

Engineering & Technical Education



November 6, 2014 Faculty of Technical Education King Mongkut's University of Technology North Bangkok



พระบรมราชานุสาวรีย์พระบาทสมเด็จพระจอมเกล้าเจ้าอยู่หัว มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าพระนครเหนือ **ICTechEd 2014 Conference Session Schedule**

Section #1: November 6, 2014: 1 PM-4 PM, (Benjarat Hall, NavamindraRajini Building, KMUTNB) Chair: Assoc. Prof. Dr. Prachyanun Nilsonk / Asst. Prof. Dr. Panita Wannapiroon

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Country	Philippines	Australia	Thailand	Thailand		Thailand	Thailand
Author's Name	Rudolf Anthory A. Lacerna	Rattanavalee Maisak, Justin Brown and Nattakant Utakrit	Pitipark Pinrod	Thitima Chuangchai and Supitcha Cheevapruk	Break	Jakkrit Premsmith and Panita W annapiroon	Sukanjana Lekapat, Panarit Sethakul, Sombat Teekasab and Boonmee Kavinseksan
Paper's Title	P002_Quality Assessment of Blended Learning in the Technical Vocational Education and Trainir(g VET) Course Software System Development in the Polytechnic University of the Philippines	P007_Accessible Online Materials in Thai UniversitiesAwareness, Attitudes and Barriers to Effective Development	P008_Conceptual Framework for Developing Thinking Skills by Learning Model on ReseareBased Techniques in Pulse Techniques Subject	P011_A Development of Electronic Media foc336269 Logistics I	Coffee	P012_Development of ChallengeBased Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students	P022_Evaluation of Research Institute Based on AERES StandardsA Comparative Study Between GREEN and RERC
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ember 6, 2014 : 1 PM- 5 PM, (Room 12807, Zone A, Floor 12, NavamindraRajini Building, KMU'	Paper's Tide	P003_Effect of Ensemble Size in Ensemble Kalman Filter Forecast of Cold Surge	P019_Thai Poetry Machine Translation to English Automate Evaluation VS Human Postedit	P005_Application of the Generalized Complex Step Method for Determination of VoMises Two-Dimensional Contact Stress State	$P00_2$. Chaotic Analysis of Meridional Circulation over Southeast Asia by a Forced Meridional ertical System in the Case of Fx = 0. Fy = rF and Fz = 0	P015_A Synthesis of Waveguide Capacitive Iris using WIM Algorithm	Coffee	POI6_Modeling of Multiple Reservoir Operation System for Water Supply using Genetic Algorithm	P020_Query and Answering on Computer Science Documents base on Ontology	P004_A Comparison of Classification Algorithms on the eNET Scores	$P017_A$ Simulation of Inductive Iris Characteristics in Microwave Engineering Course	P021_An Interesting Statistically of Skill in ICT Career
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Message from the President

An essential strategic component for national development acceleration highlights the expansion of knowledge base on the country's workforce, which can be accomplished through the higher education awareness and support for enhanced research and academic performance. In line with this key principle, King Mongkut's University of Technology North Bangkok has created a strategic plan to raise the University research profile through scholar alliances and assisting researchers to build the network and to achieve their full potential of academic excellence.

The event under the theme "The 7th National Conference on Technical Education and The 2nd International Conference on Technical Education" organized by The Faculty of Technical Education, KMUTNB is deemed in harmony with the university vision and forthcoming sustainable development goals. The undertaking has received substantial assistance from a partnership network between KMUTNB and connection partners including 9 vocational-technical education institutions along with participating universities. Besides, the active alumni network, enterprise cooperation and current students together play a valuable role in fostering and carrying out the mission. Such collaboration is a vital element for the expansion of Technical Education into broader career and academic horizons for all students, ensuring their preparedness towards the AEC 2015.

On behalf of the University administration, I wish the event fruitful deliberations and productive outcomes. I hereby acknowledge and appreciate the efforts and cooperation from everyone -- faculty members, former and current students of The Faculty of Technical Education, for project collaborative arrangement and coordination. In the meantime, my sincere gratitude is particularly extended to all those who encourage dissemination of knowledge and effective strategy implementation. Undoubtedly, your meaningful endeavors will contribute to the positive development of national studies and research relevant to advanced engineering/technology education for years to come.

