strategy and Mind Mapping techniques. Their post-test scores



were significantly higher than the pre-test scores. Finally, their satisfaction with the learning activities was found at the highest level. Furthermore, students can check their understanding themselves while they are learning and can then improve their weak points. To succeed in this instructional process, the researcher suggests to use with modern texts in class. It will encourage students' interests and enjoy learning. The teachers should keep well monitoring to students to clarify their problems in the activity.

## 7. Recommendations

It can be seen that the use of QAR strategies and Mind Mapping techniques can develop reading comprehension, but there are several point to consider. There are some recommendations based on the research result as follows:

7.1 The instrument developed by the research is based on the population in Phayakkaphumwittayakarn school so the instructors who are interesting in to use this technique should consider the appropriate texts to use with their students.

7.2 There are mixed level students in each class. The instructor should make various instructional media to be consistent practice with the type of both low and high level students.

7.3 Time and number of activities should be flexible in many learning activities at the initial lesson.

7.4 The instructor should closely observe students' behaviors and immediately adjust them for the efficiency of the learning process.

7.5 The instructor should have well preparation and cooperate with the relevant team to help students and solve problems that may occur.

7.6 The instructor should warm-up before beginning the lesson with review of the last lesson and study of new vocabularies that may be used.

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## Science and Technology (Poster Presentation)

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## Production of wine from lotus (*Nelumbo nucifera*) root extracts by *Saccharomyces cerevisiae* TISTR 5019

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### Abstract

This research focused on the effects of inoculum size (5% and 10% by volume) on production of wine from root extract of the lotus *Nelumbo nucifera*. Irrespective of the inoculum size, the final alcohol content were around 12.67–12.77% but the smaller inoculum resulted in a considerably higher yeast biomass concentration ( $= 6.22 \text{ g L}^{-1}$ ) compared to the fermentation started with a 10% inoculum. With the 5% inoculum, the final total phenolic content were also nearly twice as high as in the fermentation started with the larger inoculum. In terms of kinetic parameters, the 5% inoculum resulted in higher values of the specific growth rate ( $\mu$ ), the yield of biomass ( $Y_{X/S}$ , based on glucose) on soluble solids in the medium, the volumetric consumption rate of soluble solids (as glucose) ( $Q_S$ ), and the volumetric alcohol content productivity ( $Q_P$ ).

**Keywords :** Wine, Lotus (*Nelumbo nucifera*) root, *Saccharomyces cerevisiae* TISTR 5019

### 1. Introduction

Wine is an alcoholic beverage which is produced and consumed in many countries. Various kinds of materials are used as the source of sugars for producing the diverse wines and further variation in taste and enhanced health benefits may be achieved by mixing herbal extracts (Yuwa-Amornpilak *et al.*, 2012, pp. 874-878) with the raw juice used in the fermentation. This work deals with a novel wine produced from the extract of the lotus rhizome.

Lotus (*Nelumbo nucifera*) is a well-known plant which is consumed as a herb in many parts of Asia because of the associated benefits to human health. Based on the known phytochemical and therapeutic information, all parts of *N. nucifera* have beneficial properties such as being antimicrobial, anti-inflammatory and possessing

antioxidant activity (Mukherjee *et al.*, 2009, pp. 407-422). Lotus root and rhizome have been traditionally used to make edible products, drinkable juice and meals for brewing tea-like drinks particularly in Asia, especially in China, India and Thailand. In Nakhon Sawan Province of Thailand, large areas are devoted to growing lotus as a commercial product for use by the local community. Potentially, the juice expressed from the lotus roots could be used to make wine as a novel product for the consumer and a source of enhanced income for the local community.

## 2. Research Objectives

This research examined the effects of yeast inoculum size in production of wine from the lotus rhizome.

## 3. Research Methodology

### 3.1 Microorganism

*Saccharomyces cerevisiae* TISTR 5019 from Thailand institute of scientific technological research was used for all fermentations in this research.

### 3.2 Media

The YM agar and YM broth were used to maintain and grow pure cultures for inoculation. The media contained yeast extract (3 g L<sup>-1</sup>), malt extract (3 g L<sup>-1</sup>), peptone (5 g L<sup>-1</sup>) and glucose (10 g L<sup>-1</sup>). All media were autoclaved (121°C, 15 min) and cooled to room temperature prior to use.

3.3 Lotus root wine production (Modified from Chaikulsareewat and Wongprayoon, 2005-2006)

Dried lotus rhizome 50 g was mixed with 1 L of water and boiled for 15 minutes. This slurry was then cooled to room temperature and filtered through a cheesecloth. The filtrate, or the lotus root broth, was adjusted to pH 4 by using citric acid. The initial soluble solids in the broth were equivalent to 22 degree Brix. The earlier prepared yeast inocula were added to the lotus root broth to initiate the fermentation. The inoculum volume used in different experiments was either 5% or 10% of the volume of the extract used. The fermentation temperature was 30-32 °C. The fermenting wine was sampled every 48 hours to measure the pH, the total acid content (as acetic acid), the total soluble solids (as glucose), the alcohol content and the total phenolics.

### 3.4 Sample analyses

The pH, the total acid content, the soluble solids (as glucose) and the alcohol content were measured by using a pH meter, titration with dilute alkali, a refractometer and an ebulliometer, respectively. The total phenolics were measured by Folin-Ciocalteu's assay (Singleton and Rossi, 1965, pp. 144-158).

### 3.5 Calculations of kinetic parameters (Doran, 1995; Shuler and Kargi, 2002)

The specific growth rate ( $\mu$ ), the yield of biomass on soluble solids (measured as glucose) ( $Y_{X/S}$ ), the yield of alcohol on soluble solids (as glucose) ( $Y_{P/S}$ ), the volumetric consumption rate of the soluble solids (as glucose) ( $Q_S$ ) and the volumetric productivity of alcohol ( $Q_P$ ), were calculated as follows:

$$\mu \text{ (1/h)} = [(C_{Xt} - C_{X0})/t] \times (1/C_{X0}) \quad (1)$$

$$Y_{X/S} \text{ (g L}^{-1}\text{/degree Brix)} = (C_{Xt} - C_{X0})/(C_{S0} - C_{St}) \quad (2)$$

$$Y_{P/S} \text{ (volume percent alcohol/degree Brix)} = (C_{Pt} - C_{P0})/(C_{S0} - C_{St}) \quad (3)$$

$$Q_S \text{ (degree Brix/h)} = (C_{S0} - C_{St})/t \quad (4)$$

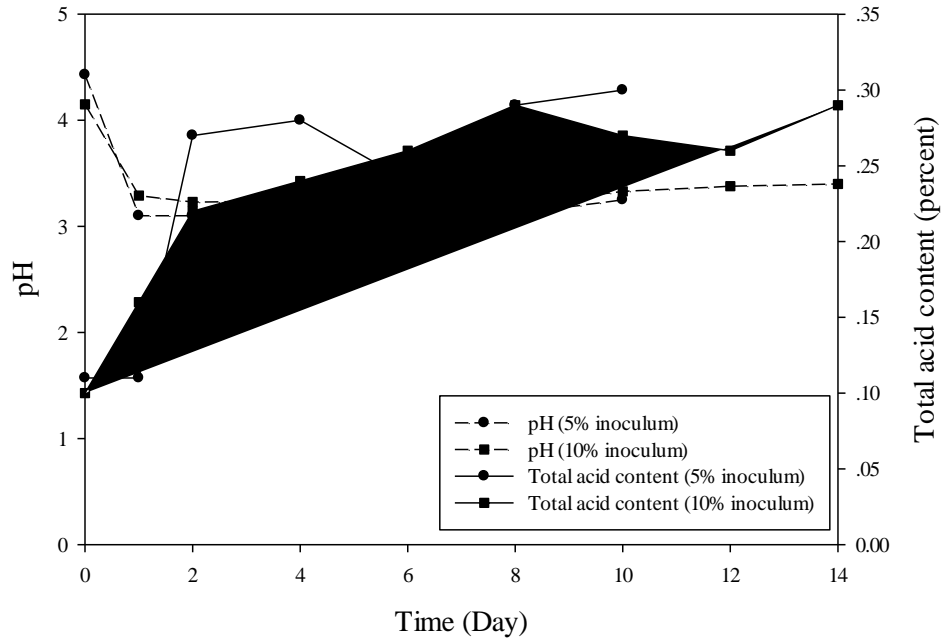
$$Q_P \text{ (volume percent alcohol/h)} = (C_{Pt} - C_{P0})/t \quad (5)$$

In the above equations,  $C_{Xt}$  is the biomass concentration, dry cell weight (DCW) at time  $t$ ;  $C_{X0}$  is the biomass concentration, dry cell weight (DCW) at time 0;  $C_{St}$  is the soluble solids content (as glucose) at time  $t$ ;  $C_{S0}$  is the soluble solids content (as glucose) at time 0;  $C_{Pt}$  is the alcohol content at time  $t$ ; and  $C_{P0}$  is the alcohol content at time 0.

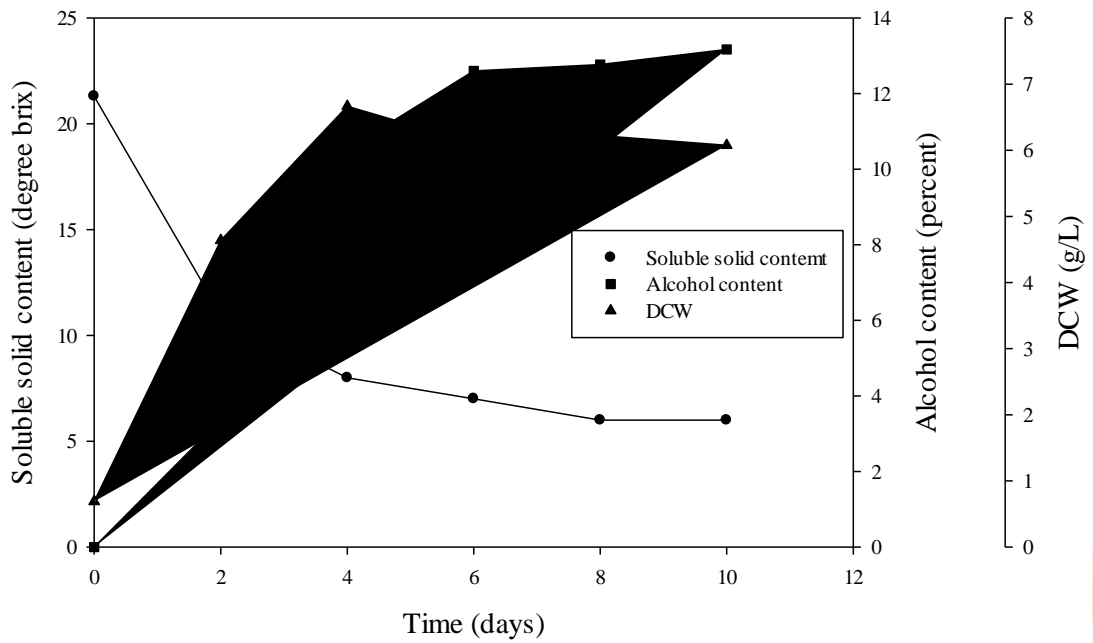
## 4. Research Results

The pH and the total acid (as acetic acid) profiles are shown in Figure 1 for the fermentations that used the two different inoculum sizes.

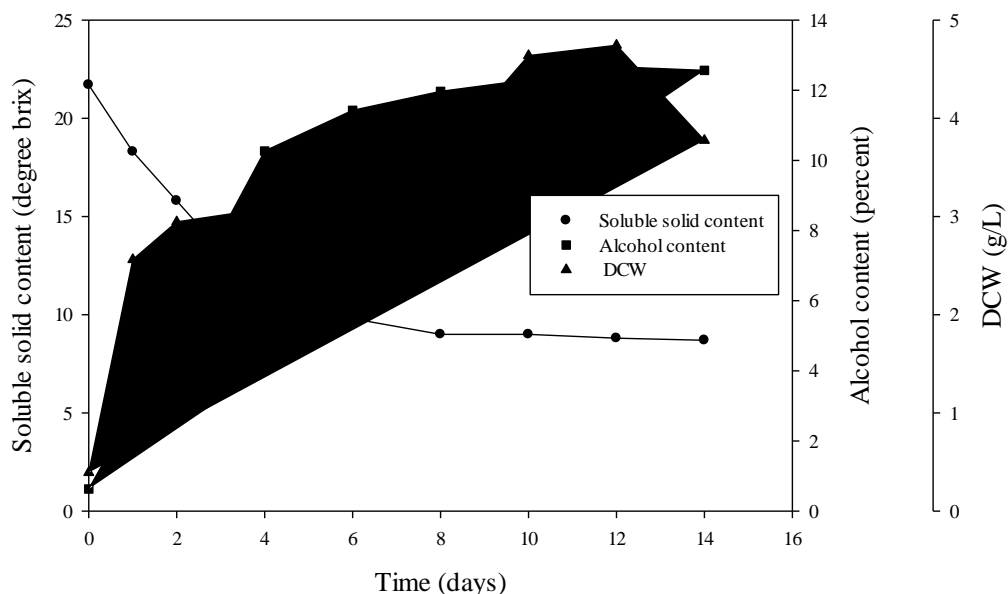
The profiles of alcohol production, the biomass production and the soluble solids (as glucose) consumption are shown in Figure 2 and Figure 3, for the two different inoculum sizes used. The final total phenolic content are reported in Table 1.



**Figure 1** The pH and the total acid (as acetic acid) profiles for fermentations carried out with inoculum sizes of 5% and 10%.



**Figure 2** The fermentation profile of lotus root extract with a 5% inoculum.



**Figure 3** The fermentation profile of lotus root extract with a 10% inoculum.

**Table 1** The total phenolics content in the final crude wine.

Inoculum size (vol/vol)	Total phenolic content (mg/L)
5%	237
10%	121

The fermentation kinetics parameters (Table 2) were calculated using the measured data (Figures 2, 3; Table 1).

**Table 2** Kinetics parameters of the fermentations with the different inoculum sizes.

Kinetics parameter	Inoculum size	
	5%	10%
(1/h)	1.00	0.93
$Y_{X/S}$ (g L <sup>-1</sup> /degree Brix)	0.362	0.337
$Y_{P/S}$ (volume percent alcohol/degree Brix)	0.83	0.93
$Q_S$ (degree Brix/h)	1.91	1.08
$Q_P$ (volume percent alcohol /h)	1.60	1.00



## 5. Discussion

The pH profiles for the fermentation were essentially identical and in both cases the pH declined rapidly mainly during the first hour (Figure 1), coinciding with the period of rapid growth and glucose consumption (Figures 2, 3). The final pH in both cases was around 3.2. In both cases, the final measured acid content was similar, being in the range of 0.26–0.29%, i.e. around 2.6–2.9 g L<sup>-1</sup>. The final acid content (measured as acetic acid) was higher compared to the initial, in both fermentations (Figure 1). In addition, the final total phenolics were nearly two-fold higher in the final crude wine produced using the smaller inoculum (Table 1). The total phenolics are a measure of the antioxidant activity. A phenolics level of 237 mg mL<sup>-1</sup> is comparable to the levels found in some other wines. For example, the total phenolics in eighteen Herzegovinian white wines were reported to be 249.3–801 mg L<sup>-1</sup> (Marković *et al.*, 2015, pp. 1–4).

As shown in Figures 2 and 3, irrespective of the inoculum size, the yeast concentration increased rapidly during the first two days and there was barely any lag phase. Nevertheless, the final biomass concentration was much higher (= 6.22 g L<sup>-1</sup>) with the smaller inoculum compared to a concentration of only 4.75 g L<sup>-1</sup> in the fermentation started with a larger inoculum. In parallel with the observed better biomass growth in the low-inoculum fermentation, the consumption of soluble solids (as glucose) in it was greater both because the growth rate of the biomass was higher and also the metabolic activity was higher than in the high-inoculum fermentation. Although the final alcohol content for both inoculum sizes were similar (12.67–12.77% alcohol by volume), the peak alcohol was achieved a little earlier in the low-inoculum culture.

Considering the kinetic parameters in Table 2, the volumetric consumption of the soluble solids (as glucose) ( $Q_s$ ) was about twice as high in the low inoculum fermentation when compared to the high inoculum fermentation. Both the specific growth rate ( $\mu$ ) and the biomass yield on soluble solids ( $Y_{X/S}$ ) were high in the low inoculum fermentation relative to the high inoculum case (Table 2). In contrast, the alcohol yield on soluble solids ( $Y_{P/S}$ ) was around 11% lower in the low-inoculum fermentation compared to the high-inoculum case. This was probably because relatively more of the substrate went into biomass growth in the low-inoculum fermentation.

## 6. Conclusions

The results showed that the use of a 5% (by volume) inoculum resulted in a nearly 2-fold higher final total phenolics level compared to if a larger inoculum was

used. A higher phenolics level suggests superior antioxidant properties of a product. Compared to the larger inoculum, a 5% inoculum size resulted in a higher specific growth rate ( $\mu$ ); a higher yield of biomass on soluble solids (measured as glucose) ( $Y_{X/S}$ ); a greater consumption of the soluble solids (as glucose) ( $Q_S$ ); and a higher volumetric productivity of alcohol ( $Q_P$ ). Clearly, therefore, a 5% inoculum size appears to be a better choice for this fermentation compared to a larger inoculum.

## 7. Recommendations

Production of wine from lotus (*Nelumbo nucifera*) root by *Saccharomyces cerevisiae* TISTR 5019 is clearly feasible, but further work is required especially on the effects of the initial pH and the mass of the dried root solids used in initial extraction, on the fermentation. Moreover, a sensory evaluation of the wine is required once it has been shown to be free of any toxic alcohols such as methanol.

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## The study of characteristics of karanda fruit (*Carissa carandas*) on difference stage of ripeness and its used in spicy candy products

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### Abstract

Karanda fruit (*carissa carandas*) has sour and stringent taste which is rich source of Vitamin C. It was found in many places for decorating the garden fences in Angthong province, Thailand. Karanda fruit pulp separated from its juice were used for making karanda spicy candy. This research aims to study chemical characteristics of half-ripened and fully-ripened of karanda pulp which can be developed to be the karanda spicy candy.

The results showed that Vitamin C produced from half-ripened karanda pulp, fully-ripened karanda pulp, half-ripened karanda pulp spicy candy and fully-ripened karanda pulp spicy candy were 236.53, 70.40, 143.21, and 50.15 mg/100g respectively, and the Monomeric anthocyanin content were 12.52, 36.74, 10.85 and 22.54 mg/L respectively.

The Anti-oxidant content were 6.88, 7.32, 5.05 and 6.39 mg/ml, respectively. Besides, the energy of half-ripened karanda pulp candy and fully-ripened karanda pulp were 3.58 and 3.67 kcal/g, respectively. The study also found that consumers' acceptance half-ripened karanda pulp spicy candy in overview was moderately 7.87 scores that the highest scores of overall acceptability. Therefore, the storage of karanda candy at low temperature was the best method for extending the storage life.

**Keywords :** *Carissa carandas*, half-ripened, fully-ripened, karanda, spicy candy

## 1. Introduction

Karanda or Namdang were found in many places for decorating the garden fences in Angthong Province, Thailand. There were recognized by different name in different places., *Carissa carandas* is a class of flowering shrub in the dogbane family, *Apocynaceae*. It is a hardy and drought-tolerant plant which thrives well in a wide range of soils. It grows naturally in the Himalayas at elevations of 300 to 1800 meters, in the Siwalik Hills, the Western Ghats and in Nepal and Afghanistan. In regions with high temperatures, it flourishes well. Commonly grown from seeds, there are other methods used for propagation which includes: air layering and stem cuttings, however they are not very commonly used. Seeds are sown during August to September and one year old seedlings are transplanted. The process of air layering in *Carissa carandas* is successful, but it is good to perform this in the beginning of the monsoon. Rooted layers can be separated 3 months after the process of layering. Karanda fruits are sour and astringent which are rich sources of iron vitamin A, C, B complex, carbohydrates, minerals such as calcium, phosphorous, potassium, sodium and sulphur (S. Simla et al., 2013). The fruit of karanda has 3 to 4 seeds inside and the seeds can be removed with the help of a paring knife by cutting the fruit into two and remove the seeds with the tip of the knife. On the other hand, boiling them is the way to make them into puree or syrup, in such a case you can expect a lot of gummy latex especially when it boils: skim this from the shell periodically while doing so. To keep the fruits longer, it is suggested to store them in the refrigerator and in room temperature. They are expected to be three to four days long. Irrespective of the environment type, they are to come just a week time or so, hence it is good to consume then and there. The fruit, does, however, freeze well. They can either be packed loosely in a large freezer bag, or can be de-seeded and boiled into syrup form beforehand. Ripened karanda are sub-acidic which sweet in taste with peculiar aroma. Anupama N et al., (2014). They will be eaten as a dessert when they are ripened or used in the preparation of fruit products such as candies, jelly, squash and chutney. V. Piewlong et al. (2013) showed that ripened karanda gave the highest Anti-oxidant activity, total phenolics and total anthocyanins, S. Yub, (2007) while the unripened karanda exhibited the highest content of Vitamin C than other stages. S. Simla et al. (2013) studied the use of karanda. They found that ripened karanda turned dark color and increases the highest phytochemical contents. To improve efficiency use of the karanda, moreover, ripening stages for harvest need to be considered. Karanda are rich of minerals, acids, phenolic compounds, terpenoids, flavonoids, vitamins, peptides and sugars. N. Hongsuwan et al., (2015).

Ripened karanda are full of acids and micro and macro nutrients which combine well with sugars, and they are used to prepare a variety of jam. R. A. Wani et al., (2013) It is now considered as a valuable source of several unique products for the medicines against various diseases and also for the development of some industrial products. The present study reviews comprehensive information on the chemical constituents, traditional uses, pharmacological actions and nutraceutical values of raw material and processed products. Karanda is relatively a new item to explore the full potential and becomes a fruit which needs to promote and publicize in the international markets. Researchers also come up with the idea to study chemical characteristics of half-ripened and fully-ripened stage of karanda for developing to a karanda spicy candy.

## 2. Research Objectives

To examine chemical characteristic of half-ripened and fully-ripened stage of Karanda for developing karanda spicy candy.

## 3. Research Methodology

### 3.1: Karanda preparation

Karanda Fruits were obtained from Angthong Province, Thailand during May, 2018 in two ripening stages; half-ripened and fully-ripened as shown in figure 1. The seeds and its shells were separated, soaked in clean water and then it was kept in the freezer for longer shelf-life.(P. Siritrakulsak et al., 2016). Karanda juice and pulp are separated by using a blender and Whatman No.1. Half-ripened and fully-ripened karanda pulp are samples.



a.



b.

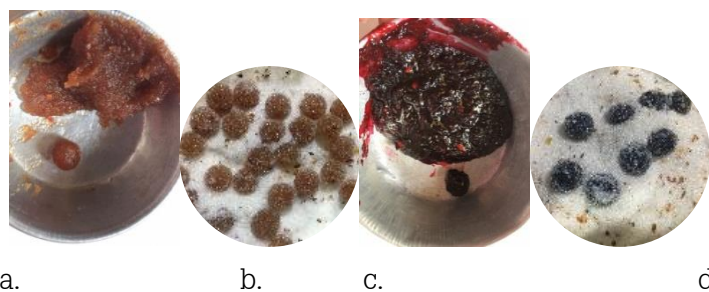
**Figure 1** Karanda fruits: a. half-ripened stages and b. fully-ripened stages

### 3.2: Karanda spicy candy production

Karanda spicy candy recipe is produced according to M. Rattanawongsanit et al., (2017). The ingredients were karanda fruit half-ripened karanda pulp or fully-ripened

karanda pulp 22 %, glucose syrup 2 %, palm sugar 76 %, and the coating powder were white sugar 30 %, Salt 0.3 % and Chili powder 0.2 %.

The mixture of karanda fruit half-ripened karanda pulp, glucose syrup and palm sugar were mixed by stirring on low heat at 90 - 95 ° C for 10 minutes P. Suwannalers, (2012). and then leave it until getting cool before making a sphere candy about 2 gram/tablet. The sphere candies were coated with the powder of mixing of white sugar 30 %, chili powder 0.2 % and salt 0.3 %. The processing of Karanda spicy candy from before coating of mixing powder and after coating with mixing powder were shown in figure 2”



**Figure 2** a: half-ripened karanda pulp spicy candy before coating with mixing powder, b: half-ripened karanda pulp spicy candy after coating with mixing powder, c: fully-ripened karanda pulp spicy candy before coating with mixing powder, d: fully-ripened karanda pulp spicy candy after coating with mixing powder.

### 3.3: Chemical characteristic analysis

#### 3.3.1 Vitamin C

To determined Vitamin C, half-ripened karanda pulp, fully-ripened karanda pulp and karanda spicy candy are conducted by using ultraviolet spectroscopy method according to S. Lisnund et al. (2015) by adding ascorbic acid 5 0 0  $\mu\text{M}$  0.0022 grams to dissolve in solvent, DI water 25 ml and sodiumthiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) 0.04% 25 ml. Then measure the light absorption in maximum wavelength ( $\lambda_{\text{max}}$ ) (200-400 nm) by the ultraviolet spectrophotometer and use  $\text{Na}_2\text{S}_2\text{O}_3$  0.04 % as a blank. The light absorption in maximum wavelength ( $\lambda_{\text{max}}$ ) is found at 2 6 5 nm. Recording the absorptivity of ascorbic acid at 5 -5 0  $\mu\text{M}$  concentration to study the line segment in Beer's law. In case of testing the measurement of ascorbic acid in the example, use the example testing in DI water and sodiumthiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) 0.04% in the ratio of 1:5.

Then spin them by centrifuge, filtering by Whatman Filter paper no.1. Then keep them in the dark place by using aluminum foil and set the light absorption in maximum wavelength ( $\lambda_{max}$ ) at 265 nm. Then record the absorptivity of ascorbic acid at 50  $\mu\text{M}$  concentration and replace the value into the equation of ascorbic acid in the line segment in Beer's law.

### 3.3.2 Monomeric anthocyanin

Anthocyanin in samples are measured according to J. Sueprasal et al. (2013) method, samples are computed using a ratio of 95% ethanol by 1: 5 which store in a dark place with aluminum foil for 120 minutes. Then spin them with a centrifuge and filter them with Whatman No.1. Next adjust volume with distilled water and dissolve the samples of anthocyanin extract with Buffer solutions at pH 1.0 and 4.5 at 1/50 concentration. All is stored in a dark place with aluminum foil for 15 minutes. The absorbance at 535 and 700 nm are measured and then the Monomeric anthocyanin is calculated as cyaniding-3-glucoside equivalents (mg / L)

$$\text{Monomeric anthocyanin} = \frac{A \times MW \times 10^3 \times DF}{\epsilon \times l}$$

### 3.3.3 Anti-oxidant

According to P. Suwannarert et al. (2012), Kaisoon et al. (2011) and Sakac et al. (2010), samples extracts are prepared of 15.625, 31.25, 62.5 125 250 and 500 ml/ethanol 1 ml. The samples are mixed with ethanol and filtered with Whatman No. 1, pipette a 0.1 ml. Then crush the samples mixed with ethanol, then filter them by Whatman Filter paper no.1 pipette the samples solution 0.1 ml by variety of concentrations. Mix them with DPPH 0.004% concentration solution in 2.9 ml ethanol. Keep them in dark for 30 minutes. Then mix the solution by the mixing machine. Measure the wavelength at 517 nm. Use the ethanol with the controlling solution, the result of the sample solution is calculated in Anti-oxidant percentages in the equation

$$\text{Anti-oxidant percentages} = \frac{A_{\text{control}} - A_{\text{sample}}}{A_{\text{control}}} \times 100$$

Then use the Anti-oxidant percentages to calculate for EC<sub>50</sub> (The ability of half of the amount of oxidative inhibitors of the sample extract in variety concentrations) Then graph to compare with the concentration of the sample extracts: 15.625,31.25 62.5,125,250 and 500 mg/ml. Calculate the equation of a straight line  $y = ax+b$  . Then replace the value into the equation of  $y = 50$  and calculate the equation for the concentration of the extract effected the oxidation reaction 50 percent inhabited (EC<sub>50</sub>) in (mg/ml)

### **3.4 Quality of Karanda spicy candy**

#### **3.4.1 Energy**

The calorimeter (C5001, IKA, Germany) is used to determine the energy content of products. All samples are analyzed three times and then the data is analyzed through statistical analysis in term of average mean score and standard deviations.

#### **3.4.2 Sensory evaluation**

A panel of thirty housewives from Anghthong Province were asked to answer questionnaire to consider the quality of half-ripened and fully-ripened karanda pulp spicy candy. The sensory attribute evaluated were color, flavor, odor, texture and overall acceptability. A 9 point hedonic scale (Annpruang, 2008) is used to interpret overall acceptance and the criteria for interpreting the findings as follows: like extremely = 9, like very much = 8, like moderately = 7, like slightly = 6, neither like nor dislike = 5, dislike slightly = 4, dislike moderately = 3, dislike very much = 2, and dislike extremely = 1.

After storage for a month, half-ripened and fully-ripened karanda pulp spicy candy at the room temperature (25°C –35°C) and the refrigerator temperature (1°C –10 °C) are tasted again to compare their Vitamin C and anthocyanin.

### **3.5 Statistic analysis**

The statistical analysis is used to compare the significant differences at  $p < 0.05$  level by T-test Independent Samples, mean score, and the average standard deviation.

## **4. Research Results**

The results of chemical characteristic analysis in karanda pulp were shown in Table 1. It revealed that Vitamin C in half-ripened karanda pulp was three times higher than Vitamin C in fully-ripened karanda pulp. In contrast, the amount of Monomeric



anthocyanin in fully-ripened karanda pulp was also three times higher than half-ripened karanda pulp. However, the result of the Anti-oxidant was nearly the same.

**Table 1** Chemical characteristic analysis in karanda pulp

Samples list	Vitamin C	Monomeric anthocyanin	Anti-oxidant
	mg / 100g	mg / L	mg / ml
half-ripened karanda pulp	236.53 <sup>a</sup>	12.52 ±0.0006 <sup>a</sup>	6.88 <sup>a</sup>
fully-ripened karanda pulp	70.40 <sup>b</sup>	36.74 ±0.0445 <sup>b</sup>	7.32 <sup>b</sup>

Note : the numerical values in the table are the mean ± standard deviation. Different letters a, b in column the significant different at  $p < .0.05$

The results of chemical characteristic analysis in karanda spicy candy in Table 2 shows that Vitamin C in half-ripened karanda pulp spicy candy was about three times higher than Vitamin C in fully-ripened karanda pulp spicy candy. On the contrary, the Monomeric anthocyanin content of fully-ripened karanda pulp spicy candy was double higher than half-ripened karanda pulp spicy candy. However, the Anti-oxidant and the energy of both half and fully ripened karanda pulp spicy candy were shown equally.

**Table 2** Chemical characteristic analysis in karanda spicy candy

Samples list	Vitamin C	Monomeric anthocyanin	Anti-oxidant	energy
	Mg / 100g	mg / L	mg / ml	kcal/g
<i>half-ripened Karanda pulp spicy candy</i>	143.21 <sup>a</sup>	10.85 <sup>a</sup>	5.05 <sup>a</sup>	3.58 ±0.07 <sup>a</sup>
<i>fully-ripened Karanda pulp spicy candy</i>	50.15 <sup>b</sup>	22.54 <sup>b</sup>	6.39 <sup>b</sup>	3.67 ±0.02 <sup>a</sup>

Note : the numerical values in the table are the mean ± standard deviation. Different letters a, b in column the significant different at  $p < .0.05$

The findings found that Vitamin C produced from half-ripened karanda pulp, fully-ripened karanda pulp, half-ripened karanda pulp spicy candy, fully-ripened karanda pulp spicy candy were 236.53, 70.40, 143.21, and 50.15 mg/100g, respectively. Moreover,

the Monomeric anthocyanin content of them were 12.52, 36.74, 10.85 and 22.54 mg/L, respectively. The Anti-oxidant content were 6.88, 7.32, 5.05 and 6.39 mg/ml, respectively. Besides, the energy of half-ripened karanda pulp spicy candy and fully-ripened karanda pulp spicy candy were 3.58 and 3.67 kcal / g, respectively.

As shown in Table 3, the karanda pulp spicy candy flavor, texture, and overall acceptability were not significantly different at the 0.05 level. However, color and odor were significantly different ( $p < 0.05$ ).

**Table 3** Sensory evaluation of karanda pulp spicy candy

Samples list	9-point Hedonic scale				
	color	flavor	odor	texture	overall acceptability
half-ripened karanda pulp spicy candy	7.60 ± 0.3 <sup>a</sup>	6.93 ± 1.05 <sup>a</sup>	8.67 ± 0.55 <sup>a</sup>	7.27 ± 0.74 <sup>a</sup>	7.87 ± 0.73 <sup>a</sup>
fully-ripened karanda pulp spicy candy	8.60 ± 0.6 <sup>b</sup>	6.83 ± 1.12 <sup>a</sup>	7.53 ± 1.07 <sup>b</sup>	7.00 ± 1.23 <sup>a</sup>	7.57 ± 0.73 <sup>a</sup>

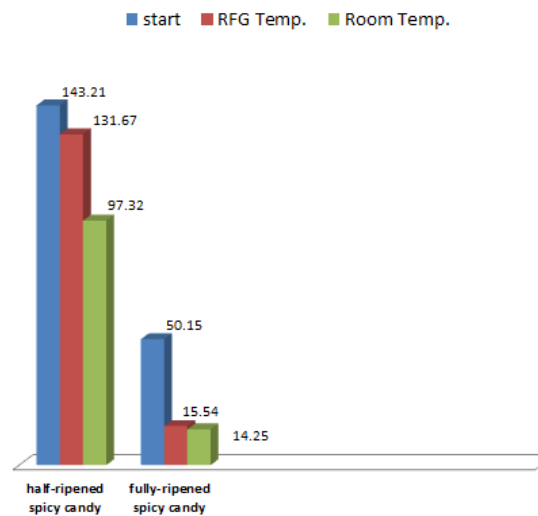
Note : the numerical values in the table are the mean ± standard deviation. The populations of each experiment = 30

Different letters a, b in column the significant different at  $p < .05$

Considering the scores of each aspect of karanda pulp spicy candy Sensory evaluation, they could be arranged in order from highest to lowest: odor (8), color and texture (7), and flavor (6). Moreover, it showed that consumers' acceptance scores of karanda pulp spicy candy in overall acceptability was 7. The study also found that consumers' acceptance half-ripened karanda pulp spicy candy in overview was moderately 7.87 scores that the highest scores of overall acceptability. However, color and odor were significantly different ( $p < 0.05$ ).

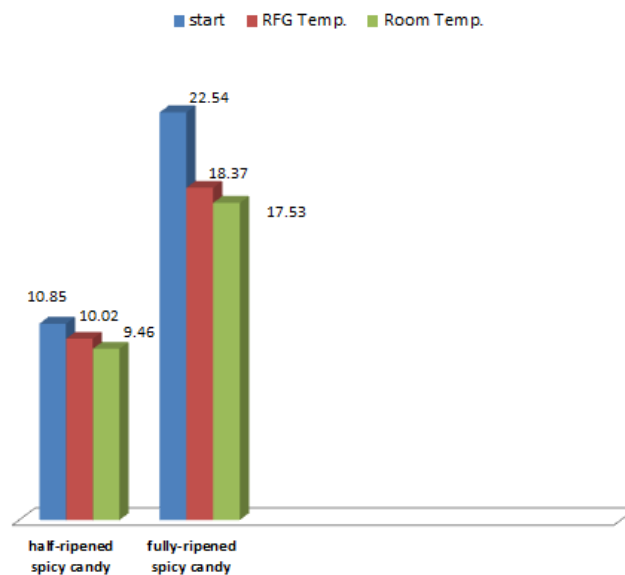
The results of the comparison karanda spicy candy stored in room temperature and refrigerator temperature were shown in Figure 3 and 4 below:

*Figure 3 The comparison of Vitamin C in karanda spicy candy stored in different temperatures for 1 month*



**Figure 3** The comparison of Vitamin C in karanda spicy candy stored in different temperatures for 1 month

*Figure 4 The comparison of Monomeric anthocyanin in karanda spicy candy stored in different temperatures for 1 month*



**Figure 4** The comparison of Monomeric anthocyanin in karanda spicy candy stored in different temperatures for 1 month

As shown in Figure 3 and Figure 4, half-ripened karanda spicy candy stored for a month in the room temperature and the refrigerator temperature lost their Vitamin C from the start 32.04% and 8.06%, respectively, lost their Monomeric anthocyanin from

the start 12.82% and 7.69%, respectively. Furthermore, fully-ripened karanda spicy candy stored for a month in the room temperature and the refrigerator temperature lost their Vitamin C from the start 71.57% and 69.03%, respectively. And they also lost their Monomeric anthocyanin from the start 22.22% and 18.52%, respectively. So that, within a month, both half-ripened and fully-ripened karanda spicy candy stored in the refrigerator temperature could contain higher Vitamin C and Monomeric anthocyanin than in the room temperature.

Figure 3 and Figure 4 also revealed that the Vitamin C of half-ripened karanda spicy candy at room temperature and refrigerator temperature were 97.32 and 131.67 Mg/100g and the Monomeric anthocyanin content were 9.46 and 10.02 mg/L, respectively. Besides, the Vitamin C of fully-ripened karanda spicy candy at room temperature and refrigerator temperature were 14.25 and 15.54 Mg/100g, respectively and the Monomeric anthocyanin values were 17.53 and 18.37 mg/L, respectively.

## 5. Discussion

Vitamin C found in half-ripened karanda pulp, fully-ripened karanda pulp, half-ripened karanda pulp spicy candy, and fully-ripened karanda pulp spicy candy were 236.53, 70.40, 143.21, and 50.15 mg/100g, respectively. This finding revealed the highest vitamin in half-ripened pulp. Piewlong et al. (2013) also described that the unripened fruits exhibited the highest content of Vitamin C than other stages. The Monomeric anthocyanin content contained in half-ripened karanda pulp, fully-ripened karanda pulp, half-ripened karanda pulp spicy candy, and fully-ripened karanda pulp spicy candy were 12.52, 36.74, 9.18 and 22.54 mg / L, respectively. This result also reported close to K. Klinsukhon et al. (2016) which explained that the highest total phenolic and Monomeric anthocyanin contents were found in fully-ripened fruit. The Anti-oxidant content in half-ripened karanda pulp, fully-ripened karanda pulp, half-ripened karanda pulp spicy candy, and fully-ripened karanda pulp spicy candy were 6.88, 7.32, 5.05 and 6.39 mg/ml, respectively. S. Simla et al. (2013) who improved the use of karanda also claimed that the highest Anti-oxidant could be found in fully-ripened pulp. When the ripe fruits turned dark color, they would produce the highest phytochemical contents.

As shown in Figure 3 and Figure 4, karanda spicy candy stored in refrigerator temperature was more constant than in the room temperature because the percentages of missing Vitamin C and Monomeric anthocyanin are lower. The result also showed that the low temperature was the best method of extending the storage life of karanda spicy candy. According to P. Siritrakulsak, et al. (2016), karanda packed in the plastic

box in refrigerators had the longest storage life for 26 days with good appearances and high content of phenolic compounds, Monomeric anthocyanin and Anti-oxidant when comparing with the other treatments. Therefore, keeping karanda in plastic boxes and place at low temperature was the best method for extending the storage life of karanda fruits.

As shown in Figure 3, Vitamin C content of half-ripened karanda spicy candy and fully-ripened karanda spicy candy were 143.21 and 50.15 mg/100g, respectively.

This showed that half-ripened karanda spicy candy contained three times Vitamin C higher than fully-ripened karanda spicy candy.

In contrast, Monomeric anthocyanin content, Anti-oxidant content, and the energy of fully-ripened karanda spicy candy and half-ripened karanda spicy candy were 22.54 and 10.85 mg/L, 6.39 and 5.05 mg / ml, and 3.67  $\pm$ 0.02 and 3.58  $\pm$ 0.07 kcal/g, respectively.

These findings revealed that Monomeric anthocyanin content, Anti-oxidant content, and the energy of fully-ripened karanda spicy candy exhibited higher than half-ripened karanda spicy candy.

As can be seen in Table 3, consumers, moreover, most accepted half-ripened karanda spicy candy and their recipe in overall with the result 7.87 that the highest scores of overall acceptability. However, color and odor were significantly different ( $p < 0.05$ ).

## 6. Conclusion

The study of characteristics of karanda fruit (*Carissa carandas*) on difference stage of ripeness and its used in spicy candy products . Karanda fruit pulp separated from its juice were used for making karanda spicy candy. Therefore, the storage of karanda candy at low temperature was the best method for extending the storage life.

## 7. Suggestions

7.1 Further research is need to examine microorganisms in karanda fruits which may be useful for our body.

7.2 It will be better to reduce sugar for further karanda spicy candy to make them more healthier.

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## Effect of Magnetic and Electric Field on the Chemical Properties of Riceberry 1

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### Abstract

The objectives of this research are to examine the effect of magnetic field on the chemical properties of Riceberry 1. Rice berry 1 after storage of 6 months represents that the moisture at 40C (4.11 g/100 g) is higher than at 40C with magnetic field 3,880 mT(3.07 g/ 100 g). Moreover, the moisture at room temperature (7.81 g/100 g) is higher than room temperature with magnetic field (7.54 g/ 100 g). Differential quantity levels of moisture content have affected the change of chemical properties. The Folin-Ciocalteu method was used to determine total phenolic content, while 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays were used to elucidate antioxidant activities. Antioxidant capacity will be decreased in magnetic field condition. Antioxidant activities at the sixth month at room temperature with and without magnetic field are 25.04 and 25.41 mg Trolox/g, respectively. Antioxidant activities at the sixth month at 40C with and without magnetic filed are 23.68 and 23.92 mg TE/g respectively. But magnetic field showed no significant effects on the total phenolic content of Riceberry 1. Except for factor from heat showed significant effects on the total phenolic content of Riceberry 1

**Keywords :** Riceberry, Magnetic field, Moisture content, Antioxidant capacity

### 1. Introduction

Rice is a staple food for more than 60% of the world's population, especially in Asia (Wei et al., 2007). As primary dietary source of carbohydrates, rice plays an important role as energy requirements and nutrient intakes (Yang et al., 2006). Rice is one of the most important cereal crops all over the world. With the improvement of people's living standards, functional foods are becoming more and more popular among different countries. It has been reported that corn had the highest total phenolic content and antioxidant activity, followed by wheat, oats and rice (Adom & Liu, 2002). Aging



during storage results in numerous changes in the chemical, physical, and biological properties of rice (Chan-Eun et al, 2012). These changes depend on the rice variety, storage conditions and amylose content (Chrastil, 1990).

The biological effects of low-frequency electromagnetic fields on living systems have been studied by many researchers (Fojt et al., 2004; Novak et al., 2007), but the effects of static magnetic fields (SMFs) on living systems are rarely examined and the results are quite controversial (WHO, 2006). In order to research the biological effects of SMFs on living systems, it is helpful to classify SMFs as weak (<1mT), moderate (1mT to 1T), strong (1-5T), and ultrastrong (>5T) types (Luciana and Luigi, 2005). In case of the high voltage electricity, air can be ionized to plasma which consists of cation and anion. It also has disinfectant properties as well.

The total phenolics and flavonoids in bran part of grains are higher than those in whole-grain flours (Butsat and Siriamornpun, 2010; Goffman and Bergman, 2004; Kong and Lee, 2010; Mattila et al., 2005; Zhang et al., 2010). Black rice bran has higher content of phenolics and anthocyanins, and has higher antioxidant activity when compared to white rice bran (Zhang et al., 2010, Goffman and Bergman, 2004). The radicals scavenging activities of phenolic compounds in rice grain have been well demonstrated in cells or animal models (Chi et al., 2007; Rattanachitthawat et al., 2010).

The objectives of this research were to explore the effects of heat and magnetic field on the moisture content, antioxidant activities and total phenolic content in the Riceberry 1.

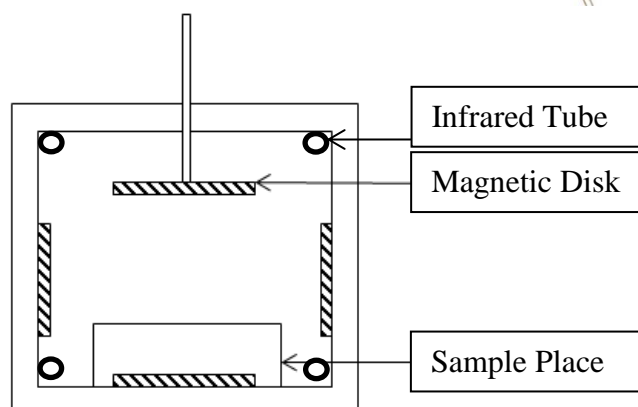
## **2. Research objective**

This research consisted of three objectives:

- 2.1 To study the effect of SMFs and temperature on moisture content;
- 2.2 To study the effect of SMFs and temperature on antioxidant capacity;
- 2.3 To study the effect of SMFs and temperature on total phenolic content;

## **3. Research Methodology**

### **3.1 Static magnetic fields and Heat Treatment**



**Figure 1** Schematic experimental setup for magnetic field system

In this research, the static magnetic fields were generated by ferrite permanent magnets which were produced by Pro-tech Ferrite Co., Ltd. Each magnet has a magnetic field intensity around 480 mT. (Figure. 1)

The static magnetic fields (SMFs) from 8 pieces of magnetic disk can generate magnetic field in the range between 1440 mT and 3880 mT. 4 pieces of magnetic disk are 22 centimeters in diameter and 1 centimetre in thickness and another 4 pieces of magnetic disk are 8 centimetre of diameter and 1 centimetre of thickness. The top plate of magnetic bar can be shifted vertically. Sample was kept at room temperature (28C), room temperature(28C) with magnetic 3880 mT, 40C and 40C with magnetic 3880 mT for 6 months and were analyzed every month.

### 3.2 Moisture content

Rice Berry 1 was harvested in Kasetsart University, Thailand in 2014. Rice Berry 1 was selected because of its antioxidant properties, high nutrition and high production in the country. The moisture content of the Riceberry 1 is determined by the methods of the American Association of Cereal Chemist (AOAC, 2000)

### 3.3 Antioxidant activity assays (DPPH radical scavenging)

The radical scavenging activity (RSA) of the extracts of the DPPH radical was measured according to the method described by Zigonenu et al., (2007) with some modifications. The extract (0.4 mL) was mixed with 5 ml of 40% ethanol solution and 0.6 mL of 0.8 mmolL<sup>-1</sup> of 2,2-Diphenyl 1-picrylhydrazyl(DPPH) solution. The mixture was vigorously shaken and left to stand for 30 min under subdued light. The absorbance was measured at 517 nm with the UV-visible spectrophotometer. The result of antioxidant capacity is represented by mg Trolox equivalents (TE)/g dry weight basis.