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Professor Dr. Teravuti Boonyasopon President of King Mongkut's University of Technology North Bangkok









Message from Dean

The National Conference on Technical Education was established for the first time in 2008 by Faculty of Technical Education of King Mongkut's University of Technology North Bangkok (KMUTNB). For this time, the 2nd International Conference on Technical Education and the 7th National Conference on Technical Education is going to start on November 6, 2014 at Benjarat Hall, NavamindraRajini Building, KMUTNB. The topic of the conference is "Engineering and Technical Education" which has the main purpose is the ideal platform for researchers, academicians, educators, traders and anyone who is interested in the area of Vocational and Technical Education for Thais and foreigners to meet together, learn, and share their knowledge and experience. To create and develop new knowledge management which is related to currently changes of economy, politics, society, environment and technology of each country. In additional, the conference makes relationship among the society of international research more securely.

On behalf of the Dean of Faculty of Technical Education at KMUTNB, I would like to express our gratefulness to all committees, instructors, staffs and students of Faculty of Technical Education for your corporation and assistance in the 2nd International Conference on Technical Education and the 7th National Conference on Technical Education to reach its objectives. Especially, thank you to King Mongkut's University of Technology North Bangkok, Technical University of Dresden, IEEE Thailand Section and the Association of Industrial Education Thai. Finally, I really appreciate to say thank you to lecturers, specialists, administrators and staffs both of Thais and foreigners of KMUTNB who mutually helped in arranging this conference.

Asst. Prof. Dr. Panarit Sethakul Dean, Faculty of Technical Education King Mongkut's University of Technology North Bangkok









Message from Chairman of Committee

Faculty of Technical Education, King Mongkut's University of Technology North Bangkok is one of educational institutions which continuously arranges a Nation Conference every year. To celebrate the 55th anniversary of King Mongkut's University of Technology North Bangkok and the 45th anniversary of Faculty of Technical Education, we organize the 7th National Conference on Technical Education (NCTechEd7) and the 2nd International Conference on Technical Education (ICTechEd2). All committee have been trying to develop the process in order to support the researchers such as planning to develop a policy, online submission, a template of the document, and notification process. The research article will be approved by the specialists from each field, reviewed by the professional editors both the seniors from inside and outside of the university. There are only 16 research articles that are approved by the specialists and published for research presentations. For this occasion, we really thank to all specialists for you times to evaluate all articles to meet the quality for benefit of researchers into society. Thanks to all researchers who submitted their research work for this conference. The NCTechEd7 and ICTechEd2 under topic of "Engineering and Technical Education" is going to be held on 6th of November, 2014 at Benjarat Hall, Navamindra Rajini Building, King Mongkut's University of Technology North Bangkok. We hope this conference will be a platform for researchers to share and exchange their experiences.

On behalf of the conference committee, we would like to express our thankfulness to the President, keynote speakers, committee and staff who helped the conference possible.

Asst. Prof. Dr. Charun Sanrach Faculty of Technical Education King Mongkut's University of Technology North Bangkok





Message from Keynote Speaker

In this year we start already the 2nd International and 7th National Conference on Engineering and Technical Education. Today, the competition between the international acting universities is growing fast. The engineer working in production lines or in research departments gets more and more challenges from the complex and dynamic technology processes.

The first International conference last year has discussed topics on demands of an engineer in changing production structures. We have stated that the companies are on the way to reconstruct their production lines or service structure. The classical, traditional way to produce products or to offer services is changing. The Taylorism as a basic principle for organization of labor will be replaced step by step by new organization forms, for instance by lean production and lean management. This fact is a challenge for the engineering educators at the universities too. We have to change the engineering education close related to the changes in the labor market. Therefore, the subject "Engineering Education" becomes more and more importance worldwide.

The conference has to try to find answers to the following questions especially:

- 1. Which new approaches to design Engineering Courses are able to meet the demands of changing working orders for engineers working in modern production lines and service structures?
- 2. Which didactical elements and methods do we have to integrate in study curricula for an engineer?
- 3. Which knowledge, skills and attitudes should have a modern engineering educator at universities?

The committee very well prepares the conference. The papers are recognized by experts and reviewed by professional editors. There are several research articles approved for the conference. For this occasion, we really thank to all specialists for your time to evaluate all articles very carefully. Thanks to all scientists who submitted their research work for the conference. On behalf of the committee, we would like to express our thankfulness to the President of KMUTNB, to the keynote speakers, to the committee and to the staff who helped to make the conference possible.