### 3.4 Total phenolic content

Total phenolic content (TPC) in the Rice Berry 1 extracts was determined using the Folin-Ciocalteu method described by Choi *et al.* (2006) with some modifications. The extracts (0.5 mL) were added to test tubes followed by 9.5 mL of distilled water, 0.5 mL of Folin-Ciocalteu reagent and 2 mL of 10% sodium carbonate solution. The contents of the test tubes were mixed thoroughly. After standing for 1 h at room temperature, the absorbance was measured at 730 nm with a UV-visible spectrophotometer (Shimadzu 1700, Japan). The results were expressed as mg gallic acid equivalents per gram dry matter.

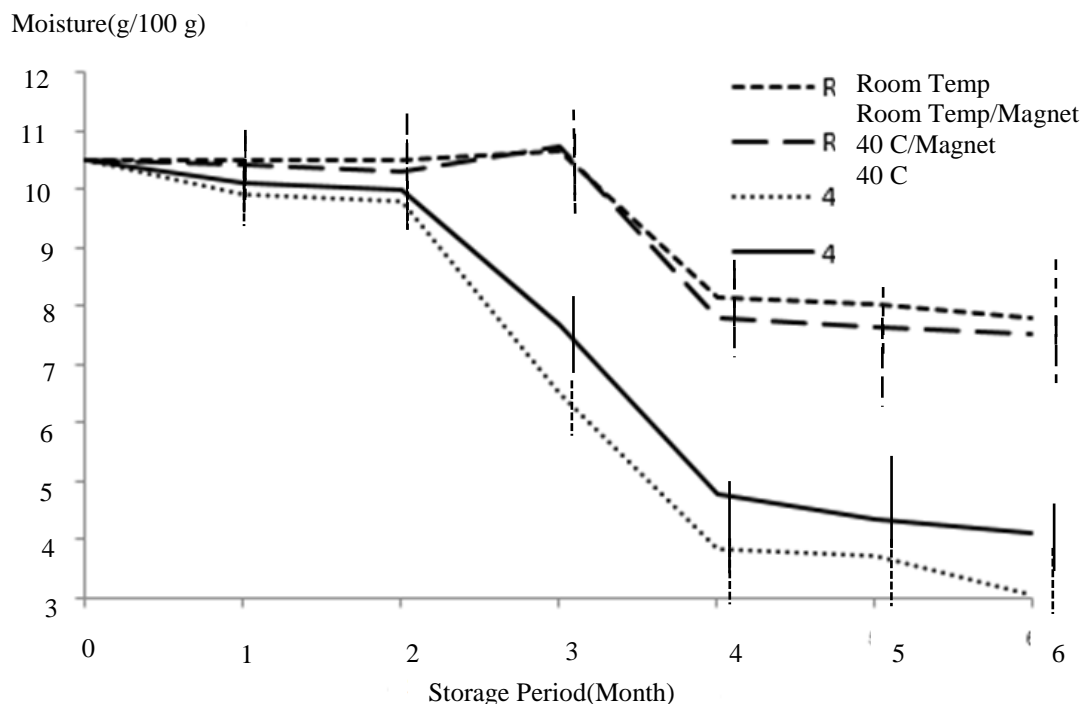
### 3.5 Statistical analysis

The data generated from the experiments were subjected to analysis of variance (ANOVA) using Statistical Package for the Social Science (SPSS). The significance of the variables was determined by two-way ANOVA. The significance of the difference between means was determined by one-way ANOVA with Tukey post-hoc tests ( $p < 0.05$ ). Correlation analysis was performed by employing Pearson Correlation ( $p < 0.01$ ). All measurements were performed in triplicate of Riceberry 1.

## 4. Research Result

The results were presented according to the research objectives as follows:

### 4.1 Effect of SMFs and Temperature on moisture content

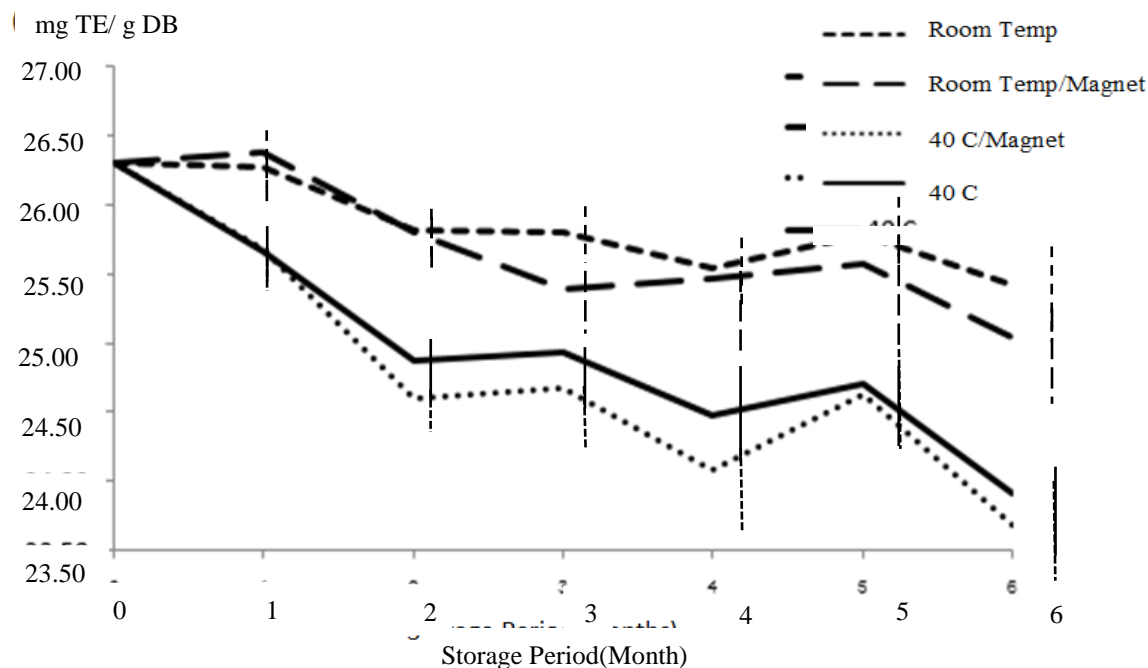


**Figure 2** Effect of SMFs and Temperature on moisture content of Riceberry1

The effects of static magnetic field and temperature on moisture content of Riceberry 1 have been investigated. The results are represented in Fig 2. Riceberry 1 has been kept for 6 months at various magnetic field and temperature controlled storage conditions. The lowest moisture content ( $p < 0.01$ ) was 3.07 g/100 g which was found at 40C with magnetic 3880 mT. In addition, the moisture content of 40C (40 °C), 28 °C and magnetic 3880 mT (Room Temp/Magnet) and 28C(Room Temp) are 4.8 g/100g, 7.82 g/100g and 8.13 g/100g, respectively. According to decomposition of water molecule which leads to the formation of oxygen radicals as reported by Zou et al. (2004) in modification of starch by glow discharge plasma. Significant difference in moisture values ( $p < 0.05$ ) was found between and treated samples and untreated samples.

When the temperature condition has been increased, the intensity of magnetic field will be increased as well. Magnetic force has an effect on various nano molecules such as the instability of water molecules which can cause the change in the condition of the water into steam. It can affect the loss of molecular structure of water.

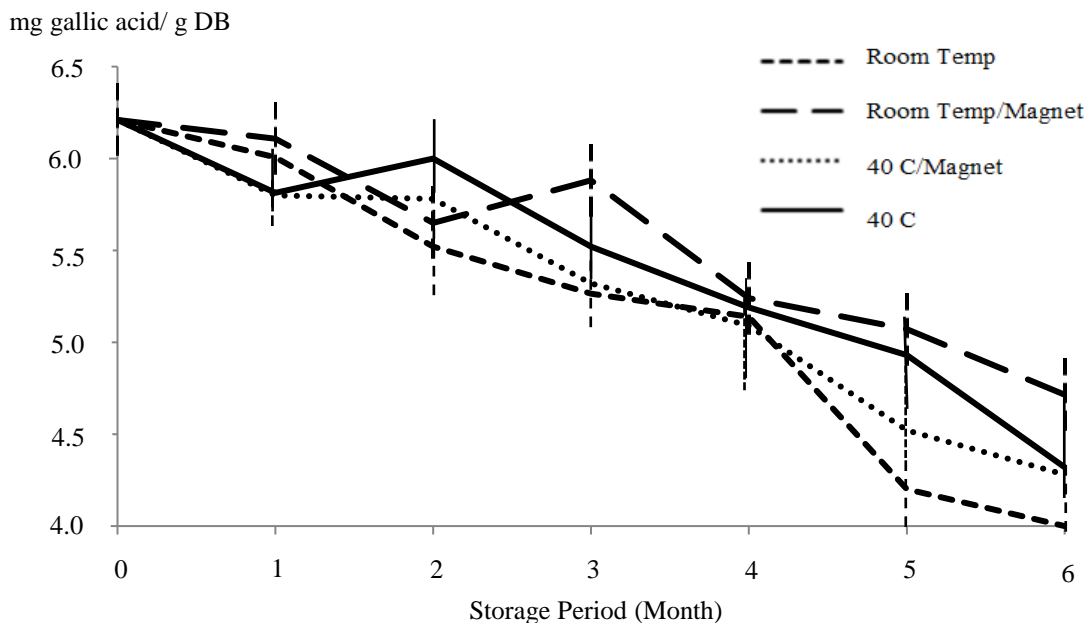
### 4.2 Effect of SMFs and Temperature on antioxidant capacity



**Figure 3** Effect of SMFs and Temperature on antioxidant capacity of Riceberry1

The effect of static magnetic field and Temperature on antioxidant capacity of Riceberry1 was investigated. The result is shown in Fig 3. After place for 6 month at magnetic and temperature control storage condition, the lowest antioxidant capacity was found at 40°C and magnetic 3880 mT(40 °C/Magnet)( antioxidant capacity 23.68 mg TE/g), 40°C (40 °C)(antioxidant capacity 23.92 mg TE/g), 28 °C and magnetic 3880 mT(RT/Magnet) (antioxidant capacity 25.04 mg TE/g), 28°C (28°C)(antioxidant capacity 25.41 mg TE/g). The magnetic field and temperature are significant factors on antioxidant properties. Therefore, their two-tail p-value are, respectively, 0.01 and 0.05. In addition, the changing of moisture content can effect on stability of antioxidants.

### 4.3 Effect of SMFs and Temperature on Total Phenolic Content



**Figure 4** Effect of SMFs and Temperature on Total Phenolic Content of Riceberry1

The effect of static magnetic field and Temperature on antioxidant capacity of Riceberry1 was investigated. The result are shown in Fig 4. After place for 6 month at magnetic and temperature control storage condition, the total phenolic content was found at 40°C and magnetic 3880 mT(40 °C/Magnet)(total phenolic content 4.28 mg gallic acid/g), 40°C (40 °C)(total phenolic content 4.32 mg gallic acid/g), 28°C and magnetic 3880 mT(RT/Magnet)(total phenolic content 4.71 mg gallic acid /g), 28°C (28°C)(total phenolic content 4.00 mg gallic acid/g). The magnetic field and temperature are significant factors on antioxidant properties. Therefore, their two-tail p-value are, respectively, 0.01 and 0.05. In addition, the changing of moisture content can affect on stability of antioxidants.

The objectives of this research were to explore the effects of heat treatment and magnetic field on the moisture content, antioxidant activities and total phenolic content in the Riceberry 1.

## 5. Discussion

This research has been studied about the effect of the magnetic field and temperature on the moisture content, antioxidant activities and total phenolic content

in the Riceberry 1. It was found that the effect of heat treatment and magnetic field on chemical properties was significant. However, total phenolic content were affected by magnetic field at high temperature because the intensity of magnetic field had increased when temperature of system increased.

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## Efficiency of *Feronia limonia* (L.) Swing crude extract as tyrosinase activity inhibition

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### Abstract

The research aimed to extract *Feronia limonia* (L.) Swing from a dried of branches and stem with 95% ethanol by maceration technique, calculate a percentage of yield, and to study the tyrosinase activity inhibition by dopachrome method. The result showed that the crude extract from branches and stem had a percentage of yield as 9.40 and 13.26 respectively. In terms of the tyrosinase activity inhibition found that showed the crude extract from branches and stem had as tyrosinase activity inhibition which IC<sub>50</sub> as 0.27 mg/ml and 0.16 mg/ml respectively, which are comparable to kojic acid which IC<sub>50</sub> as 0.06 mg/ml. In summary the ethanol crude extract of *Feronia limonia* (L.) Swing from part of branches and stem had as tyrosinase activity inhibition.

**Keywords:** *Feronia limonia* (L.) Swing, Tyrosinase activity inhibition

### 1. Introduction

Weather and pollution are getting worse every day. Causes dullness to the skin, freckles, effect of the tyrosinase enzyme working too much. Tyrosinase is a copper containing enzyme find in plants and animals. For humans, tyrosinase enzymes are also responsible for producing the melanin pigments in our skin to protect the skin from environmental conditions (Zhang et al., 2006). The accumulation of melanin in the skin will make to the skin darker called "Hyperpigmentation". (Friedman, 1996). Tyrosinase enzyme there are in the fruits and vegetables that causes brown color.

Plants growing in the midst of environmental had filled with pollution in the air such as chemicals, heat, ray etc. Therefore, plants synthesize important substances such as Arbutin, Vitamin C etc. These substances can inhibition a tyrosinase enzyme. Which led to research in the extracts of plants and further to developed as raw materials from plant extracts used for cosmetics industry, whitening skin at present (Kunlad et al., 2008).

Present, active ingredient from plants to use for cosmetics is more prevalent, such as Thanakha internationally recognized to cosmetic ingredient. Thanakha (*Limonia acidissima* L. or *Hesperethusa crenulata* (Roxb.) Roem.) Family : Rutaceae is well-known in Myanmar as a kind of make-up which is adored and widely used by the Myanmar women of all ages since over 2,000 years ago (Aung, 2014). This can be found in the ancient Myanmar lyrics and verses . The Thanakha grinding stone (flat and circular in shape) of Myanmar princess , daughter of king Bayinnaung (15 Century) seen at the museum (Thein & Anal, 2014). Giving the whitening to skin. (Wangthong et al., 2010) to studied the tyrosinase activity inhibition in stem of Thanakha, the result showed that the extracted with  $\text{CH}_2\text{Cl}_2$  to the best activity inhibition at  $\text{IC}_{50}$  as  $0.546 \pm 0.012$  mg/ml which are comparable to kojic acid which  $\text{IC}_{50}$  as  $0.009 \pm 0.001$  mg/ml. Therefore the Thanakha can be use for helps to reduce pigment production make to whitening the skin. Thailand there is *Feronia limonia* (L.) Swing it also has the same family as Thanakha. Now a day to rare and nearly extinct in Thailand. The researchers assumed it had as tyrosinase inhibitory activity as same as Thanakha.

*Feronia limonia* (L.) Swing or *Feronia limonia* (L.) Swingle had a common names is wood apple and Thai people called Ma-kwid (Fig.1). It used to the traditional medicines such as a decoction of the bark is effective for uterine disorders, leaves help cure diarrhea etc. Chankana (2016), to studied in *Feronia limonia* (L.) Swing from leaves, the results demonstrated that the dichloromethane and ethyl acetate extracts had anti-malarial of *Plasmodium falciparum* activity with  $\text{IC}_{50}$  value of 3.35 and 4.11  $\mu\text{g/ml}$ , respectively. Muang-Ngam et al. (2013), to studied the antioxidant activity in Ma-kwid crude extract from branches by DPPH scavenging assay method, the result showed that it had the antioxidant activity which  $\text{IC}_{50}$  as 9.53  $\mu\text{g/ml}$ . Tidchai & Phasuk (2018), to studied in Ma-kwid crude extract from stem, the result found that it had the antioxidant activity which  $\text{EC}_{50}$  as 0.2717 mg/ml. But no study of the tyrosinase activity inhibition.



**Fig.1.** *Feronia limonia* (L.) Swing.  
Source: Kanagasabapathipillai (2006)

So, the researcher interested to study the tyrosinase activity inhibition of *Feronia limonia* (L.) Swing crude extract from branches and stem can be further developed into raw material extracts use for cosmetics to make fame and conservation of Thailand valuable plant resource in the future.

## 2. Research Objectives

The research aimed to extract *Feronia limonia* (L.) Swing from branches and stem with 95% ethanol by maceration technique and to study the tyrosinase activity inhibition by dopachrome method.

## 3. Research Methodology

### 3.1 Plants extraction

Watch dry of *Feronia limonia* (L.) Swing from branches and stem use 600 grams of the minced wrap with thin washrag and put in 6 L 95% ethanol. Then put it in the room at normal temperature for 7 days. The filtrates extracts and evaporate it with vacuum rotary evaporator and freeze dryer then weigh the crude extract and calculate the percentage yield.

$$\text{Percentage yield} = \frac{\text{Weight of crude extract}}{\text{Weight of dry}} \times 100$$

### 3.2 The study of tyrosinase activity inhibition of crude extracts by a modification of the dopachrome method.

#### 3.2.1 Preparing example solution

Use 0.010 grams of crude extract and dissolve it with 10 ml of 99.99% ethanol. Shack for 30 minutes to help the dissolution. Dilute with 20% ethanol to meet the different level of concentrations (1000, 500, 250, 125, 62.5  $\mu\text{g/ml}$ ).

#### 3.2.2 Preparing the standard solvent.

Use 0.010 grams of standard (kojic acid) and dissolve it with 10 ml of 99.99% ethanol. Shack for 30 minutes to help the dissolution. Dilute with 20% ethanol to meet the different level of concentrations (1000, 500, 250, 125, 62.5  $\mu\text{g/ml}$ ).

#### 3.2.3 Preparing the Sodium Phosphate Buffer solution (0.02 molarity pH 6.8).

Use  $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$  0.44 grams and use  $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$  0.39 grams dissolve it with 250 ml of distilled water.

#### 3.2.4 Preparing the tyrosinase enzyme.

Use 0.2 milligrams of tyrosinase enzyme and dissolved with 5 ml Sodium Phosphate Buffer Solution (0.02 molarity pH 6.8)

#### 3.2.5 Preparing the L-DOPA solution.

Use 0.32 milligrams of L-DOPA as substrates and dissolved with 5 ml Sodium Phosphate Buffer Solution (0.02 molarity pH 6.8)

#### 3.2.6 Determined the tyrosinase activity inhibition of crude extracts.

Take the solution at different concentration to examine the ability to pair up with the tyrosinase enzyme and compared with standard solution kojic acid add A, B, C and D solution by mix solutions in the Microplate Reader as showed in table 1 (Repeat the experiment 3 times)

**Table 1** Add solutions to determine the tyrosinase activity inhibition by Dopachome method.

A (control):	- Tyrosinase enzyme solution - Sodium Phosphate Buffer Solution (0.02 molarity pH 6.8) - 20% Ethanol	50 µl 150 µl 50 µl
B (blank of A):	- Sodium Phosphate Buffer Solution (0.02 molarity pH 6.8) - 20% Ethanol	150 µl 50 µl
C(test sample):	- Tyrosinase enzyme solution - Sodium Phosphate Buffer Solution (0.02 molarity pH 6.8) - Crude extract solution or Standard solution in 20% Ethanol	50 µl 150 µl 50 µl
D (blank of C):	- Sodium Phosphate Buffer Solution (0.02 molarity pH 6.8) - Crude extract solution in 20% Ethanol	150 µl 50 µl

Mix each well and keep it at room temperature for 10 minutes in the dark place. Add L-DOPA solution 50 µl and mix them. The absorbance was measured with Microplate Reader at the wavelength 492 nanometer. After that keep it at room temperature for 2 minutes in the dark place and measure absorbance with Microplate Reader at the wavelength 492 nanometer again.

3.2.7 Calculate the percentage of tyrosinase activity inhibition.

$$\% \text{ Tyrosinase inhibition} = \left[ \frac{(A-B) - (C-D)}{(A-B)} \right] \times 100$$

Where A, B, C and D as absorbance at the wavelength 492 nanometer.

A = absorbance of blank solution with enzyme

B = absorbance of blank solution without enzyme

C = absorbance of sample solution with enzyme

D = absorbance of sample solution without enzyme

Calculate the percentage of tyrosinase activity inhibition and extent of inhibition by addition of samples is expressed as the percentage necessary for 50% inhibition ( $IC_{50}$ ).

#### 4. Research Results

##### 4.1 The percentage yield.

The percentage yield of *Feronia limonia* (L.) Swing ethanolic crude extract from branches and stem as 9.40 and 13.26, respectively.

##### 4.2 The tyrosinase activity inhibition.

The study of tyrosinase activity inhibition . The dry *Feronia limonia* (L.) Swing from branches and stem were extract by 95% ethanol. The crude extracts were studied the tyrosinase activity inhibition by a modification of the dopachrome method. The relationship between the concentration of the test substance and the response generated in the form of % Scavenging showed in table 2

**Table 2** Result of tyrosinase activity inhibition

Example	Conc.(µg/ml)	% Scavenging	IC <sub>50</sub> (mg/ml)
<i>Feronia limonia</i> (L.) Swing crude extract from branches	62.5	32.61	0.27
	125	42.29	
	250	51.97	
	500	70.25	
	1,000	78.85	
<i>Feronia limonia</i> (L.) Swing crude extract from stem	62.5	37.99	0.16
	125	46.59	
	250	58.78	
	500	74.91	
	1,000	85.06	
Kojic Acid	62.5	44.08	0.06
	125	52.32	
	250	63.79	
	500	80.28	
	1,000	97.84	

The table 2 showed that the tyrosinase activity inhibition from *Feronia limonia* (L.) Swing crude extracts from branches and stem had as tyrosinase activity inhibition with IC<sub>50</sub> as 0.27 and 0.16 mg/ml, respectively, which are comparable to kojic acid which IC<sub>50</sub> as 0.06 mg/ml.

## 5. Discussion

The tyrosinase activity inhibition of *Feronia limonia* (L.) Swing crude extract from branches and stem by a modification of the dopachrome method showed that the crude extract of stem a better than crude extract of branches with  $IC_{50}$  as 0.16 mg/ml and 0.27 mg/ml, respectively which are comparable to kojic acid with  $IC_{50}$  as 0.06 mg/ml. This result is similar to the research of Muang-Ngam et al., (2013), to studied the tyrosinase activity inhibition from *Naringi crenulata* (Roxb.) Nicolson crude extract. This plants belong family as same as *Feronia limonia* (L.) Swing and *Limonia acidissima* L. or *Hesperethusa crenulata*, the result showed  $IC_{50}$  as 0.28 mg/ml with are comparable to kojic acid which  $IC_{50}$  as 0.03 mg/ml. And similar to the research of Wangthong et al., (2010), studied the tyrosinase activity inhibition crude extract from *Hesperethusa crenulata* stem. They extracted with  $C_6H_{14}$ ,  $CH_2Cl_2$ , EtOAc, MeOH 85%, EtOH and  $H_2O$ . The result showed that with  $IC_{50}$  the tyrosinase activity inhibition was  $0.623 \pm 0.01$ ,  $0.546 \pm 0.12$ ,  $0.697 \pm 0.012$ ,  $1.420 \pm 0.015$ ,  $0.860 \pm 0.006$ ,  $1.089 \pm 0.01$  mg/ml which are comparable to kojic acid which  $IC_{50}$  as  $0.009 \pm 0.001$  mg/ml.

## 6. Conclusion

A result showed that the percentage yield of *Feronia limonia* (L.) Swing crude extract from stem had higher than crude extract from branch. The tyrosinase activity inhibition showed that crude extract from stem a better than crude extract of branch.

## 7. Recommendations

The ethanolic crude extract of *Feronia limonia* (L.) Swing from branches, and stem had as tyrosinase activity inhibition. Which, it can help to reduce melanin pigment in the skin. However, should in studying of toxicity to animal cells then to developed raw material extracts use for cosmetic and cosmetic product in the future, and to make fame, conservation of Thailand valuable plant resource for value added for Thai medicinal plants.

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**Effects of using dried distillers cassava pulp with solubles (DDCS)  
on growth performance  
of growing Thai Native x Anglo-Nubian female goats**

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**Abstract**

The objective of this study was to evaluate the effects of using dried distillers cassava pulp with solubles (DDCS) on growth performance of growing Thai Native x Anglo-Nubian female goats. Twelve Thai Native x Anglo-Nubian female goats ( $15.13 \pm 2.75$  kgBW and  $185.5 \pm 60.52$  days of age) were stratified by weight as a randomized complete block design (RCBD) to determine the effects of DDCS on growth performance of growing Thai Native female goats. The treatments were the three levels of distillers dried cassava pulp with solubles (DDCS) in the concentrate mixes at 0%, 20% and 40% of diet DM. All animals were fed rice straw *ad libitum* as roughage. The results showed that total dry matter (DM) intake was not significantly different among dietary treatments (691.44, 705.79 and 621.92 gDM/d;  $P>0.05$ ). Increase in level of DDCS caused decrease linearly ( $P<0.01$ ) and quadratically ( $P<0.05$ ) in dry matter digestibility (73.68, 73.13 and 66.79 %) and organic matter (OM) digestibility (74.39, 73.83 and 67.66 %) and were lowest in goats fed at 40% DDCS. Ruminal ammonia-N ( $\text{NH}_3\text{-N}$ ) concentration (12.24, 12.42 and 15.13 mg%) was highest in goats fed 40% DDCS and showed that with increasing level of DDCP in the diet caused increase linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) in ruminal  $\text{NH}_3\text{-N}$  concentration. Moreover, total volatile fatty acid (TVFAs) linearly and quadratically decreased ( $P<0.01$ ) (85.99, 85.20 and 75.89 mM/l) reflecting increases in level of DDCS. Bacteria [ $2.24, 2.24$  and  $1.96$  ( $\times 10^{10}$  cell/ml)] and protozoa [ $2.07, 2.06$  and  $1.82$  ( $\times 10^5$  cell/ml)] populations also decreased linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) as the level of DDCS increased, but, goats fed at 0% and 20% DDCS were not differ. Average daily gain (ADG) (70.34, 70.29 and 54.25 g/d) was decreased linearly ( $P<0.01$ ) as the level of DDCS was increased. Moreover, Gain to Feed ratio (G:F) (0.10, 0.11 and 0.09 kg of gain/kg of DMI) decreased linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) as DDCS increased in the ration and were lowest in goats fed

40% DDGS, but at 0 and 20% DDGS were not differ. It could be concluded that DDGS inclusion in concentrate for growing Thai Native female goat at 20% without any negative effect on growth performance.

**Keywords :** distillers dried cassava pulp with solubles (DDCS), Thai Native x Anglo-Nubian female goats, growth performance of Thai Native x Anglo-Nubian goat

## 1. Introduction

Ethanol production from cassava has increased exponentially in the last decade in Thailand (Sriroth et al., 2010a). Moreover, in the United States, dried distillers grain with solubles (DDGS) is a byproduct from dry-grind ethanol plants (corn grains), which are responsible for producing 60% of the ethanol used. With this expansion brings an affordable and viable feed source for ruminants. Distillers dried cassava pulp is a byproduct from ethanol production, similar to process for bioethanol production of corn grains, in the United States as namely “DDGS”. However, distillers dried cassava pulp do not contain a high protein content as corn grains, cassava DDGS contains less protein contents (11-14% CP and 30% CP for corn DDGS) (Sriroth et al., 2010a). In any livestock commodity, the single greatest cost is feed (Solaiman, 2010). Goat producers strongly agree that the high cost of goat production is a challenge facing the industry (Gillespie et al., 2013). Utilizing by-products that are less expensive can help reduce this challenge. Research involving the feeding of dried distillers grain with solubles (DDGS) to ruminants has become more prominent in the past due to the rising costs of feedstuffs, particularly corn. During the growing and finishing phase, DDGS fed to steers at 30% of the diet did not affect any performance variable or carcass characteristic (Luepp et al., 2009). Furthermore, Schauer et al. (2008) reported that inclusion of DDGS up to 60% in lamb diets did not sacrifice live performance and carcass traits. Moreover, Felix et al. (2012) reported a quadratic effect with 20% DDGS being optimal for average daily gain in lambs compared with 0%, 40%, and 60% DDGS. However, there is very limited research evaluating the use of DDGS in growing Thai Native female goat diets. Therefore, the objectives of this study was to evaluate the effects of distillers dried cassava pulp with solubles from ethanol production (DDCS) on on growth performance of growing Thai Native female goats.

## 2. Materials and Methods

### 2.1 Experimental animals

Twelve Thai Native x Anglo-Nubian female goats ( $15.13 \pm 2.75$  kgBW and  $185.5 \pm 60.52$  days of age) were stratified by weight as a randomized complete block design (RCBD) to determine the effects of DDCCS on growth performance of growing Thai Native x Anglo-Nubian female goats. The treatments were the three levels of distillers dried cassava pulp with solubles (DDCCS) in the concentrate mixes. The dietary treatments were as follows: DDCCS in the concentrate at 0% (T1), 20% (T2) and 40% (T3). All animals were fed *ad libitum* of rice straw together with concentrate at 1.5% BW, twice daily at 08.00 am. and 17.00 pm. Each animal was housed in an individual pen and free access to clean water all times.

### 2.2 Sample collection and chemical analysis

Daily collection of faeces were made in the last 7 days of 60 days feeding period. The samples were stored at  $-20^{\circ}\text{C}$  until analysis. Daily faeces collect in each animal were bulked, mixed and a 5% sub sample taken. The sample of faeces were oven dried and ground (1 mm. Screen) for determination of DM, ash, OM, NDF, ADF and N content. Rumen fluid was collected on the last day of the experiment. Ruminal pH was measured immediately after ruminal fluid sampling, 5 ml of 6 N HCl was added to 50 ml. Rumen fluid was collected 0, 3, 6 and 9 h post feeding and stored at  $5^{\circ}\text{C}$  until analysis. Live weight of animals were measured at the beginning of the trial and every 15 days. Rice straw and concentrate were sampled every two weeks and the composited samples analyze for NDF, ADF and ADL content (Goering and Van Soest, 1970), and CP DM and ash were determined by the methods of AOAC (1985). Rumen fluid TVFAs concentration was determined by titration technique of Briggs et al. (1957).

### 2.3 Statistical analyses

All data obtained from the experiment were subjected to analysis of variance using Proc. GLM (SAS, 1996) according to a randomized complete block design (RCBD). Treatment means were statistically compared by Duncan's New Multiple Range Test (Steel and Torries, 1980) and the General Linear Models (GLM) procedure for orthogonal polynomial analysis of SAS (SAS, 1996).

### 3. Results and Discussion

#### 3.1 Chemical composition of individual ingredients and treatment diets

The chemical composition of the diets is shown in Table 2. Crude protein within concentrates was small (approximately 16.2 %CP) and was slightly higher than formulated at 16% CP.

**Table 1** Ingredients of dietary treatment containing in varying amounts of DDGS (%DM basis)

Ingredient	Dietary treatment (DDGS ,%)		
	0	20	40
DDGS (9.8% CP)	0.0	20.0	40.0
Cassava pulp (1.6% CP)	49.3	38.3	26.3
Rice bran (12.0% CP)	20.0	14.0	10.0
Soybean meal (45.0% CP)	14.0	11.0	7.0
Palm meal (11.6% CP)	7.0	7.0	7.0
Molasses	6.0	6.0	6.0
Sulfur	0.2	0.2	0.2
Urea	2.0	2.0	2.0
Lime stone	0.5	0.5	0.5
Salt (NaCl)	0.5	0.5	0.5
Mixed mineral	0.5	0.5	0.5
Total	100.0	100.0	100.0
<b>Cost/kg of feed (bath)</b>	<b>6.04</b>	<b>5.40</b>	<b>4.78</b>

DDGS: distillers dried cassava pulp with solubles

However, the diets used in this experiment contained similar crude protein (approximately 16.2% CP) in all dietary treatments.

The high DDGS (40%) rations contained higher NDF than those of other treatments. Increases in NDF content at higher inclusion level of 40% DDGS in the diets may be caused by high dietary fiber concentrations in DDGS. Moreover, reported by Pornjantuek et al. (2015), Phonsean et al. (2016), and Laorodphan et al. (2013) reported that distillers dried cassava pulp from ethanol production contain a high NDF (approximately 49.7%) and less protein contents (approximately 5-6% CP), resulting in

a decrease in feed intake and digestibility. However, the total feed intake in this experiment was not significantly different among dietary treatments.

**Table 2** Chemical composition of dietary treatment

Chemical composition (%) <sup>2</sup>	Dietary treatment <sup>1</sup>			Rice straw	DDCS
	DDCS (%)				
	0	20	40		
DM	91.4	90.8	90.3	95.8	91.6
	.....%DM.....				
OM	92.2	91.8	91.4	92.6	93.1
NDF	16.7	17.3	18.9	64.5	40.2
ADF	8.8	9.4	10.6	46.1	20.5
ADL	3.7	3.9	4.4	9.2	4.9
Ash	7.8	8.2	8.6	7.4	6.9
AIA	1.3	1.5	1.6	1.1	1.7
CP	16.3	16.3	16.2	2.1	9.8
ME Mcal/kg	2.59	2.51	2.43	1.52	2.18

<sup>1</sup>Level of DDCS = 0%, 20% and 40%

<sup>2</sup>Based on analysis of composite feed sample; DM: dry matter, OM: organic matter, NDF: neutral detergent fiber, ADF: acid detergent fiber, ADL: acid detergent lignin, AIA: acid insoluble ash, CP: crude protein,

### 3.2 Dry matter intake

The effect of DDCS on feed intake is shown in Table 3. These results indicated that concentrate intake (191.63, 164.85 and 94.70 gDM/d) decreased linearly ( $P < 0.05$ ) as the levels of DDCS increased, but total dry matter (DM) intake was not significantly different among treatments (691.44, 705.79 and 621.92 gDM/d;  $P > 0.05$ ). Similar, Kalscheur (2006) reported that when DDGS was included at concentrations greater than 20%, DMI decreased. In addition, cows fed over 30% DDGS less DMI than the control group. Decreases in feed intake at higher inclusion levels may be caused by high NDF content (Lammers et al., 1995). In the case of 40% DDCS fed to goats in this experiment, there were apparent palatability problems with higher inclusion levels of DDCS in the diet. In addition, reported by Pomjantuek et al. (2015) that when distillers dried cassava

pulp from ethanol production as namely “CPE” fed to meat goat greater than 20%, DMI would decreased.

**Table 3** Effect of levels of DDGS on feed intake and digestible nutrient intake of goats

Items	Dietary treatment					Contrast*	
	DDGS (%)			SEM	P-value	L	Q
	0	20	40				
Feed intake (gDM/d)							
Concentrate	191.63 <sup>a</sup>	164.85 <sup>ab</sup>	94.70 <sup>b</sup>	20.38	0.03	0.02	0.42
Roughage	499.81	540.94	527.22	16.15	0.26	0.17	0.21
Total intake	691.44	705.79	621.92	28.44	0.16	0.29	0.21
Total intake (%BW)	3.66	3.54	3.43	0.13	0.48	0.81	0.94
Total intake (g/kgBW <sup>0.75</sup> )	79.53	77.65	73.92	3.07	0.47	0.27	0.95
Nutrient intake (g/d)							
OM	639.52	652.25	574.76	26.24	0.16	0.30	0.21
CP	41.72 <sup>a</sup>	38.23 <sup>a</sup>	26.41 <sup>b</sup>	3.41	0.04	0.02	0.36
Digestible nutrient intake (g/d)							
OM	335.49 <sup>a</sup>	339.28 <sup>a</sup>	286.7 <sup>b</sup>	10.89	0.03	0.02	0.08
MCP	61.93 <sup>a</sup>	62.71 <sup>a</sup>	50.50 <sup>b</sup>	3.23	0.06	0.04	0.15

SEM = standard error of the mean, \*Orthogonal polynomial contrast L= linear and Q= quadratic, MCP (microbial crude protein) = 0.13 x kgDOMI (ARC, 1984)

### 3.3 Feed digestibility

The effect of DDGS on feed digestibility is shown in Table 4. Increase in level of DDGS caused decrease linearly ( $P<0.01$ ) and quadratically ( $P<0.05$ ) in dry matter (DM) digestibility (73.68, 73.13 and 66.79 %) and organic matter (OM) digestibility (74.39, 73.83 and 67.66 %) and were lowest in goats fed at 40% DDGS. Moreover reported by Pornjantuek *et al.* (2015) that when CPE fed to meat goat greater than 20%, DM, OM and CP digestibility decreased. In contrast, Gurung *et al.* (2012) reported that no differences were observed in DM and neutral detergent fibre (NDF) digestibility among treatments when corn DDGS fed to goats at 0, 12.7, 25.4 and 38.1% of DDGS. Decreases DM digestibility and OM digestibility at higher DDGS levels may be caused by DDGS

do not contain a high protein content as corn grains. Siroth *et al.* (2010a) reported that cassava DDGS contains less protein contents (11-14 %CP and 30%CP for corn DDGS) and also its taste. Corn DDGS is commonly referred to as a protein source, but can also be used to provide energy, depending on the animal's nutritional requirement (Maynard, 2015). These data indicated that matching supply of energy and N supply and balancing the overall daily ratio of RUP and RDP in the rumen may improve microbial growth and activity. The nitrogen requirement of rumen bacteria on a given diet can be estimated from the amount and digestibility of organic matter digested by the animal (Chumpawadee, 2006).

**Table 4** Effect of levels of DDGS on digestibility and growth performance of goats

Items	Dietary treatment			SEM	P-value	Contrast*	
	DDGS (%)					L	Q
	0	20	40				
Digestibility (%DM)							
DM	73.68 <sup>a</sup>	73.13 <sup>a</sup>	66.79 <sup>b</sup>	0.84	<0.01	<0.01	0.03
OM	74.39 <sup>a</sup>	73.83 <sup>a</sup>	67.66 <sup>b</sup>	0.82	<0.01	<0.01	0.03
CP	77.35 <sup>a</sup>	74.07 <sup>a</sup>	64.75 <sup>b</sup>	2.02	0.01	<0.01	0.27
Body weight (kg)							
Initial weight	14.60	15.70	15.08	-	-	-	-
Final weight	18.81	19.92	18.33	0.42	0.08	0.05	0.04
ADG (g/d)	70.34 <sup>a</sup>	70.29 <sup>a</sup>	54.25 <sup>b</sup>	2.90	0.01	<0.01	0.07
Gain to Feed ratio (G:F)	0.10 <sup>a</sup>	0.11 <sup>a</sup>	0.09 <sup>b</sup>	0.005	0.03	<0.01	<0.01

SEM = standard error of the mean, \*Orthogonal polynomial contrast L= linear and Q= quadratic, ADG = average daily gain

### 3.4 Growth performance and gain efficiency

Average daily gain (ADG) (70.34, 70.29 and 54.25 g/d) (Table 4) decreased linearly ( $P<0.01$ ) and Gain to Feed ratio (G:F) (0.10, 0.11 and 0.09 kg of gain/kg of DMI) decreased linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) as the level of DDGS increased and were lowest in goats fed at 40% DDGS, but at 0 and 20% DDGS were not differ. The results indicated that DDGS increased from 20 to 40%, resulting in a decrease in ADG and G:F. Similar, Maynard (2015) reported that goats fed over 30% corn DDGS less

ADG than the control group. Decreases in ADG at higher inclusion levels of DDCS may be caused by high dietary fiber concentrations, resulting in a decreases in DMI, digestibility and ADG. Pornjantuek et al. (2015) reported that when the level of distillers dried cassava pulp from ethanol production (CPE) increased from 10% to 20%, ADG linearly decreased. In this respect feeds starch (maize or cassava) are better suited for supplementation with N source than those rich in fiber (cassava pulp), as the rate of fermentation of starches matches better the rate of release of ammonia from N source; the rate of cellulose degradation is slow, and adequate amounts of energy are not supplied in the presence of excess ammonia (Maeng et al., 1997). Structural carbohydrate was high so that the fiber intake increased and energy content decreased. The decrease in ME density is possibly associated with the limited energy availability from plant fiber carbohydrates and the inhibitory effect of fiber on fat and protein digestion (Baer et al., 1997). Therefore, in this experiment, high NDF in diets possibly affected growth performance.

### **3.5 End-products of ruminal fermentation**

Ruminal pH data are showed in Table 5. Ruminal pH (6.39, 6.44 and 6.67) was highest in goats fed at 40% DDCS and showed that with increasing DDCS in the diet caused increased linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) in ruminal pH. Similar, reported by Pornjantuek et al. (2015) that when CPE fed to meat goat greater than 20%, ruminal pH linearly increased. Volden et al. (2002) reported that low pH values appeared to be related to high VFA and high bacterial nitrogen production. H-ion concentration appeared to be influenced more by VFA than by ammonia or lactate production. A relationship between rumen pH and ammonia concentration which depended on quantities of VFA. Increasing pH increased ammonia absorption and that low rumen pH was associated with high VFA absorption.



**Table 5** Effect of levels of DDCS on rumen fermentation and microbe population of goats

Items	Dietary treatment			SEM	P-value	Contrast*	
	DDCS (%)					L	Q
	0	20	40				
pH	6.39 <sup>b</sup>	6.44 <sup>b</sup>	6.67 <sup>a</sup>	0.03	<0.01	<0.01	<0.01
NH <sub>3</sub> -N (mg%)	12.24 <sup>b</sup>	12.42 <sup>b</sup>	15.13 <sup>a</sup>	0.09	<0.01	<0.01	<0.01
TVFAs (mM/l)	85.99 <sup>a</sup>	85.20 <sup>a</sup>	75.89 <sup>b</sup>	0.24	<0.01	<0.01	<0.01
Bacteria (x 10 <sup>10</sup> cell/ml)	2.24 <sup>a</sup>	2.24 <sup>a</sup>	1.96 <sup>b</sup>	0.01	<0.01	<0.01	<0.01
Protozoa (x 10 <sup>5</sup> cell/ml)	2.07 <sup>a</sup>	2.06 <sup>a</sup>	1.82 <sup>b</sup>	0.004	<0.01	<0.01	<0.01

SEM = standard error of the mean, \*Orthogonal polynomial contrast L= linear and Q= quadratic , TVFAs= total volatile fatty acid

Rumen NH<sub>3</sub>-N concentration are presented in Table 5. Ruminal ammonia-N (NH<sub>3</sub>-N) concentration (12.24, 12.42, 15.13 mg%) was highest in goats fed at 40% DDCS and showed that with increasing DDCS in the diet caused increased linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) in ruminal NH<sub>3</sub>-N concentration. Similar, reported by Pornjantuek et al. (2015) that when CPE fed to meat goat greater than 20%, ruminal NH<sub>3</sub>-N quadratically increased. If this were the case, then one would expect ruminal ammonia of the high DDCS fed group to be higher than that 0% DDCS group. It is possible that low efficient capture of N for microbial protein synthesis. because N sources from DDCS was utilized less efficiently than nitrogen from natural plant proteins. Reported by Kolver et al. (1998) that decreases ammonia concentration were the results of a more efficient capture of N for microbial protein synthesis. In addition, increasing pH in rumen would increase ammonia absorption and that low rumen pH was associated with high VFA absorption (Volden et al., 2002)

Total VFA concentrations (TVFAs) are showed in Table 5. Linearly decreases (85.99, 85.20, and 75.89 mM/l;  $P<0.01$ ) in observed were reflecting increases in level of DDCS. Similar, reported by Pornjantuek et al. (2015) that when CPE fed to meat goat greater than 20%, TVFAs linearly ( $P<0.01$ ) and quadratically ( $P<0.01$ ) decreased. The low concentration of VFA probably reflecting asynchronuous diet, resulting in decreased ruminal end product (Kim, 2001). Moreover, Witt et al. (1999) reported that higher VFA concentration might have been related to the microbial population in the same time as

optimum pH. Higher VFA concentration at 3 h post feeding might have been related to the microbial population in the rumen that increased at the same time; however, at the 6 h post feedings VFA concentration was decreased indicating a more capture of C-skeleton for increased microbial protein synthesis (Sinclair et al., 1993; Witt et al., 1999).

### 3.6 Rumen microbe populations

Rumen microbe populations are presented in Table 5. Bacteria [ $2.24, 2.24, 1.96$  ( $\times 10^{10}$  cell/ml)] and protozoa populations [ $2.07, 2.06, 1.82$  ( $\times 10^5$  cell/ml)] also decreased linearly ( $P < 0.01$ ) and quadratically ( $P < 0.01$ ) as the level of DDCS increased, but, goats fed at 0% and 20% DDCS were not differ. The lowest population recorded was on animals fed at 40% DDCS diet ( $P < 0.01$ ). It is possible that lower synchronizing rate of degradation of dietary energy and N release in the rumen beneficially increased rumen microbe population and microbial protein synthesis (Herrera-Saldana et al., 1990). Sinclair et al. (1993) and Kim (2001) reported that higher synchronizing rate of degradation of dietary energy and N release in the rumen beneficially increased microbial protein synthesis. Moreover, Jouaney and Ushida (1999) reported that ruminal protozoa growth depends on high rate of soluble sugars and starches in the ration. The decrease in ME density is possibly associated with the limited energy availability from plant fiber carbohydrates and the inhibitory effect of fiber on fat and protein digestion (Baer et al., 1997). Therefore, in this experiment, high NDF in diets possibly affected the rumen microbe population.

## 4. Conclusions and Recommendations

In conclusion, the results of this study indicated that distillers dried cassava pulp with solubles (DDCS) from ethanol production can be added up to 20% of the diet dry matter of growing Thai Native x Anglo-Nubian female goats without any negative effects on feed intake, ADG, rumen microbe populations, end-products of ruminal fermentation and digestibility. DDCS can be an excellent protein and energy supplement for goats to replace a portion of rice bran and soybean meal in the diet. The higher fiber content of DDCS may be effective in preventing acidosis in growing goats fed high grain diets. Differences in performance among the limited feeding studies suggest the quality of the DDCS source being fed may be important in order to achieve optimal performance. Conservatively, adding DDCS at a level of 20% of growing goat diets will provide good performance results, although high inclusion rates may also result in acceptable performance.

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**Effect of dietary supplementation of moringa (*Moringa oleifera*)  
leaf meal and turmeric (*Curcuma longa* L.)  
on productive performance of native chickens**

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**Abstract**

The objective of this study was to compare the effect of dietary supplementation of moringa (*Moringa oleifera*) leaf meal and turmeric (*Curcuma longa* L.) on productive performance and carcass percentage of native chickens in local condition. The experimental design was completely randomized design. One hundred and twenty crossbred native chickens at average weight 134.13 ± 11.370 gram per bird (21 days-old) were used in this study. The chickens were 4 received treatment diets with 3 replications and each replication was consisted of 10 birds. The experimental diets were; control diet (T1; without supplementation of any herbs. T2 was dietary supplementation of 0.3 % of moringa leaf meal plus 0.1 % turmeric, and T3 was dietary supplementation of 0.6 % moringa leaf meal plus 0.1 % turmeric, and T4 was dietary supplementation of 0.9 % moringa leaf meal plus 0.1 % turmeric. The experiment was conducted for 10 weeks. Data of feed intake, average daily gain (ADG), Feed conversion ratio (FCR), carcass percentage, live ability and productive index were collected for data analysis by using ANOVA and compared the average by Duncan's New Multiple Range test (DMRT). The results have shown that the chickens that received dietary supplemented with 0.6 % moringa leaf meal plus 0.1 % turmeric showed the best result in productive performance by final weight was 1019.4469.92 grams/chick, weight gain was 879.9469.21 grams/chick, FCR was 3.000.57, ADG was 12.570.98, Productive Index was 329.55142.84 by there was no significantly different from other groups. While the chickens in control group showed the lowest results especially the mortality rate was highest. In conclusion, dietary supplementation of 0.6% moringa leaf meal plus 0.1%

turmeric showed the best result in productive performance in native chickens. It was an alternative way for producing herbal or organic native chickens.

**Keywords :** moringa (*Moringa oleifera*) leaf meal, turmeric (*Curcuma longa* L.)  
productive performances, native chickens

## 1. Introduction

Native chicken meat is one of the most commonly used as animal protein source for people in rural community (Vasinopas and Meckvichai, 2015). Rural native chicken fanning is being practiced in many areas throughout Thailand. Rural backyard poultry production plays a vital role in the rapidly growing economy. It provides livelihood security to the family in addition to security the availability of food (Padlii, 2016). The native chicken meat has lower fat and cholesterol content but the disadvantages of native chickens are lower growth efficiency and low productive performances is attributable to lack of proper feed, management, and sanitation programs (Jaturasitha et al., 2008). Generally, native chickens are raised without using antibiotics or chemicals but some fanners used the antibiotic when they found the chickens infected some diseases but they do not know the proper way to use antibiotics. These antibiotics can be a remained in die meat and caused some side effects to the consumers.

At present, the consumers need natural products that have high nutritive value, no contamination with microbes, harm chemicals and good quality product. Thus, many researches attempt to use medicinal plants in broiler production instead of antibiotics. Some herbs are widely used as antibacterial agents, improved the feed palatability, enhance activities of digestive enzymes and nutrient absorption. From previous studies revealed that medicinal plant such as turmeric (*Curcuma longa* Linn.) which is tropical plant native to southern, southeastern tropical Asia and also in Thailand. Turmeric has the main yellow bioactive substances isolated from the rhizomes are curcumin. Turmeric has been widely used in poultry feed as many studies (Durrani et al. 2006) (Zainali et al., 2009) (Hosseini-Vanshan et al., 2012) and it was found that the use of tunneric as feed additive enhances the overall performance of poultry such as broilers (Abd Al-Jaleel, 2012; Al-Mashhadani, 2015; Narumon et al. 2015; Samarasinghe et al., 2016) or native chickens (Somkuna et al., 2015a; Somkuna et al., 2015b Boonjiam et al., 2017; Somkuna et al., 2016; Somkuna, 2017; Somkuna et al., 2017). But the actual level of using is not stable because there are many factors affected

on the bioactive substances.

Moringa (*Moringa oleifera*) is a type of local medicinal Thai herb which has turned out to be familiar in the tropical and subtropical countries. It is one of the vegetables of the Brassica order and belongs to the family Moringaceae. The Moringaceae is a single genus family with 13 known species (Khawaja et al., 2010). Moreover, it is as a food source in the tropics especially in rural areas. For centuries, moringa has been noted for traditional medicinal and industrial uses. All parts of the moringa tree are edible and have long been consumed by humans and animals. Moringa also consisted of antipyretic, anti-ulcer, anti-epileptic, diuretic, cholesterol lowering, renal, anti-diabetic, and hepatoprotective activities (Abdull Razis, Ibrahim, and Kntayya, 2014). The leaves are rich in minerals, vitamins and other essential phytochemicals.

In addition, Udom and Idiong (2011) reported that moringa leaves are unique because of their tremendous amounts of minerals but lower amounts of harmful compounds such as tannin and phytates are 12 and 21 grams/kilogram of dry matter, respectively. The moringa leaves also contain saponin, which gives a bitter taste to animals but no harmful effects on them (Nouman et al., 2014). Effects of bioactive compounds in moringa on productive performance of poultry production has been proven by many researches as it can be used in broiler feeds (Zanu et al., 2012; Akhouri et al., 2013; Owele et al., 2013; Gadzirayi & Mupangwa, 2014; Nkukwana et al., 2014; Sebola et al., 2015; Obakanurhe & Okpara, 2016). However, there are a few researches on using moringa leaf meal and turmeric in native chickens. Therefore, it is very interesting to study the effect of dietary supplementation of moringa leaf meal and turmeric on productive performance and carcass percentage of native chickens raised in local condition where villagers raised native chickens in backyard and easy to find moringa leaves and turmeric utilize in feed. Thus, the objective of the study was to compare the effect of dietary supplementation of moringa leaf meal and turmeric on productive performance and carcass percentage of native chickens.

## 2. Research Objectives

To compare the effect of dietary supplementation of moringa (*Moringa oleifera*) leaf meal with turmeric (*Curcuma longa* L.) on productive performance and carcass percentage of native chickens.



### 3. Research Methodology

The experimental design was completely randomized design. One hundred and twenty crossbred native chickens (mixed sex) at average weight 134.13–113.70 gram per bird (21 days-old) were used in this study. The chickens were 4 received treatment diets with 3 replications and each replication was consisted of 10 birds. The experimental diets were control diet T1; without supplementation of any herbs. T2 was dietary supplementation of 0.3 % of moringa leaf meal plus 0.1 % turmeric, and T3 was dietary supplementation of 0.6 % moringa leaf meal plus 0.1 % turmeric, and T4 was dietary supplementation of 0.9 % moringa leaf meal plus 0.1 % turmeric. For basal feed, the chickens received the experimental diet consisted of 18% CP and 3,100 Kcal/kg ME. The experiment was conducted for 10 weeks. Data of feed intake, average daily gain (ADG), Feed conversion ratio (FCR), carcass percentage, live ability, and productive index were collected for data analysis by using ANOVA and compared the average by Duncan's New Multiple Range test (DMRT).

### 4. Research Results

The results have shown that the chickens that received dietary supplemented with 0.6 % moringa leaf meal plus 0.1 % turmeric showed the highest result in productive performance by final weight (1,019.4469.92 grams/chick), weight gain (879.9469.21 grams/chick), FCR (3.000.57), ADG (12.570.98 grams/chick), and Productive Index (329.55142.84) by there was no significantly different among groups. While the chickens in control group showed the lowest results especially the mortality rate was highest as shown in Table 1

**Table 1** Effect of dietary supplementation of moringa (*Moringa oleifera*) leaf meal with turmeric (*Curcuma longa* L.) on growth performance and carcass percentage of crossbred native chickens

Productive performances	T1 (control)	T2 (0.3 moringa+ 0.1 turmeric)	T3 (0.6 moringa+ 0.1 turmeric)	T4 (0.9 moringa+ 0.1 turmeric)	P-value
Initial weight (gram/chick)	126.004.24	128.5017.67	139.500.70	142.5013.43	0.47
Final weight (gram/chick)	944.053.70	877.2210.21	1019.4469.92	991.5074.86	0.16
Weight gain (gram/chick)	818.057.94	748.727.46	879.9469.21	849.0061.42	0.16

**Table 1** (Continue)

Productive performances	T1 (control)	T2 (0.3 moringa+ 0.1 turmeric)	T3 (0.6 moringa+ 0.1 turmeric)	T4 (0.9 moringa+ 0.1 turmeric)	P- value
Average Feed intake (gram/day/chick)	46.198.17	32.155.16	36.964.20	36.893.84	0.23
Feed conversion ratio (FCR)	4.000.67	3.050.52	3.000.57	3.100.54	0.37
Average daily gain (gram/day/chick)	11.690.11	10.690.10	12.570.98	12.130.87	0.16
Live ability (%)	50.0028.28	90.000.04	75.0021.21	80.0014.14	0.32
Productive index	152.2486.0 8	315.8746.47	329.55142.84	321.84108.92	0.08
Carcass percentage (%)	73.000.00	76. 643.86	75.451.01	75.401.05	0. 49

## 5. Discussion

From the result, it has shown that the chickens that received dietary supplemented with 0.6 % moringa leaf meal plus 0.1 % turmeric showed the best result in productive performance by final weight, weight gain, FCR, ADG, and Productive Index when compared with the other groups. This might due to the active compound (curcumin) in turmeric and protein in moringa leaf meal could stimulate feed intake and growth performance. It is noteworthy that the chickens in control group showed the lowest productive performance especially tile mortality rate was highest. This was due to the chickens were not received any herbs in the diet. The result was consistent with Somkuna et al. (2015) reported that native chickens received turmeric at 0.1% showed better growth performance. In addition, the experimental diets that were supplemented with moringa leaf meal showed a higher level of protein than the control group even just a little but the nutritive value of moringa could help the chickens showed a better result. For broilers, Nkukwana et al. (2014) reported that supplementation of *M. oleifera* leaf meal up to 25 g per Kg of feed did not impair nutrient utilization efficiency, but enhanced the broiler chickens for growth performance. Whilst Gadzirayi et al. (2012) found that dietary supplementation of *Moringa oleifera* meal as protein supplement in broiler at 25 percent inclusion level showed similar weight and growth rate compared

to the broilers fed under conventional commercial feeds by there was no significantly different.

In addition, at the higher level of supplementation (0.9 percent of moringa leaf meal of feed) then native chickens did not show the higher productive performance than 0.6 percent supplementation. This was due to some bioactive compounds in moringa leaves such as phytate or tannin or polyphenols that have properties to exhibit digestive enzymes and reduce digestibility (He et al., 2006). Both phytate and tannins have the capacity to bind proteins in the gut and depress protein digestibility, as well as intestinal uptakes of dietary and endogenous nutrients (Moyo et al., 2011).

## 6. Recommendation

For future study, digestibility studies at supplementation levels higher than 0.9 percent of feed are recommended to determine nutrient flow and retention until excretion at various growth periods. This would help elucidate the maximum supplementation level of moringa leaf meal in native chicken's diet.

## 7. Conclusion

It was conclude that dietary supplementation of 0.6% moringa leaf meal plus 0.1% turmeric showed the best result in productive performance in native chickens. It was an alternative way for producing herbal or organic native chickens by supplementation of herbs or plant protein in native chicken diet.

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## Effects of Cadmium and Arsenic to a Microalga *Desmodesmus maximus*-A Potential Strain for Toxicity Test in Thailand

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### Abstract

Heavy metals contamination and bioaccumulation have caused serious problems in Thailand's aquatic system. However, previous studies showed that there are disadvantages to the current chemical heavy metal detection methodologies. Therefore, alternative ways for a quick assessment of contaminants in the water are required. This study aims to evaluate the possible toxic effects of cadmium (Cd) and arsenic (As) on *Desmodesmus maximus* AARLG071, which is an alternative strain for toxicity test. During the exponential growth phase, cells were exposed to different concentrations of Cd and As for 72 h. After 72 h, the results show that EC<sub>50</sub> for Cd and As were 0.024 mg.L<sup>-1</sup> and 0.022 mg.L<sup>-1</sup>, respectively. Both metals affected the microalgal cellular physiology including growth inhibition, morphological change as well as the number of cells per coenobium. These findings might provide not only new information of a microalga response to heavy metals, but also become a novel strain for further toxicity test.

**Keywords :** *Desmodesmus maximus*, Arsenic, Cadmium, Toxicity, Microalgae

### 1. Introduction

Heavy metals occur from natural components of the earth's crust and soil. Normally, heavy metals are defined as elements with metallic properties having an atomic number of more than 20. In general, the terminology heavy metal includes any metallic chemical elements which has relatively high density as well as low concentration of toxic or poison. The most common heavy metal contaminants include

cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), lead (Pb), and zinc (Zn) (Hong *et al.*, 2011). Attention has been drawn to the serious problems of heavy metals pollution in the aquatic ecosystems. This phenomenon has caused harmful impact which has been continuously increasing. Some heavy metals are highly toxic when they are transformed into persistent metallic compounds. The heavy metals can be bioaccumulated in soil, water and even in living organisms. Overtime, they can actually intensify in the food chains, thus threatening human health (Jin, 1992). Activities leading to the increase of heavy metals in the aquatic ecosystem are mining, smelting, metallurgical industries, chemical industries, textile printing, fossil fuel combustion, steel production, agrochemical/ animal feed industries, electroplates, paper, and fiber production (Freitas *et al.*, 2008). In everyday life, humans unconsciously eat, drink, and touch heavy metals due to the fact that some of them have no color or smell.

Arsenic (As) poses a serious threat in many areas, especially in fresh water. Normally, it is naturally found in the aquatic system at low concentrations which is less than  $0.5 \text{ g.L}^{-1}$  and up to more than  $5000 \text{ g.L}^{-1}$  depending on the source of contamination (Rahman, 2014 & Hasegawa, 2012). In fact, Pollution Control Department of Thailand (2018) said in standard water quality that waste water from industries should not have As and Cd contaminant more than  $0.25$  and  $0.03 \text{ mg.L}^{-1}$ , respectively. Moreover, the presence of cadmium (Cd) in the environment is raised due to its frequent use in industrial processes. It is a common industrial pollutant which is the one of the most dangerous metals found in wastewater (Cristina *et al.*, 2010). However, the toxicological effects on aquatic organisms depend on their concentration, the chemical forms, duration of exposure and species of organism (Jianying *et al.*, 2013). Thus, the toxicity of As and Cd exposed to different aquatic organisms as well as the variance of the concentration are essential in providing the insight of how these metals can affect to physiological parameters.

Microscopic photosynthetic organisms known as Microalgae have the same photosynthetic mechanisms as plants. These can be found in both marine and freshwater environments. In terms of biomass, they form the world's largest group of primary producers for at least 32 percent of global photosynthesis. Microalgae are ideally suited for water quality assessment because they have rapid reproduction rates and have very short life cycles, making the valuable indicators of short-term impact. Moreover, they are sensitive to some pollutants and are ready to accumulate pollutants as well. Most studies on heavy metals in microalgae are focusing on Cu, followed by Cd, Ni, Pb, Zn, Hg, and Cr (Suresh *et al.*, 2015). Therefore, a standard toxicity test using



microalgae has been developed. The reference strains of microalgae for toxicity tests are *Pseudokirchneriella subcapitata*, *Desmodesmus subspicatus*, *Navicula pelliculosa*, *Anabaena flos-aquae*, and *Synechococcus leopoliensis* (OECD/OCDE 201, 2011). However, those species are rarely found in Thailand's freshwater and native common microalgal reference strains are required. The use of *Desmodesmus maximus* is interesting. This specie is an important primary producer which is commonly found in the freshwater of Thailand. It is the largest in size belonging to *Desmodesmus* genus which its morphological changes can be easily noticed.

As biomonitors or bioindicators of aquatic heavy metals, different methods or techniques can be adopted based on different aims and demands. One of the methods is morphological and behavioral observation which provides the most direct toxic effects on the organisms. This can be commonly noticed due to the fact that it is an interesting topic of the related fields. Many techniques based on morphological observations have been developed using various organisms. Following OECD 201 (2011), the morphological alteration is one of the standard methods for toxicity test, for example, the percentage of cell inhibition, growth curves, biomass, biovolume, EC<sub>10</sub>, EC<sub>20</sub>, EC<sub>50</sub>, and EC<sub>80</sub>. Some of microalgae are standardized for the evaluation of individual or combined toxicities and for the risk assessment of environmental pollution (Qunfang, 2008). For instance, using *Pseudokirchneriella subcapitata* could determine toxicities of ZnO, TiO<sub>2</sub>, and CuO nanoparticles from manufactured industries and household (Villem, 2009). However, many factors also affect morphological changes of green algae. Their appearance responses to environmental conditions, such as light, temperature, nutrient, salinity, suspended matter, predators, pollutants, and etc. Moreover, in culture conditions, the number of cells per coenobium may be changed due to their environment and coenobia of *D. maximus* could be found in one, two, four, and eight. This characteristic can be defined as phenotypic plasticity which is the ability of a genotype to produce different phenotypes because of environmental changes (Uherkovich, 1995). In some algal species, heavy metals influence specific morphological characteristics. For example, *Scenedesmus bernardii* underwent morphology and the number of cells in coenobium colony differ in response to Zn, Cd, and Pb (Dimitrova *et al.*, 2011). Furthermore, in 2018, a research found significant morphological changes in *D. quadricauda* which were increased one-celled coenobium over 24 and 48 h of exposure in acrylamide (Barbara *et al.*, 2018).

For development of a novel test strain of heavy metal contaminated water, this study investigated the acute toxicity of dissolved Cd and As to the freshwater

microalga *D. maximus*. The possible toxic effects such as percentage of yield inhibition, biovolume, morphology and phenotypic plasticity alteration were evaluated. These results will contribute as supportive information for a new method to assess contamination of heavy metals in water.

## 2. Research Objective

To evaluate the possible toxic effects of Cd and As on freshwater microalga *Desmodesmus maximus*

## 3. Research Methodology

### 3.1 Reagents

All chemicals used were analytical grade or higher. Cadmium and Arsenic stock solution were previously prepared from  $\text{CdCl}_2 \cdot \text{H}_2\text{O}$  and  $\text{NaAsO}_2$ , respectively.

### 3.2 Culturing microalgae cell

*Desmodesmus maximus* ARRLG071 was obtained from culture collection of the Applied Algal Research Laboratory, Department of Biology, Faculty of Science, Chiang Mai University. The microalga was maintained in Jaworski's medium (JM) with pH adjustment medium to 7.0 (Andersen, 2005). The cultures were maintained in a temperature-controlled room at 25 °C.

### 3.3 Toxicity test protocol

Toxicity tests were carried out according to OECD/OCDE 201 guidelines (2011) with some modification. A volume of 50 mL medium was used in 250 mL Erlenmeyer flasks, with metal treatments prepared by the appropriate addition of metal stock.

To obtain *D. maximus* ARRLG071 cells in exponential growth phase, the stock culture was prepared four days prior to performing the assay and kept under the same conditions namely temperature, light, and agitation rate 125 rounds per minute. The toxicity test was done in triplicate, and they were set in an incubator 25 °C, with continuous illumination and constant agitation for a period of 72 h. Every 24 h, aliquots of 6,000 L per flask were taken for analysis of the effects of heavy metals on algal biomass. Numbers of cells were calculated by microscopic counting with a haemocytometer glass slide counting chamber (Hawksley cristalite, neubauer). Samples were taken from test solutions of each replicate for pH at the start (day 0) and end (day 7) of toxicity test.

Because the study focuses on the acute toxicity test with microalgae, the

concentration should inhibit 10% to 50% of their growth or biomass. Both heavy metals concentrations were ranged from 0.01-0.1 mg.L<sup>-1</sup>. After that, the percent of inhibition in yield (% I<sub>y</sub>) was calculated for each treatment replicate as follows eq. 1 (OECD 201, 2011):

$$\% I_y = \frac{Y_c - Y_t}{Y_t} \times 100 \quad \text{----- (1)}$$

Where: % I<sub>y</sub> = percent inhibition of yield; Y<sub>c</sub> = mean value for yield in the control group; Y<sub>t</sub> = value for yield for the treatment replicate. Then, EC<sub>50</sub> values which the inhibitory concentration is giving a 50% reduction in algal growth rate after 72 hours compared to control were calculated.

To obtain the biovolume, 30 cell samples were taken from each flask, at all exposure of the experiment (0, 24 h, 48 h, and 72 h). The estimated biovolume was calculated with eq. 2:

$$V = \frac{\pi}{6} d^2 h \quad \text{----- (2)}$$

Where: d is the cell width and h is the cell height. Cell biovolume was calculated from the average width and length of cells (Olenina, 2006).

For phenotypic plasticity at different heavy metals concentrations, the identification of the coenobium was performed alongside microscopic cell counts and the data were transformed into a percentage of coenobium such as one, two, four, and eight-celled per coenobium.

### 3.4 Statistical analyses

The effects of Cd and As cations upon the growth of the green microalga was calculated using simple linear regression. The mean values and standard deviations will be calculated from 3 replicates (n=3). The homogeneity of variance was evaluated and ANOVA followed by a Tukey's test with 95% confidence was performed using statistical software SPSS 16.0 to assess the significance of differences in methods.

## 4. Research results

### 4.1 Determination of EC<sub>50</sub>

*Table 1* shows the effect of various Cd and As concentrations on cell densities, and percentage of yield inhibition of the microalga *D. maximus* ARRLG071. Cadmium and Arsenic EC<sub>50</sub> was calculated from the yield inhibition found in the different concentrations, compared with the control, where no growth inhibition was observed.

The results showed that *D. maximus* was relatively sensitive to Cd and As resulting in EC<sub>50</sub> concentration of 0.024 and 0.022 mg.L<sup>-1</sup>, respectively. After 72 h of exposure of both heavy metals treatments, every concentration showed a mortality rate equals to or higher than 50%. In Cd treatments, %I<sub>y</sub> of 0.025, 0.05, and 0.01 mg.L<sup>-1</sup> were the same at 51%, while As treatments found that the highest inhibition was 65.16% at 0.1 mg.L<sup>-1</sup>, and the lowest inhibition was 40.74% at 0.01 mg.L<sup>-1</sup>. The average percentage of yield inhibition showed that the effective concentration of both metals was increased in accordance to higher concentration. The overall treatment of dissolved metals toxicity to *D. maximus* based on %I<sub>y</sub>, As showed higher toxicity to this species than Cd. This result demonstrates that *D. maximus* might be a metal-sensitive species.

### 4.2 Biovolume

Biovolume results are shown in *Table 2*. There was a significant difference between 0.5, 0.1 mg.L<sup>-1</sup> of Cd compared with control groups. The highest concentrations can increase the cell width. Cell biovolume was also significantly increased by 0.5 and 0.1 mg.L<sup>-1</sup> of Cd treatments. This demonstrates that there is a variation in the volume of the cells resulting from 72 h exposure to Cd. However, there was no significance of biovolume between As treatments compared to control. The cells seemed to slightly increase in cell width and cell length when they were exposed to the heavy metals.

### 4.3 Phenotypic plasticity

Phenotypic plasticity is the capacity of one genotype to present more than one phenotype when exposed to different conditions. The peculiar characteristic differentiation in coenobia of *Desmodesmus* genus, especially under laboratory cultivation (Shubert *et al.*, 2014), had also been observed in this study. The exposure of different concentrations of Cd and As could interfere coenobia forming of this genera. From the microscopic findings, four types of morphological expressions were identified as one, two, four, and eight cells per coenobium. *Figure 1a, 1b* shows the standard form of coenobia, and *Figure 1c, 1d, and 1e* shows some of the possible morphological alteration.

**Table 1** Cell densities and percentage of yield inhibition for each concentration after a 72-h exposure

Hms	Conc. (mg.L <sup>-1</sup> )	24 h		48 h		72 h		Averag	
		dens.	%I <sub>y</sub>	dens.	%I <sub>y</sub>	dens.	%I <sub>y</sub>	e yield	%I <sub>y</sub>
Cd	0	14.31 <sup>a</sup>	0	21.46 <sup>a</sup>	0	16.63 <sup>a</sup>	0	17.47 <sup>a</sup>	0
	0.01	12.94 <sup>a</sup>	9.63	14.3 <sup>b</sup>	33.34	11.52 <sup>b</sup>	30.72	12.92 <sup>b</sup>	26.03
	0.025	10.56 <sup>a</sup>	26.22	13.33 <sup>b</sup>	37.90	8.15 <sup>c</sup>	50.98	10.68 <sup>ab</sup>	38.86
	0.05	9.51 <sup>b</sup>	33.49	13.13 <sup>b</sup>	38.80	8.11 <sup>c</sup>	51.25	10.25 <sup>c</sup>	41.3
	0.1	9.18 <sup>b</sup>	35.89	13.11 <sup>b</sup>	38.92	8.18 <sup>c</sup>	50.82	10.15 <sup>d</sup>	41.87
As	0	15.16 <sup>a</sup>	0.00	15.72 <sup>a</sup>	0.00	14.76 <sup>a</sup>	0.00	15.21 <sup>a</sup>	0
	0.01	10.63 <sup>b</sup>	29.85	8.47 <sup>b</sup>	46.13	8.75 <sup>b</sup>	40.74	9.28 <sup>b</sup>	38.98
	0.025	10.47 <sup>c</sup>	30.92	7.18 <sup>ab</sup>	54.34	6.93 <sup>c</sup>	53.03	8.19 <sup>bc</sup>	46.13
	0.05	8.58 <sup>c</sup>	43.38	5.7 <sup>c</sup>	63.72	7.31 <sup>bc</sup>	50.45	7.2 <sup>cd</sup>	52.68
	0.1	7.82 <sup>c</sup>	48.39	5.65 <sup>c</sup>	64.03	5.14 <sup>d</sup>	65.16	6.21 <sup>d</sup>	59.2

Hms., heavy metals; Conc., concentration; Dens., density (10<sup>6</sup> cells.mL<sup>-1</sup>); %I<sub>y</sub>, percentage of yield inhibition; Average yield (24-72 h)

As a result, the characteristic of the coenobium was observed under light microscope cell count and the data were analyzed in percentage of cell per coenobium. *Figure 2a* and *2b* shows the percentage of one, two, four, and eight cells coenobium in each different Cd and As concentrations exposed in 24, 48, and 72 h.

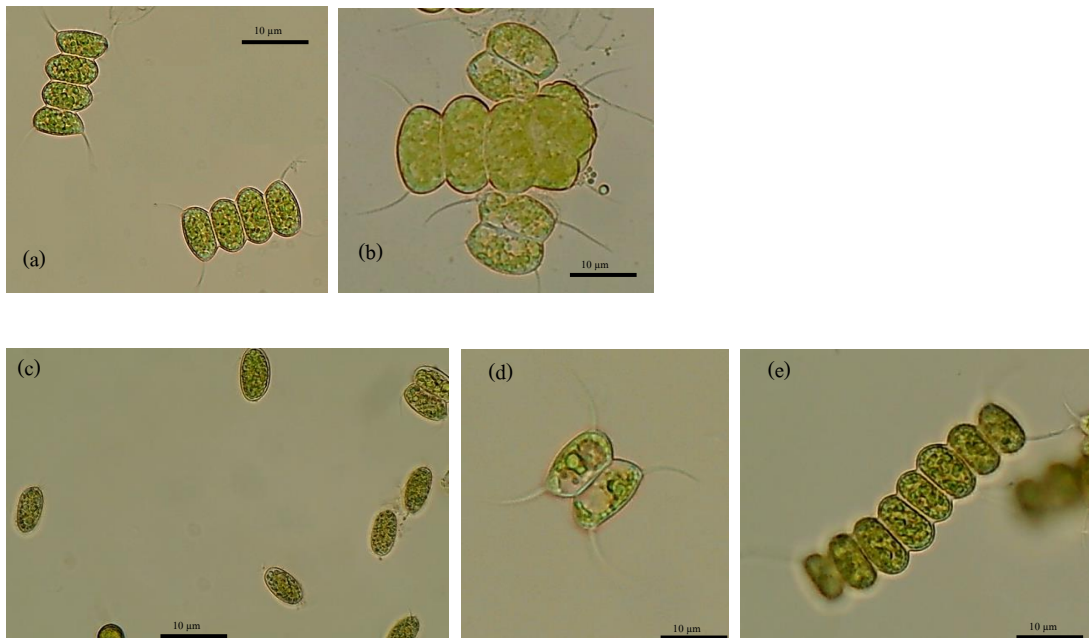
**Table 2** The average standard deviation of cell biovolume, and cell length and width after exposure to Cd and As

Conc. (mg.L <sup>-1</sup> )	Cell width (m)		Cell length (m)		Cell biovolume (mm <sup>3</sup> .L <sup>-1</sup> )			
	Cd	As	Cd	As	Cd	As		
Control	14.07	14.84	30.61	28.17	3.22	0.84 <sup>a</sup>	3.61	1.80 <sup>a</sup>
	3.07 <sup>a</sup>	3.23 <sup>a</sup>	1.62 <sup>ab</sup>	7.95 <sup>a</sup>				
0.01	14.69	15.17	29.78	30.99	3.43	0.93 <sup>a</sup>	3.82	1.09 <sup>a</sup>
	3.00 <sup>ab</sup>	1.61 <sup>a</sup>	1.69 <sup>b</sup>	2.99 <sup>ab</sup>				
0.025	15.41	14.76	30.27	30.69	3.6	1.48 <sup>ab</sup>	3.69	1.59 <sup>a</sup>
	3.70 <sup>ab</sup>	2.59 <sup>a</sup>	2.48 <sup>ab</sup>	3.20 <sup>ab</sup>				

**Table 2** (Continue)

Conc. (mg.L <sup>-1</sup> )	Cell width (m)		Cell length (m)		Cell biovolume (mm <sup>3</sup> .L <sup>-1</sup> )			
	Cd	As	Cd	As	Cd		As	
0.5	14.78	14.21	30.15	30.80	3.94	1.63 <sup>b</sup>	3.76	1.59 <sup>a</sup>
	2.58 <sup>ab</sup>	5.24 <sup>a</sup>	2.45 <sup>ab</sup>	3.18 <sup>ab</sup>				
0.1	16.11	16.43	32.38	31.93	4.61	2.02 <sup>b</sup>	4.74	2.07 <sup>a</sup>
	3.65 <sup>b</sup>	3.01 <sup>a</sup>	2.60 <sup>b</sup>	3.40 <sup>b</sup>				

\*Indicates a significant difference compared to the control group at the same exposure time (p < 0.05 in the same column).



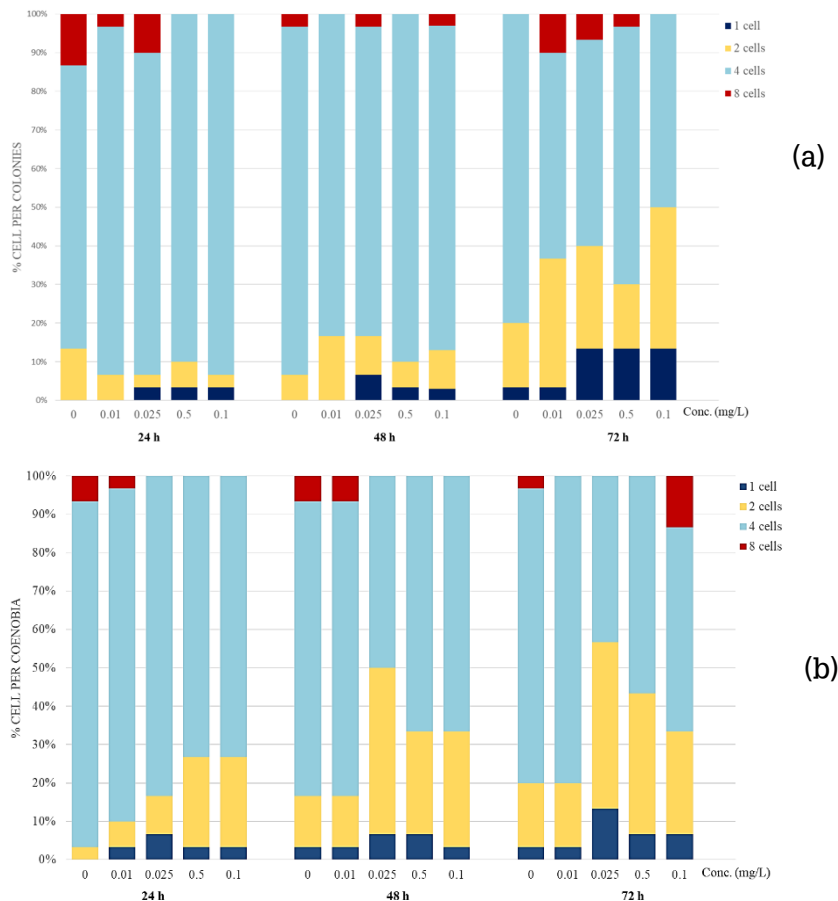
**Figure 1:** The different *coenobia* of *D. maximus* AARLG071:

(a) are the standard form commonly found in the environment and in control group; (b) The cells were swollen after 72-h As exposure;

(c, d, e) are some of the possible phenotypic plasticity after 72 h exposure on metals.

It was found that the forming coenobium of the one-celled and two-celled were noticeably increased in both metals compared to those of the control group, especially after 72 h exposure of As. The number of two-celled coenobium trended to increase more when it was exposed in longer time and higher concentration of As. The

highest number of two-celled was in As treatments under 72 h exposure. Therefore, this result demonstrates that the As might interfere the forming of coenobia more than Cd metals. Moreover, two-celled coenobium in As treatments seemed to have increased starting from 48 h exposure which was faster than Cd treatments. Comparing to control group, four-celled coenobium exhibited a consistent percentage level (73-90%).



**Figure 2:** Percentage of cells per coenobium with one, two, four, and eight cells, in each concentration during 72 h: (a) Cd treatments, and (b) As treatments.

## 5. Discussion

According to the study, the range of heavy metal concentrations were chosen lower than the standard limitation values of wastewater from the water quality law reported by Pollution Control Department in 2018. The results found EC<sub>50</sub>, thus, it is proven that this stain is sensitive to heavy metals and is suitable for the use of indicating metal contaminated water.

Compared with the previous reports, *D. maximus* seemed to be more sensitive to Cd and As than other green microalgae. Cristina *et al.* (2011) tested the toxicity of

Cd on two microalgae, *Scenedesmus obliquus* and *Desmodesmus pleiomorphus*, and found that 96-h EC<sub>50</sub> values of those strains were 0.058 and 1.92 mg.L<sup>-1</sup>, respectively. Furthermore, the study of a soil microalga *Scenedesmus* sp. shows that 72-h IC<sub>50</sub> values of this alga when being exposed to arsenite and arsenate in low-phosphate growth medium were 196.5 and 20.6 mg.L<sup>-1</sup>, respectively (Md *et al.*, 2012). Regarding to another Chlorophyceae algae, Cd at the concentration of 7 mg.L<sup>-1</sup> inhibited *Chlorella vulgaris* growth, expressed as the number of cells, over 18 days exposure (Cheng *et al.*, 2016). Suarez *et al.* (2010) evaluated the toxicity of Cd on *Chlamydomonas moewusii* Gerloff, obtaining an EC<sub>50</sub> 96-h of 4.1 mg.L<sup>-1</sup>. For Arsenic toxicity study, The EC<sub>50</sub> values of AS<sup>III</sup> and As<sup>V</sup> were 27 and 1.15 mg.L<sup>-1</sup> for *Chlorella* sp. (Azizur, 2014).

While analyzing the biovolume of As treatments, it did not differ significantly because the cells may have died before the morphological changes, resulted from the higher percent of yield inhibition. While Cd treatments in this study changed the cell size at concentration of 0.1 mg.L<sup>-1</sup>, Barbara *et al.* (2018) also found that the size of *D. quadricauda* cell significantly changed from 5.88 mg.L<sup>-1</sup> acrylamide exposure. However, up to our knowledge, there is still no report about *D. maximus* biovolume changes. The finding led to the hypothesis that both heavy metals do not only inhibit the growth, but also changes the morphology of algal cells. Morphological changes were generally poor indicators of low metal toxicity compared to growth rate inhibition and the number of cells per coenobium. However, they provided insights of metal-specific toxic modes of action.

The changes of cell number in coenobia demonstrated that Cd and As might be induced as a partial replacement of four-celled coenobium to one-celled and two-celled individuals. *D. maximus* is normally presented in four-celled coenobium. The significant changes into one, two, or eight cells means the cell was being stressed. According to Morales and Trainor (1997), the alteration of morphology did not affect individuals immediately, but they happen from mother-cells to daughter-cells in response to environmental factors. Therefore, programmed phenotypic modifications shown by populations occur as a genotype survival strategy under various environmental conditions (Barbara *et al.*, 2018).

Other studies have reported the effects of toxic substance on the phenotypic plasticity of algae. For example, in 2004, Pena-Castro *et al.* found that coenobium formation of *Scenedesmus incrassatulus* was changed under exposure to various heavy metals. Moreover, Barbara *et al.* (2018) also found the largest phenotypic change in one-celled coenobium after 72 h exposure to acrylamide.



The results showed the potential of using this microalga as test strain for evaluation of heavy metals toxic in water systems. *D. maximus* is sensitive to both heavy metals with relatively low concentrations due to the reducing growth inhibition, the increasing cell biovolume as well as the decreasing cells per coenobia.

## 6. Conclusion

This study established a toxicity test for assessment of Cd and As contaminants in water by using the freshwater microalga *Desmodesmus maximus* AARLG071. The results indicated that both metals caused significant toxic effects to the cells namely the alterations to population growth, the cellular biovolume, and the number of cells per coenobium. *D. maximus* was sensitive to Cd and As, which inhibited 50% of population ( $EC_{50}$ ) after 72-h exposure at 0.024 and 0.022 mg.L<sup>-1</sup>, respectively. In the future, it is suggested that these microalgae should be used as a bioindicator for detection of heavy metals due to their easily observed size and sensitivities.

## 7. Recommendations

7.1 Better understanding of mixture interactivity of this specie is still required to guide environmental management.

7.2 For clearer understanding, chlorophyll concentration and lipid concentrations are recommended.

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## Health Science (Poster Presentation)

## The Effects of a Fall Prevention Program Among Elderly People

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### Abstract

This quasi-experimental study was to examine effects of a fall prevention program for elderly people applying Self-care Theory. Sixty elderly people in Sa Yai Som District, Suphanburi Province, aged 60-75 years, which were a risk of falling were invited to participate in this study. There were 30 participants in the experimental group and 30 participants in the comparison group. The 8 week fall prevention program consisted of enhancing awareness, giving support, enhancing self-care capability and creating environment modification, all of which were designed to improve the effect of self-care capability on fall prevention. The comparison group received conventional care as part of the routine work of the Sub-district Health Promotion Hospital in their community. Data was collected before and after the intervention and included socio-demographic data and the effects of self-care capability on fall prevention. Data analysis was performed using percentage, mean, standard deviation, paired t-test and independent t-test. Results revealed that, at the post-test the experimental group had a significantly higher self-care capability on fall prevention scores than the pre-test score ( $p < 0.001$ ). In addition, the self-care capability on fall prevention scores of the experimental group were greater than in those comparison group ( $p < 0.001$ ). The fall prevention program for elderly people could be adopted by sub-district health promotion hospital personnel to promote the effect of self-care capability on fall prevention for elderly people at home and in the community.

**Keywords :** Fall prevention, Elderly people

## 1. Introduction

“Population ageing is a triumph of humanity but also a challenge to society” (Wongboonsin, K., Philip, G., and Vipap, P., 2004: 10). Worldwide, the number of persons the age over 60 years is growing faster than any other age group. The number of this age group was estimated to be 688 million in 2006, and is projected to grow to almost two billion by 2050 (Burnside, I., and Schmidt, M.G., 1994) By that time, the population of older people will be much larger than that of children under the age of 14 years for the first time in the human history. Moreover, the oldest segment of population, age 80 and over, particularly prone to falls and its consequences is the fastest growing within older population expected to represent 20% of the older population by 2050 (World Health Organization, 2007). The beneficial effects of physical activity for older adults on well-being and quality of life are promote exercise program, particularly strength training, have been shown to be highly effective in reducing subsequent incidence of falls among old people. In program combine strength, balance and endurance training, the risk of fall was reduced the risk by 25 percent; tai chi reduce the risk by 47 percent (Aimee, L., Kio-Wei, L. and Peter, K., 2013)

Falling is one of the most serious problems among elderly people because of physical impairment, function impairment and associated chronic disease. (Gregg E.W., Pereira M.A., Caspersen, 2000 ) Presently, falling among older adult has increased and has been a major problem in many countries where older population continue to increase. Falling among elderly people has two major causes including 1) Intrinsic factors, which are physical and pathological change from the aging process, and 2) Extrinsic factors or environmental conditions, e.g., objects on the pathway, inadequate lighting, or slippery floors. Similarly, many fall prevention studies, both in Thailand and other countries, can be separated into two groups. The first group is a single intervention using one activity for fall prevention. The second group is a multi-functional intervention, which is composed of various activities such as health education, environmental modification, and exercise. (Jittapunkul & Punyacheewin, 1998)

The situation of falls at home among elderly people in the Sayaisom Distric, of the Supanburi Province was examined in a pilot study. Sixty- seven elderly people at the Sayaisom Hospital Elderly Club were asked to complete the Thai Fall Risk Assessment Tool (Thai FRAT) developed by L. Thiemwong, Jittapunkul and Punvacheewin in 2004. It was found that 40.59 % of the elderly people had a risk of falling and 15.26 % had experience a fall in the last 6 months. Most falls took place in the home (65.58%). The majority of the falls were found among elderly people 70-74

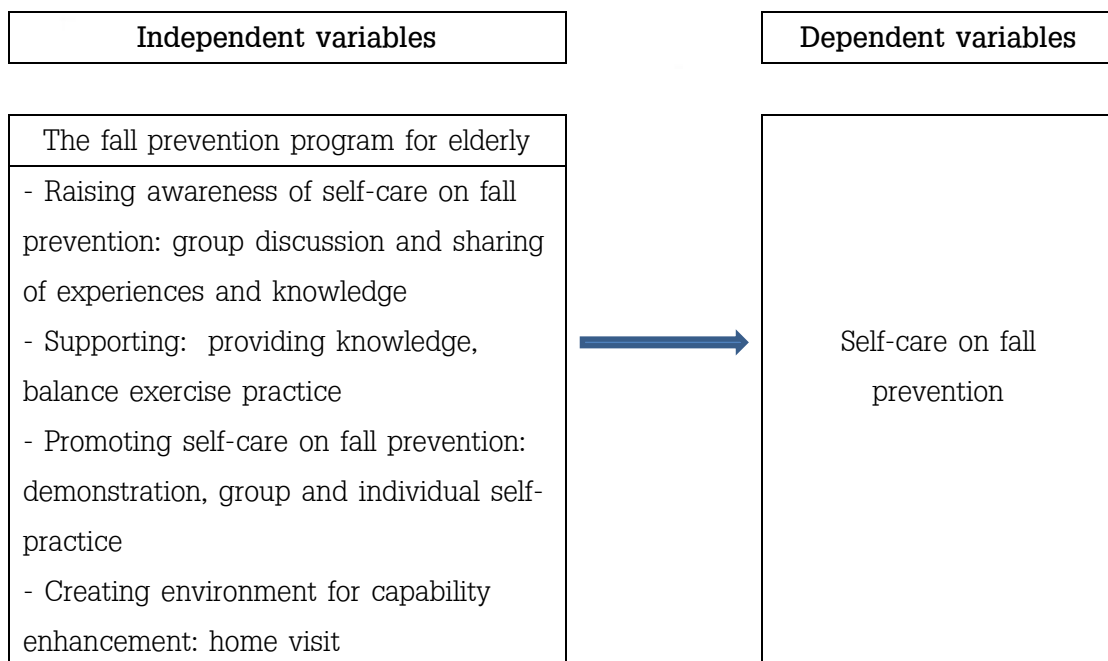
years old (46.66%), 65-69 years old and 75-79 years old (26.66% and 22.22%). The elderly people who experience the falls had visual deficits (72.22%), and balance deficits (65.65%). Most falls resulted in bruises, scratches, and sprains (32.22%). The fall situation among this population reveals that elderly people had visual and balance deficits. These experiences resulted in deficits in the self-care capabilities of those in the study and associated falls. According to the review of literature, when such deficits can be appropriately assessed, falling among elderly people could be prevented.

The researcher intended to examine effects of a fall prevention program for elderly people applying Self-Care Theory. The activities included information regarding self-care for fall prevention and a balance training exercise using a chair and environmental modifications were also provided. These activities comprised four steps as followings : 1) Raising awareness on self-care for fall prevention, emphasis with on risk factors, causes of falling and the necessity of self-care for fall prevention ; 2) Support in term of knowledge of self-care for fall prevention, observing symptoms leading to failing, and balance exercise practicing ; 3) Promoting self-care capacities on fall prevention including proper medication use ; 4) and Creating appropriate environment for all prevention at home.

The researcher intended to develop a fall prevention program which could promote self-care capability on fall prevention at home for elderly people. This program was one primary prevention in health protection. In addition, this program should be more of a health care prevention method than treatment after falling incidences. This program could benefit the quality of life and economy of elderly people, families, communities and nations.

## **2. Research Objectives**

The research objective was to examine the effects of a fall prevention program for the elderly in Sayaisom Distric, Supanburi Province.



**Figure 1** Conceptual framework of the study

### 3. Research hypothesis

3.1 After completion of the intervention, elderly participants in the fall prevention program will have higher scores of self-care on fall prevention than before beginning the intervention.

3.2 After completion of the intervention, elderly participating in the fall prevention program will have higher scores of self-care regarding fall prevention than the comparison group.

### 4. Research Methodology

This study was a quasi-experimental study (using two groups and a pre-test/ post-test design).

#### 4.1 Population

The elderly with risk of falling and living in Sayaisom Distric, Supanburi Province.

#### 4.2 Samples

Purposive sampling was employed to recruit the sample communities. Two similar communities were assigned as the experimental group or the comparison group



by simple random sampling. Based on inclusion criteria, thirty participants were placed in the experimental groups and the other thirty participants were in the comparison.

#### 4.3 Research Instruments

The research instruments used consisted of 3 parts:

**Part 1:** The Thai Fall Risk Assessment Tool for screening (Thai FRAT: L. Thiemwong, S. Jittapunkul, & J. Punyacheewin, 2004).

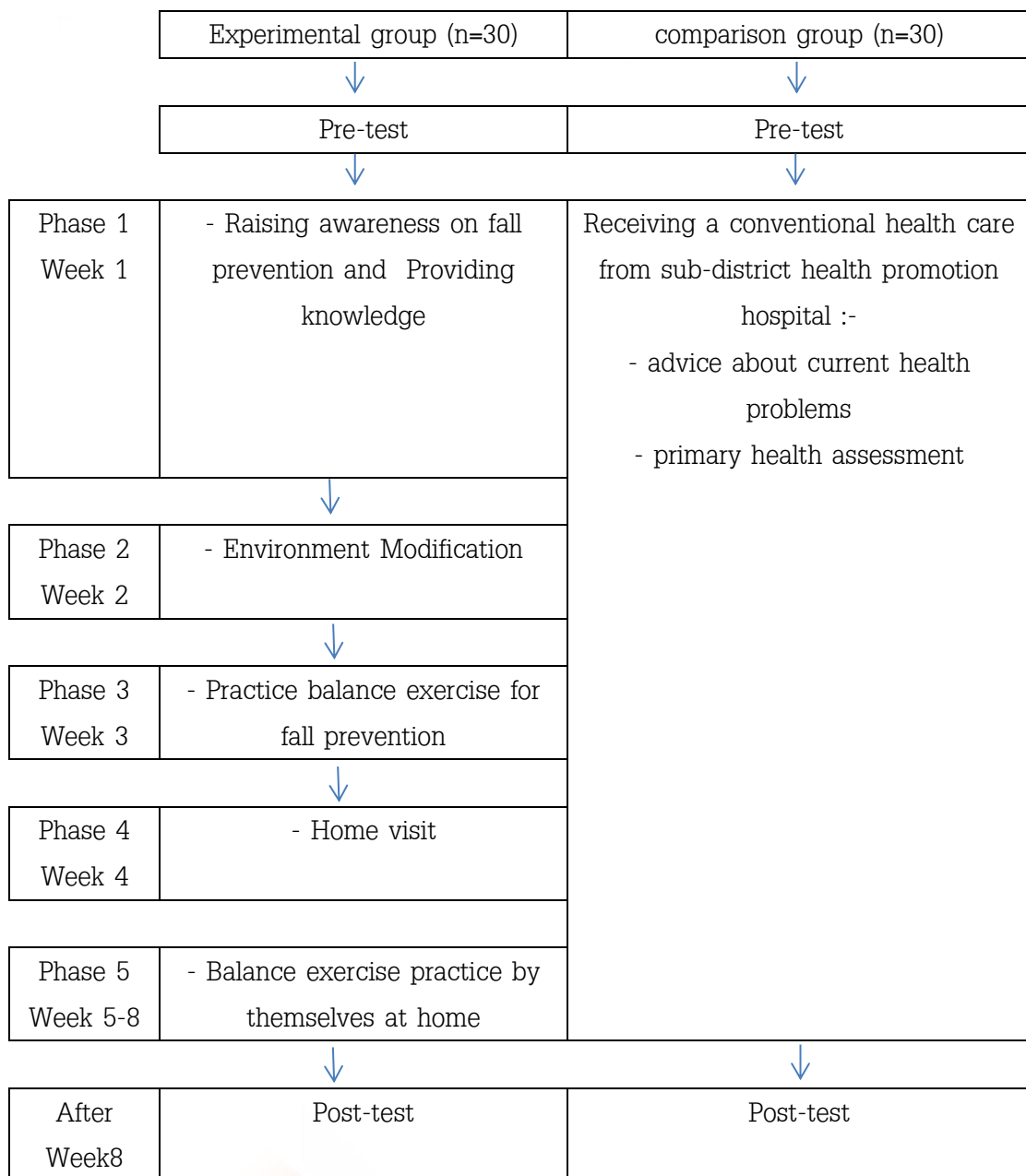
**Part 2:** The instrument for data collection utilized questionnaire including:

1. General socio-demographic characteristics
2. Self-care on fall prevention questionnaire: this is a 28-item rating scale. The total scores ranged from 28 – 84. The content analysis was examined by three experts, resulting in the CVI of 0.81. The revised questionnaire was tried out among 30 elderly who had similar characteristics to the samples. The reliability, examined by Cronbach's Coefficient was 0.72.

**Part 3:** The intervention instrument comprised of a fall prevention program for elderly, a handbook of self-care on fall prevention, a home and environmental modification, a home and environment assessment self-checklist for assessed risk of falling at home, and a record of balance exercise practices was provided to each participant in the experimental group as a monitor instrument during the 5<sup>th</sup> to 8<sup>th</sup> weeks of the intervention. This record was attached at the back of the handbook of self-care on fall prevention.

#### 4.4 Data Collection

The comparison group received conventional health care while the experimental group participated in a falling prevention program. The intervention consisted of 5 phases :



**Figure 2** Research procedures

Phase 1: Raising awareness on fall prevention and Providing knowledge (The 1<sup>st</sup> week of the intervention) The researcher provide a guidance and information regarding the situation and meaning of falling. The impact of falling and risk factors were discussed. The researcher distributed a self-care handbook for self-studying at home. In addition, all participants in the experimental group were asked to assess their

home and surrounding environment using a home and environment assessment self-checklist.

Phase 2: Environment Modification. (The 2<sup>st</sup> week of the intervention) This session consisted of the environment modification discussion for fall prevention as the experimental group had done at the session 1. In this session they watch a video of safety home for elderly along with a presentation conducted by the researcher regarding environment modification for fall prevention.

Phase 3: Balance exercise for fall prevention. (The 3<sup>st</sup> week of the intervention) A balance exercise practice of “stand up and sit down on a chair” was provided to increase balance competency for all participants in the experimental group. They were trained to this exercise at home.

Phase 4: Home visit. The research conducted a home visit in associate with health volunteers to monitor and assess the elderly’s home environment modification. The family members were incited to join in the environment modification for fall prevention.

Phase 5: The participants in the experimental group had balance exercise practice at home and were guided, educated and encouraged to promote their self-care on preventing capacity.

#### **4.5 Data Analysis**

The data were collected before and after the intervention and analyzed descriptive and inferential statistics.

1. The socio-demographic data were analyzed and presented by frequency distributions, percentages, means and standard deviations.
2. The difference of the self-care on fall prevention average scores within the experimental and comparison groups was examined by using an independent t-test.
3. The difference of the self-care on fall prevention average scores between the experimental and comparison groups, were examined using a paired t-test.

### **5. Research Results**

#### **5.1 The socio-demographic characteristics**

The majority of the elderly people in the experimental group and comparison group were female (90.51 % and 91.62 % respectively ), widowed, single, divorced or separated (42.22% and 58.72% respectively) completed a primary or secondary level of education (98.54% and 87.23% respectively) and were still working (41.21% and 42.92% respectively). Most lived in a two-storey house (59.35% and 68.83% respectively). Their

body mass index was in a normal rang (20-24.99 kilogram/meter<sup>2</sup>, 62.14% and 55.64% respectively) which were metabolic disease (i.e. hypertension). The experimental group had an average age of 71.02 years, and an average income of 3,500 Baht. The comparison group had an average age of 72.54 years, with the average income being 4,700 Baht. A comparison of the personal characteristics between the experimental group and the comparison group using Chi-square and an independent t-test revealed no significant difference ( $p > 0.05$ ).

### 5.2 The hypothesis testing results

At post-test, the experimental group had greater self-care on the average fall prevention scores than scores at the pre-test ( $t = -16.47$ ,  $df = 29$  ;  $p < 0.001$ ). Participants in the experimental group also indicated a significantly higher self-care on fall prevention average scores than those in the comparison group ( $t = -15.121$ ,  $df = 29$  ;  $p < 0.001$ ) whereas the self-care on fall prevention average scores in the comparison group between the pre-test and post-test were not different. ( $p > 0.05$ ).

**Table 1** The comparison of self-care on fall prevention average scores within and between groups, before and after the intervention

self-care on fall prevention	$\bar{X}$ t-test	S.D.	Paired t-test	Independent	df	p
Within group						
Experimental Group			-16.470	-	29	<0.001
	Pre-test	62.39	4.24			
Comparison group	Post-test	75.28	3.92		29	0.592
	Pre-test	65.33	4.51	-1.325		
Between group	Post-test	65.28	3.92		58	<0.001
	Experimental Group	75.28	3.92	13.053		
	Comparison group	65.28	3.92			

## 5. Discussion

The activities of this study consisted of 4 procedures as followings:

### 5.1 Raising awareness of self-care on fall prevention :-

The participants were guided about the fall situation, risk factors (internal factors and external factors including other possible impacts or danger caused by falling) leading to falling. The participants that were encouraged to participate in a group

discussion resulted in the higher awareness. In addition, the participants could make their decision on fall prevention better based on the knowledge and discretion of their experience. This was in accord with the self-care concept stating that the individual could take care of themselves best when they had knowledge about themselves and a better understanding of the environment surrounding them. Therefore, a self-care required proper knowledge on internal and external circumstances (Orem, 2001: 145)

#### 5.2 Support :-

The participants were supported as follows: (1) teaching self-care on fall prevention in terms of general care; (2) physical balance exercise by “standing up and sitting down on a chair” practice under supervision of health volunteers or mentors. (3) use of a self-care handbook on falling prevention so that the elderly could practice at home; (4) home visits carried out by researchers and health volunteers in order to assess and enhance the environmental modifications, and follow-up with the use of balance exercise practices. It was expected that family members would voluntarily participate in the environmental modifications and the spiritual encouragement and praises given to the elderly. This is similar to the research that revealed that self-care capacity for elderly requires social support (Day and others, 2002)

5.3 Promoting self-care on fall prevention : Education was the best way to improve the knowledge and skill of elderly on self-care capacity enhancement. This finding was in agreement with the concept of Orem’s Self-Care (Orem, 2001: 25) stating that self-care was carried out by persons with specific purpose and goal. According to the literature review, there are several kinds of balance exercise that can be used in fall prevention for elderly such as Chinese Ti Kek exercise (Li and others, 2005), dancing and Yoga exercise. These exercise require group practice should be at least 3 times a week for 8 weeks to improve the physical balance. Yoga may not be suitable for the elderly who were the participants of this study. Note that the participants lived quite far away from each other, so group exercise was impossible. As such, the balance exercise by “stand up and sit down on a chair” practice was used instead on the fall prevention (Diane, 2018). The “stand up and sit down on a chair” practice is easy to practice, and can be performed at home while doing other activities such as watching TV or listening to a radio. The “stand up and sit down on a chair” should be performed 30 minutes per session and at least 3 times a week. The “stand up and sit down on a chair” should be regularly recorded in the self-care handbook an fall prevention for further reference during home visits.

5.4 Creating the environmental modification was also important and adjusted their behavior to achieve the set goal. Referring to the literature review, the environment or the external factors are the main causes of falling among the elderly people, accounting for 51% (World Health Organization, 2007). In this study, the participants were encouraged to realize the importance of external risk factors that were the causes of falling. The participants were asked to observe and assess their home and surrounding environment using checklists. The participants also watched a video about safety at home. At last, the elderly people would acknowledge and conclude conceptual framework. After home visits and the assessment of the environment, the participants and their family members should be praised and verbally encouraged. Having been provided with knowledge and understanding on fall prevention, home visit, assessment, observation and group discussion, most participant indicated better environmental modification. Such findings were in accord with the study of Cumming and others (1999: 1397-1402) which reveals that the experimental group indicated an improved environmental modification after home visits, remarkably accounted for 50%

## 6. Conclusion

The fall prevention program for elderly could enhance self-care on fall prevention among elderly who had risk of falling. This outcome could be promote through balance exercise practice and home environment modification.

## 7. Recommendation

The following are some recommendation based on the research results:

7.1 The fall prevention program for elderly people could be used as a guideline for primary care providers in primary health care settings (e.g. sub-district health promotion hospitals). This program could promote elderly people's health and their quality of life. However, such guidelines should be adjusted in compliance with the related contexts and lifestyle of elderly people in each community

7.2 The research finding should be presented to community leaders or local administration executives. This information can be employed to establish health policies of fall prevention in elderly people or integrated into a long-term care policy as the elderly population is increasing.

7.3 The balance exercise practice by stand up and sit down on a chair should be used as an exercise foe elderly people with chronic disease such as osteoarthritis, diabetes, hypertension etc. Such an exercise can improve not only the

physical balance but also the blood circulation system. This balance exercise is very ideal for the elderly people because it is easy to perform at home and can be practiced while doing such things as watching TV or listening to a radio.

7.4 The family members and relatives should be encouraged to participate in the environmental modification and assessment. Moreover, the health volunteers should supervise the balance exercise of standing up and sitting down on a chair promote optimal safety.

7.5 Policy surrounding fall prevention should be further established to promote the health of elderly in the community. The local administration organizations should be give a budget and the required manpower for the environmental modification to prevent the elderly from falling more efficiently.

7.6 The telephone contact may be used along with the home visit for the following-up of behavior and environment modification.

7.7 For further study, other techniques for illiterate elderly to review self-care knowledge on fall prevention should include videos, VCDs, and movies along with the use of a self-care handbook.

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## Antimicrobial activity of *Hiptage candicans* (Hook.f.) Sirirugsa crude extracts against human pathogens.

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### Abstract

This research aimed to study the antimicrobial activity of *H. candicans* (Hook.f.) Sirirugsa crude extracts from stem and leaves against the human pathogens, including *Staphylococcus aureus* TISTR 1466, *Staphylococcus aureus* TISTR 2329, *Staphylococcus epidermidis* TISTR 518, *Propionibacterium acnes* DMST 14916, *Streptococcus mutans* DMST 14283, *Pseudomonas aeruginosa* TISTR 781, *Escherichia coli* TISTR 073, *Escherichia coli* TISTR 780, *Proteus vulgaris* DMST 557 and *Candida albicans* TISTR 5554. The screening of antimicrobial activity of extracts was conducted by a disc diffusion method. Then the minimum inhibition concentration (MIC) and the minimum bactericidal concentration (MBC) of extracts were determined. The result showed that the leaf crude extract had the antimicrobial activity and effective against *S. epidermidis* TISTR518 ( $13.00 \pm 0.00$  mm.), *P. vulgaris* DMST 557 ( $12.67 \pm 0.58$  mm.), *S. aureus* TISTR 2329 ( $12.33 \pm 0.58$  mm.), *S. aureus* TISTR 1466 ( $12.00 \pm 0.00$  mm.) and *S. mutans* DMST 14283 ( $9.67 \pm 0.58$  mm.), whereas, the stem crude extract were effective against *S. epidermidis* TISTR 518 ( $11.67 \pm 0.58$  mm.), *S. aureus* TISTR 1466 ( $11.33 \pm 0.58$  mm.), *S. aureus* TISTR 2329 ( $11.33 \pm 0.58$  mm.), *P. vulgaris* DMST 557 ( $10.33 \pm 0.58$  mm.), and *S. mutans* DMST 14283 ( $6.67 \pm 0.58$  mm.). However, both crude extracts did not show antimicrobial activity against *P. acnes* DMST 14916, *P. aeruginosa* TISTR 781, *E. coli* TISTR 073, *E. coli* TISTR 780 and *C. albicans* TISTR 5554. The MIC and MBC of the crudes extract which were against with *S. epidermidis* TISTR 518 was 3.90 and 15.62 mg/ml respectively. The results of this study found that the antimicrobial activity of *H. candicans* (Hook.f.) Sirirugsa crude extracts have an effect on the skin pathogen.

**Keywords:** *Hiptage candicans* (Hook.f.) Minimal Inhibitory Concentration (MIC) Minimal bactericidal concentration (MBC)

## 1. Introduction

A diverse microbial flora is associated with the skin and mucous membranes of every human being from shortly after birth until death. The microbial can live as a commensal organism on the skin, nose, and throat (Ahoyo et al., 2014). Some bacterial infections are mild and easily treated with topical antibiotics; however, others require an oral antibiotic. There are wide spread cutaneous pathogen responsible for the great majority of microbial infections in humans. There has also been a rapid increase in the incidence of infections with drug-resistant microorganisms acquired by patients while in the hospital. Pathogenic microbial human infection strains are correlated with nosocomial infection, fomites and antimicrobial-resistant strains. The advancement of chemistry led to the development of the pharmaceutical industry and the provision of chemical drugs. Although the effect of chemical drugs are faster and stronger than herbal drugs treated disease. Obtaining new antimicrobial agents from natural resources is necessary to develop alternative drugs for safe and cost-effective health care. Thailand use of medicinal plants as a source for relief from illness can be traced back over for thousands of years and have been isolated natural plants of modern drugs.

In Thailand, Nora or scientific name is *Hiptage candicans* (Hook.f.) Sirirugsa has been used as a herbal medicine for burning sensation, wounds, ulcers, inflammations, leprosy, scabies, cough and rheumatism (Chen,S.K.andM. Funston, 2008). This plant is belong to the Malpighiaceae family and found almost throughout India, China, Myanma, Southeast Asia, Malaysia and Thailand (Phennapa Subcharoen, 2006) Nora is erect shrubs, small trees, or lianas; branchlets and leaves densely yellowish. Petiole 5-10 mm; leaves blade oblong or elliptic-oblong, 9-15 × 4-8 cm, abaxially densely yellowish or gray-white tomentose to sparsely pubescent along veins, adaxially glabrate, or both surfaces glabrous, base broadly cuneate or rounded, with or without glands, apex shortly acuminate; pedicels 1.5-2 cm, articulate distally, bracteoles lanceolate. Sepals 4-5 mm, densely yellow-brown pubescent, apex triangular; gland black, oblong-lanceolate, 3-4 mm, base decurrent to pedicel. Petals white or pink, ovate or rotund, 8-11 × 6-8 mm, densely white pubescent. Stamens differing in size, longest up to 15 mm, others 3-4 mm; anthers 1.5-2 mm. Style thin, ca. 12 mm, apex pointed. Samara yellow-brown pubescent, abaxial wing elliptic-lanceolate, 3-3.5 cm, apex rounded or sometimes shallowly lobed, lateral wings 1-1.5 cm, apex rounded or shallowly lobed. Fl. Feb-Mar, fr. Apr-May (J. D. Hooker, Fl. Brit, 1874).

According to the study it has been found that, Nora or *H. candicans* was used medicinal plants by wood core is used as a tonic for nourishing, bark and leaves are use treat for wounds, treat skin diseases (Vittaya, Nutee.2556). M.V.Kumudhavalli et al. (2010) have studied deals with the phytochemical and pharmacological studied of leaves of Nora, shows the preliminary phytochemical studies the presence of

carbohydrate, proteins, amino acids, saponins, tannins, glycosides, phenolic compounds and flavonoids in ethanol extract, have been reported which has antimicrobial effect and mainly used in the treatment of diarrhea and ear infection in human beings, besides it also has antimicrobial properties against. Murugan M and Mohan V.R. (2011) have studied deals with the antibacterial activity was carried out against *S. aureus*, *K. pneumoniae*, *B. subtilis*, *E. coli*, *P. aeruginosa* and *S. typhi* by disc diffusion method. Among the solvent extracts, methanol extract was the most effective against with the tested microorganisms.

The screening of plant extracts and their products for antimicrobial activity have shown that, higher plants represent potential sources of novel antibiotic prototypes (Afolayan, 2003). Even though many of *Hiptage* spp. has been tested for antimicrobial properties, the vast majority of them have not yet been evaluated (Balandrin et al., 1985). Considering this, an attempt has been made to investigate the antimicrobail activity of ethanal extracts parts of leaves and stem bark of *H. candicans* (Hook.f.) Sirirugsa. Antibiotics extracted from medicinal plants are an alternative method to reduce the antibiotic resistance of microbial pathogens.

## 2. Research Objectives

These reseach aimed to study the antimicrobial activity of *H. candicans* (Hook.f.) Sirirugsa crude extracts from stem and leaves against the human pathogens.

## 3. Research Methodology

### Collection of plant material

Leaves and stem of Nora or *H. candicans* (Hook.f.) Sirirugsa were collected from Phetchabun province, Thailand.

### Plant extraction

Each leaves and stem were washed, dried in sunlight, and then placed in a hot-air oven with temperature controlled at 60 °C. Dried plant parts were then collected blended and weighed before extraction. 3,000 g of shade-dried power was filled in the thimble and extraction successively with 95% ethanol for 3-5 days. The extract solutions were filtered through Whatman filter paper No. 1. The filtrates were concentrated by evaporation and frozen in a freeze dryer. Finally the crude extract powder were calculated for % yield and stored under refrigeration at 4 °C for further studies. The extraction yield (%) was expressed as shown as following equation.

$$\% \text{ Extraction yield} = \frac{\text{amount (g) of dried crude extract obtained}}{\text{amount (g) of finely grounded plant material used}} \times 100$$

### Human pathogen

Ten stains of human pathogen were used for screening the antimicrobial activity of the plant extracts. There were bacterial cultures of *S. epidermidis* TISTR 518, *S. aureus* TISTR 1466, *S. aureus* TISTR 2329, *E. coli* TISTR 780, *E. coli* TISTR 073, *P. aeruginosa* TISTR 781 and fungi cultures of *C. albicans* TISTR 5554 were obtained from Thailand Institute of Scientific and Technological Research (TISTR), *S. mutans* DMST 14283 *P. acnes* DMST 14916 and *P. vulgaris* DMST 557 were obtained from the culture collection centre, Department of Medical Sciences, Thailand. The bacterial were maintained on Muller Hinton Agar (MHA) and Trypticase Soy Broth (TSB), fungi was maintained on Sabouraud Dextrose Agar (SDA) at 37 °C for 18–24 hr. and *P. acnes* DMST 14916 was maintained on Brain Heart Infusion (BHI) incubated under anaerobic conditions at 37 °C 18–24 hr.

### Preparation of Inoculum

Microbial (including *S. epidermidis* TISTR 518, *S. aureus* TISTR 1466, *S. aureus* TISTR 2329, *E. coli* TISTR 780, *E. coli* TISTR 073, *P. aeruginosa* TISTR 781, *C. albicans* TISTR 5554, *S. mutans* DMST 14283 and *P. vulgaris* DMST 557) were sub-cultured in TSB overnight at 37 °C. Only for *P. acnes* DMST 14916 was maintained on Brain Heart Infusion (BHI) incubated under anaerobic conditions at 37 °C 18–24 hr. In order to prepare a microbial suspension, fresh and young bacterial were transferred to the Muller Hinton Broth and incubated at 37 °C for 2 hr., therefore. Bacterial strain cultures were adjusted to obtain a final concentration of 10<sup>8</sup> CFU/ml using a 0.5 McFarland standard (Bauer, et al., 1966).

### Screening of the antimicrobial activity

Disc diffusion assay on Muller Hinton Agar plates were used to screen the antibacterial and antifungal activities by determine the inhibition zone of stem and leaf crude extracts according to method of Bauer, et al., (1966). Whatman's No.1 filter paper was punched into 6 mm. disc form and they sterilized, each sterile disc was incorporated individually with 20 µl. 500 mg of leaves and stem crude extracts were dissolved in dimethyl sulfoxide (DMSO). The condensed crude extracts were applied in on discs and they were allowed to dry in air. The 20 ml of sterilized Muller Hinton Agar (MHA) for bacteria, Brain Heart Infusion (BHIA) for *P. acnes* and Sabouraud Dextrose Agar (SDA) for *C. albicans* were poured into sterile petriplates, after solidification, 100 µl of fresh culture of human pathogens were swabbed on the respective plates. The discs were kept over the agar plates using sterile forceps at various concentrations. A solvents DMSO was used as a negative control. Antibiotics, Cloxacillin and Clindamycin were used as positive control for bacteria, while Ketoconazole was used for *C. albicans* TISTR 5554. Plates were then incubated for 24 hr. at 37 °C. Antimicrobial activity was measured in terms of the diameter of the

inhibition zone (mm). The experiment was performed triplicately. The plant extracts that showed antimicrobial activity then were tested to determine the minimum inhibitory concentration (MIC) and the minimum bactericidal concentration (MBC) for each bacterial and fungal sample.

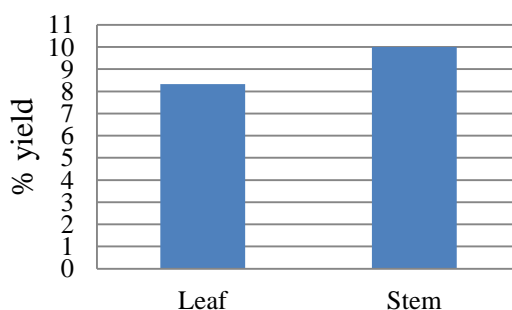
#### Determination of MIC and MBC

The MIC and MBC were determined by two-fold serial dilution method using a macro-broth dilution technique modified method according to (Schwalbe, Steele-Moore & Goodwin, (2007). A stock solution (500 mg/ml) of each extract was serially two-fold diluted in a tube with 1 ml Muller Hinton Broth (MHB) to obtain concentrations ranging from 500 mg/ml to 0 mg/ml. The zero concentration tube served as a growth control. The inoculum size was prepared by diluting cell cultures in TSB to obtain a cell concentration of  $10^8$  CFU/ml using 0.5 McFarland standards. Then 1 ml of each standard inoculum was added to the diluted extracts. Cultivation was carried out at 37 °C for 18–24 hr. to determine bactericidal or bacteriostatic activity. Bactericidal effect was determined when no growth occurred on the sub-culture medium after the MIC determination. Minimal bactericidal concentration (MBC) was defined the lowest concentration of a plant extracts that killed the majority of the initial bacterial inoculum.

### 4. Research Results

#### 4.1 Extraction Yield

To evaluate % extraction yield of crude extracts, Stem and leaves of *H. candicans* (Hook.f.) Siriruga were extracted in 95% ethanol. The ethanol extracts were concentrated under rotary evaporation (BCHI Rotavapor R-114, Switzerland) and dried by freeze dryer (Labconco, Kansas City, MO). The result in figure 1 showed that stem crude extract gave significantly higher percentage yield than leaf crude extract with percentage yield at 10.00 and 8.33 respectively.



**Figure 1.** Extraction yield of leaf and stem crude extract of *H. candicans* (Hook.f.) Siriruga

#### 4.2 Antibacterial Activity

The inhibition zone was determined using agar disc diffusion method. The crude extracts of part leaves and stem of *H. candicans* (Hook.f.) Sirirugsa showed the inhibitory activity on the test microorganism. The mean of the inhibition zones shown in table 1

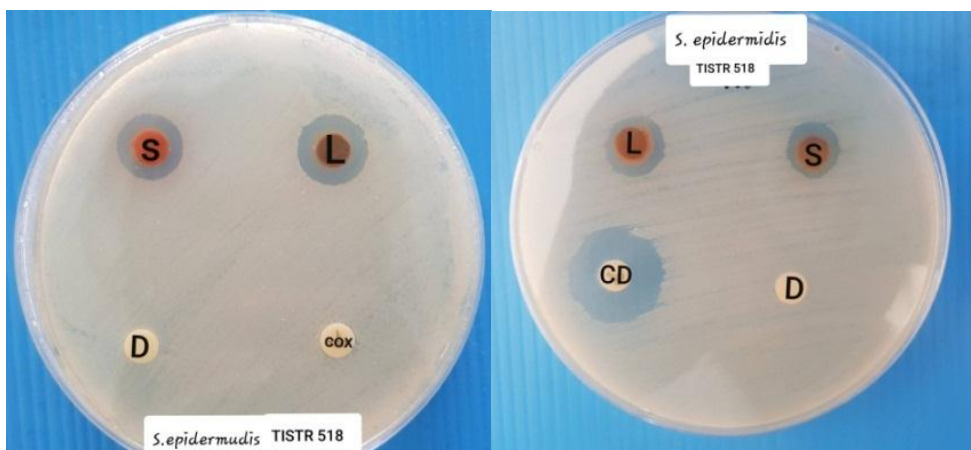
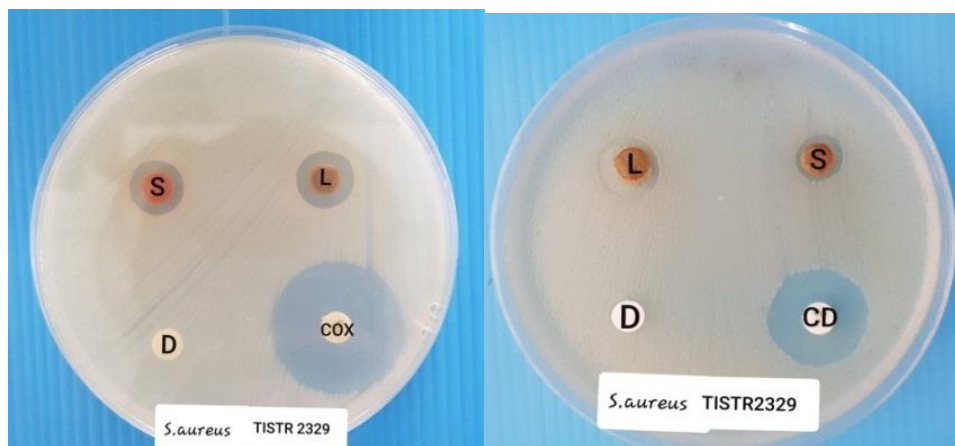
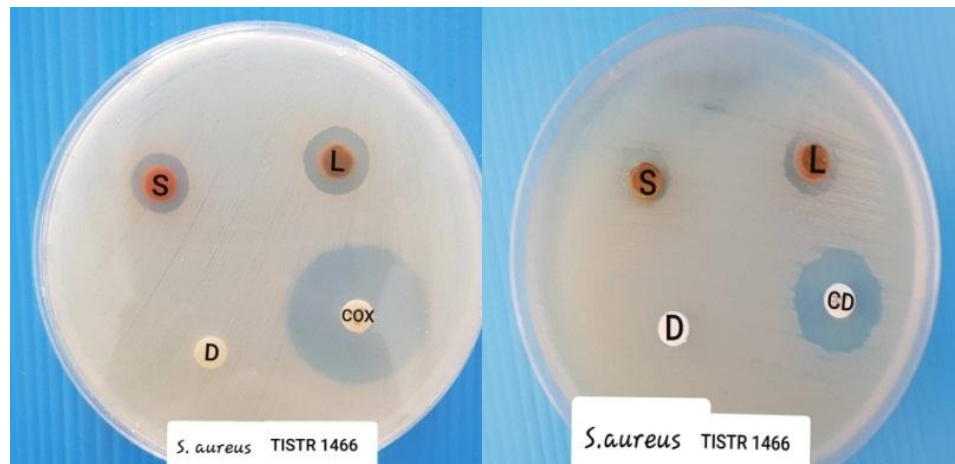
**Table 1** screening the antimicrobial activity of leaves and stems *Hiptage candicans* (Hook.f.) Sirirugsa crude extracts by disc Diffusion method

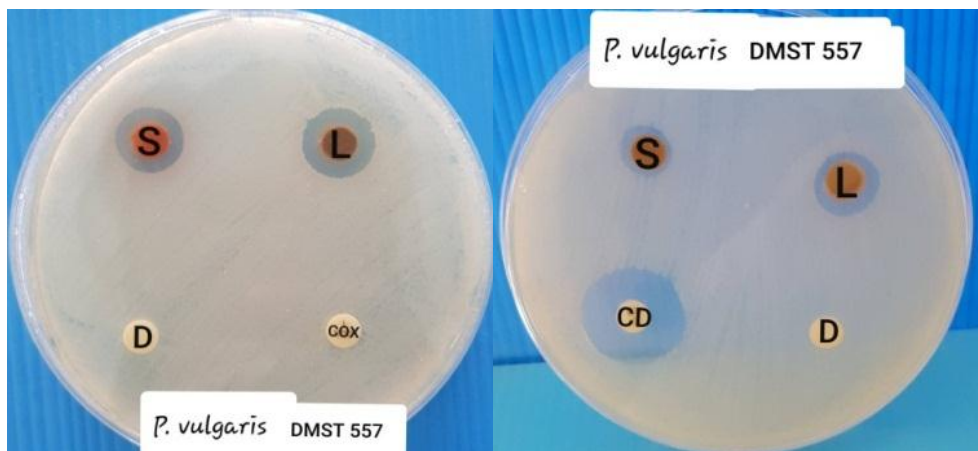
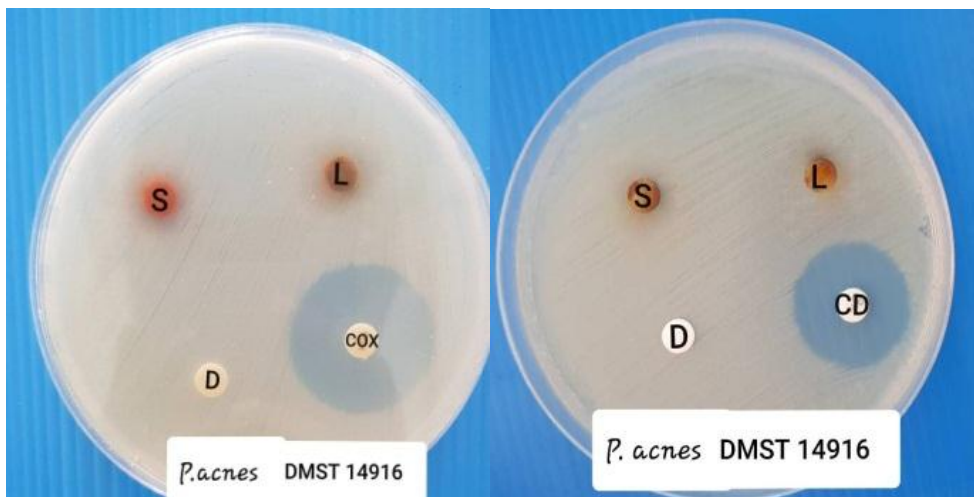
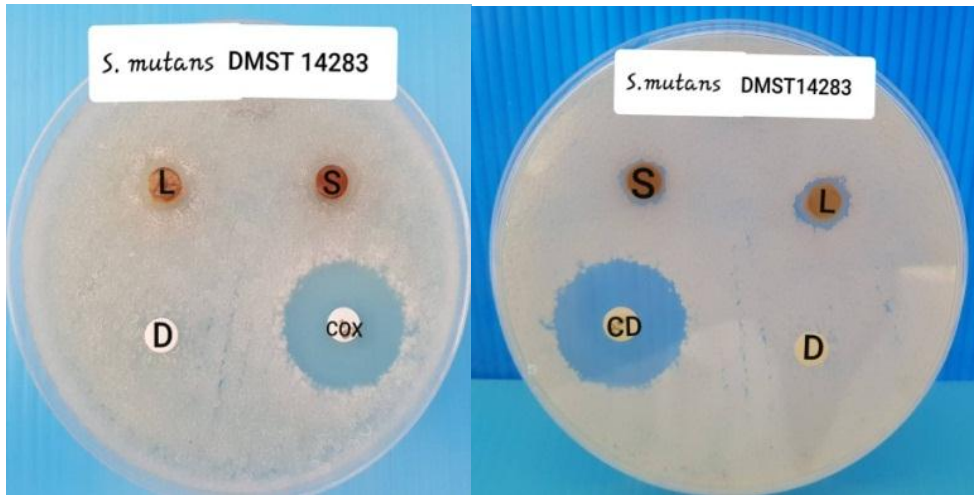
Pathogenic Bacteria	Inhibition zone (mm.)					
	Leaves	stem	DMSO	Antibiotics		
				cloxacillin	clindamycin	ketoconazole
<i>S. aureus</i> TISTR 1466	12.00 ± 0.00	11.33 ± 0.58	-	27.67 ± 0.58	23.67 ± 0.58	NT
<i>S. aureus</i> TISTR 2329	12.33 ± 0.58	11.33 ± 0.58	-	28.00 ± 0.58	23.55 ± 0.58	NT
<i>S. epidermidis</i> TISTR 518	13.00 ± 0.00	11.67 ± 0.58	-	-	18.33 ± 0.58	NT
<i>S. mutans</i> DMST 14283	9.67 ± 0.58	6.67 ± 0.58	-	24.33 ± 0.58	24.33 ± 0.58	NT
<i>P. acnes</i> DMST 14916	-	-	-	27 ± 0.00	24 ± 0.00	NT
<i>P. vulgaris</i> DMST 557	12.67 ± 0.58	10.33 ± 0.58	-	-	20.33 ± 0.58	NT
<i>P. aeruginosa</i> TISTR 781	-	-	-	-	-	NT
<i>E. coli</i> TISTR 073	-	-	-	-	-	NT
<i>E. coli</i> TISTR 780	-	-	-	-	-	NT
<i>C. albicans</i> TISTR 5554	-	-	-	NT	NT	27 ± 0.00

**Note:** NT = No Test, - No inhibition zone, DMSO = Dimethylsulfoxide was used as negative control, Antibiotics were used as positive control

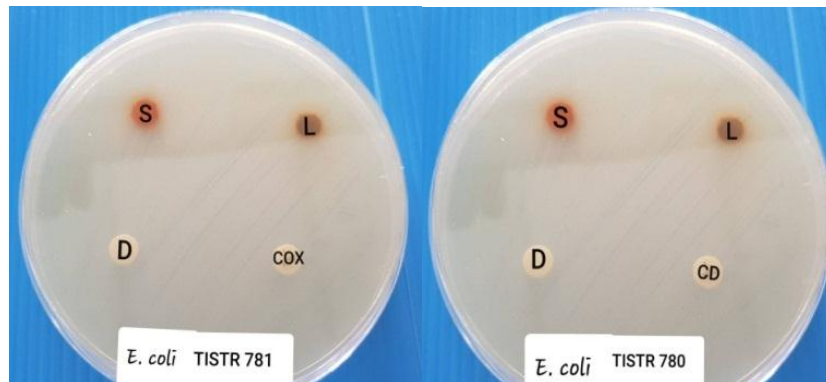
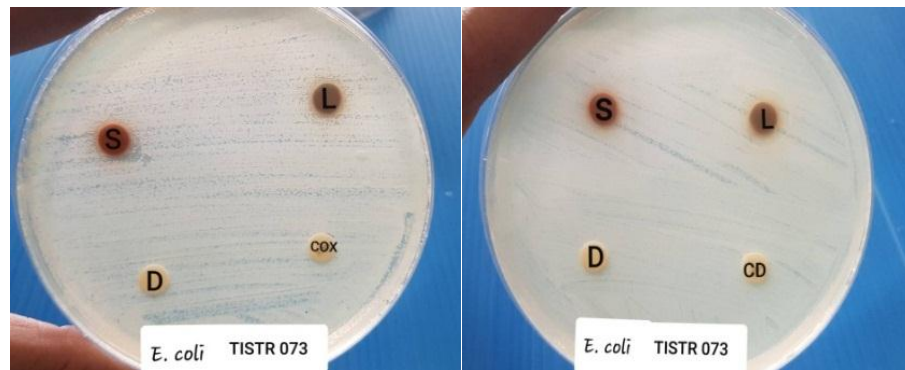
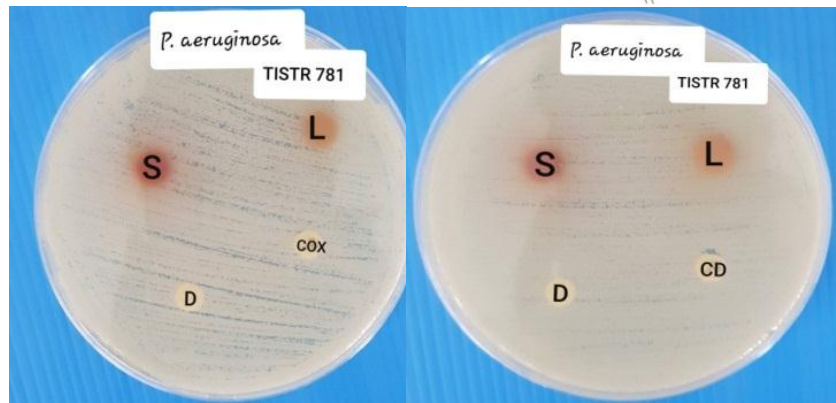
The leaf crude extract exhibited strong inhibitory effects against *S. aureus* TISTR 1466, *S. aureus* TISTR 2329, *S. epidermidis* TISTR 518, *S. mutans* DMST 14283, and *P. vulgaris* DMST 557 with inhibition zones in the ranges of 12.00 ± 0.00, 12.33 ± 0.58, 13 ± 0.00, 9.67 ± 0.58 and 12.67 ± 0.58 mm. respectively. The stem crude extract exhibited strong inhibitory effects against *S. aureus* TISTR 1466, *S. aureus* TISTR 2329, *S. epidermidis* TISTR 518, *S. mutans* DMST 14283, and *P. vulgaris* DMST 557 with inhibition zones in the ranges of 11.33 ± 0.58, 11.33 ± 0.58, 11.67 ± 0.58, 6.67 ±

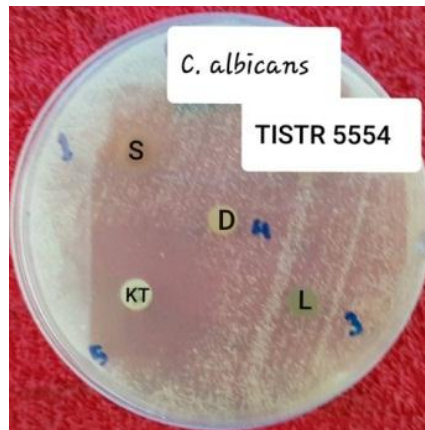
0.58,  $10.33 \pm 0.58$  mm. respectively. None of the leaves and stem crude extract was effective against *P. acnes* DMST 14916, *P. aeruginosa* TISTR 781, *E. coli* TISTR 073, *E. coli* TISTR 780, *C. albicans* TISTR 5554. Figure 2 shown the antimicrobial activity of leaves and stem *H. candidans* (Hook.f.) Sirirugsa crude extracts using disc diffusion method











**Figure 2.** Inhibitory activity part leaves and stem of *H. candidans* (Hook.f.) Sirirugsa crude extract against. L = leaf crude extract, S = stem crude extract, D = DMSO, CD = clindamycin, cox = cloxacillin, K = ketoconazole

### Determination of bacterial susceptibility to crude extract by MIC and MBC

Table 3 showed the MIC and MBC of stem and leaf crude extract on the effective stains such as *S. epidermidis* TISTR 518, *S. aureus* TISTR 1466, *S. aureus* TISTR 2329, *P. vulgaris* DMST 557 and *S. mutans* DMST 14283. The ethanolic leaf crude extract was found to be more active against *S. epidermidis* TISTR 518 with a MIC of 3.90 mg/ml (MBC = 15.62 mg/ml), followed by *S. aureus* TISTR 1466 with a MIC of 7.81 mg/ml (MBC = 31.25mg/ml), *S. aureus* TISTR 2329 with a MIC of 7.81 mg/ml (MBC = 31.25 mg/ml), *P. vulgaris* DMST 557 with a MIC of 62.5 mg/ml (MBC = 125mg/ml), and *S. mutans* DMST 14283 with a MIC of 125 mg/ml (MBC = 250mg/ml). The stem crude extract was found to be more active against *S. epidermidis* TISTR 518 with a MIC of 3.90 mg/ml (MBC = 15.62 mg/ml), followed by *S. aureus* TISTR 1466 with a MIC of 15.63 mg/ml (MBC = 62.5 mg/ml), *S. aureus* TISTR 2329 with a MIC of 15.63 mg/ml (MBC = 62.5 mg/ml), *P. vulgaris* DMST 557 with a MIC of 125 mg/ml (MBC = 125 mg/ml), and *S. mutans* DMST 14283 with a MIC of 125 mg/ml (MBC = 250 mg/ml)

**Table 3.** MIC and MBC of leaves and stem *Hiptage candidans* (Hook.f.) Sirirugsa crude extract

Pathogenic Bacteria	Leaf crude extract (mg/ml)		Stem crude extract (mg/ml)	
	MIC	MBC	MIC	MBC
<i>S. aureus</i> TISTR 1466	7.81	31.25	15.63	62.5
<i>S. aureus</i> TISTR 2329	7.81	31.25	15.63	62.5
<i>S. epidermidis</i> TISTR 518	3.90	15.62	3.90	15.62
<i>S. mutans</i> DMST 14283	125	250	125	250
<i>P. vulgaris</i> DMST 557	62.5	125	125	125

## 5. Discussion

Our results of leaves and stem of *H. candicans* were extracted from 95% ethanol and were demonstrated antimicrobial activity, the leaf crude extract exhibited strong inhibitory effects against *S. aureus* TISTR 1466, *S. aureus* TISTR 2329, *S. epidermidis* TISTR 518, *S. mutans* DMST 14283, and *P. vulgaris* DMST 557, which better than stem crude extract. Furthermore, the minimum inhibition concentration (MIC) and the minimum bactericidal concentration (MBC) of extracts were determined. The result showed that the leaf crude extract were *S. epidermidis* TISTR 518 ( $13.00 \pm 0.00$  mm.), *P. vulgaris* DMST 557 ( $12.67 \pm 0.58$  mm.), *S. aureus* TISTR 2329 ( $12.33 \pm 0.58$  mm.), *S. aureus* TISTR 1466 ( $12.00 \pm 0.00$  mm.) and *S. mutans* DMST 14283 ( $9.67 \pm 0.58$  mm.) whereas, the stem crude extract were effective against *S. epidermidis* TISTR 518 ( $11.67 \pm 0.58$  mm.), *S. aureus* TISTR 1466 ( $11.33 \pm 0.58$  mm.), *S. aureus* TISTR 2329 ( $11.33 \pm 0.58$  mm.), *P. vulgaris* DMST 557 ( $10.33 \pm 0.58$  mm.), and *S. mutans* DMST 14283 ( $6.67 \pm 0.58$  mm.). However, both crude extracts did not show antimicrobial activity against *P. acnes* DMST 14916, *P. aeruginosa* TISTR 781, *E. coli* TISTR 073, *E. coli* TISTR 780 and *C. albicans* TISTR 5554. The MIC and MBC of the leaf crude extract on *S. epidermidis* TISTR 518 (showed the lowest minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) at 3.90, 15.62 mg/ml respectively. The lowest (MIC) and (MBC) of the stem crude extracts were *S. epidermidis* TISTR 518. These results were similar to research of Queiroz et al (2015) who study the antibacterial activity *B. armeniaca* (*Malpighiaceae* family) ethanolic extract has a moderate to excellent antibacterial activities against all microorganisms tested. The flavonoid mixtures showed an excellent effect against all tested bacteria. The ethanolic extract showed more active against *S. aureus*, as expected, due to natural products to be more active against gram positive bacteria. This is based on different characteristics observed among gram positive and gram negative cell wall outer-membrane permeability barrier which limits the compound accesses to their targets. The outer phospholipid membrane of gram-negative bacteria has lipopolysaccharide (LPS) components, making it impermeable to lipophilic solutes. The cell wall of gram-positive bacteria has only an outer peptidoglycan layer, which is not an effective permeability barrier (Vital & Rivera, 2009). Although, ethanolic extract results of *B. armeniaca* against gram negative bacteria cannot be neglected, an unusual fact observed on natural products (H.A. Kirst 2013). Some authors also reported significantly antibacterial activity of other *Malpighiaceae* family genus, such as *Mascagnia macroptera* hexane extract that had an activity against enteropathogenic bacteria (S. F. M. Salazar, et al, 2008). Some reports have been phytochemicals analysis from the leaves and stem bark of *Hiptage benghalensis* (L) Kurz which was extracted using different solvents of various polarities such as petroleum ether, chloroform, acetone, methanol and water that revealed the presence of alkaloids, coumarin, flavonoids, phenols, tannins and terpenoids. The antibacterial

activity was carried out against *S. aureus*, *K. pneumoniae*, *B. subtilis*, *E. coli*, *P. aeruginosa* and *S. typhi* by disc diffusion method. Among the solvent extracts, methanol extract was the most effective against the tested microorganisms (Murugan M and Mohan V.R., 2011). Phytochemical analysis revealed the presence of alkaloids, coumarin, flavonoids, phenols, tannins and terpenoids. The factors affecting the quality of plant extracts are the nature of the plant material (season, topography and climate) and its origin (locations). The type of solvent used in the extraction procedure plays an important role in the diversity of compounds in the plant extracts (Tiwari et al., 2011).

## 6. Conclusion

In comparing the antibacterial activities of different plant parts of leaves and stem crude extraction, it was found that stem crude extraction gave higher extraction yields than leaves but the leaf crude extracted showed a higher antimicrobial activity than stem crude extracted. Also exhibited antibacterial activity against and effective against stains of human pathogens include *S. epidermidis* TISTR 518, *S. aureus* TISTR 1466 and *S. aureus* TISTR 2329 are gram-positive bacteria and the gram-negative bacteria is *P. vulgaris* DMST 557 respectively. All of these bacteria have been report as skin diseases pathogens. None of the leaves and stem crude extract were effective against *P. acnes* DMST 14916, *P. aeruginosa* TISTR 781, *E. coli* TISTR 073, *E. coli* TISTR 780, *C. albicans* TISTR 5554

## 7. Recommendation

The results obtained suggest that antimicrobial activity of *Hiptage candicans* (Hook.f.) Sirirugsa crude extract against human skin pathogens could be used as a potential natural source for drug development to treat bacterial skin infections.

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