Prof. Dr. Paed. Habil. Hanno Hortsch Technische Universität Dresden Institut für Berufspädagogik



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EDUCATION







Quality Assessment of Blended Learning in the Technical Vocational Education and Training (TVET) Course Software System Development in the Polytechnic University of the Philippines

Prof. Rudolf Anthony A. Lacerna

Polytechnic University of the Philippines College of Communication and Institute of Technology Manila, Philippines

Abstract- In the Philippines, Blended Learning (BL) implementation in distance education was proven effective in the teaching-learning process. Thus, the research study focused on the assessment of BL in Technical Vocational Education and Training (TVET) particularly in the Polytechnic University of the Philippines (PUP) Institute of Technology (ITech).

Anchoring the Context, Input, Process, and Product (CIPP) Model of Daniel Stufflebeam, the implementation of innovation in the Software System Development (SSD), an Information Communication Technology (ICT) major course in PUP ITech, was assessed.

The study used both quantitative and qualitative research approaches and descriptive method was the design used. The respondents were 130 ICT students, who were given the survey to gather quantitative data. On the other hand, qualitative data were generated from the interview conducted for the course specialist.

Research found BL appropriate in the context of SSD. Majority of learners had resources needed in the implementation of BL. In learning facility, opening files uploaded by the course specialist and understanding online lectures were both easy. Other than that, tasks were done on time though difficulty was experienced in taking quizzes and assignments. Finally, the knowledge and skills on competencies was effectively acquired by the learners.

I. INTRODUCTION

According to the Long Term Higher Education Development Plan of the Commission on Higher Education (CHED), the commissioning body of higher education in the Philippines, Information Communication Technologies (ICTs) has reshaped the educational landscape by transforming the content and modes of delivery and acquisition of learning as well as how the educational institutions operate (CHED, 2001). With that, teaching and learning processes is transformed, and one of the changes brought by ICTs in the field of education is the implementation of BL.

Blended Learning (BL) is prescribed and used as mode of delivery to facilitate instruction in distance education. Librero (2007) explains that common features of distance education includes the separation of teachers and learners in terms of time and space, and the use of technical media in the presentation of concepts and processes. Thus, BL through ICTs breaks the problem between students and facilitators. In fact, 37.50% of the Higher Education Institutions in the Philippines offering distance education uses BL (Gapasin, 2011).

However, Technical Vocational Education and Training (TVET) is an aspect of the educational process involving the study of technologies and related sciences with the acquisition of practical skills, attitudes, understanding and knowledge relating to occupants in various sectors of economic and social life (UNESCO, 2001). Since this primarily involves the use of technology, faculty members as well as administrators must be innovative in delivery for the convenience of both learners and teachers.

In the 3rd World Congress on TVET, Richardson (2012) discusses the flexibility of BL. Therefore, BL mode of delivery is possible in facilitating learning for TVET.

Since this is an education reform or innovation, it is important to see its effectiveness to the learners and to identify the appropriate blending in the teaching process.

II.BACKGROUND OF THE STUDY

The Polytechnic University of the Philippines (PUP), the largest university in Asia in terms population, has a vision of clearing the paths while laying new foundations to transform the university into an epistemic community. This kind of community is composed of networks of professionals who have recognized skills and specializations that are contributory in building the nation.

The Institute of Technology (ITech) is the TVET system of PUP. It envisions to be a leading institution that provides globalized skilled workforce in a technologically-driven culture. ITech exists to provide globally competitive graduates in the field of technology. In addition to that, one of the goals of the institute is to





ensure teaching-and-learning efficiency and effectiveness by means of highly qualified and committed faculty members. With that, to ensure such competencies, evaluation must be conducted. This will serve as the basis for another innovation in teaching and learning in TVET specifically in PUP ITech.

Information Communication Technology or ICT is one among six TVET programs in PUP ITech which aims to prepare students to design, implement, and manage a variety of computer-based information systems through its specialized curriculum. To attain the objectives of ICT program, Software System Development (SSD) as one of the major ICT courses is included in the curriculum designed to build up students' understanding in developing software system. It also includes advancement in the process and fundamental principles of system development with object oriented technology using Unified Modeling Language (UML). The course initiates students to different software process models, project management, and software requirements engineering process, system analysis and design as a problem solving activity, key elements for analysis and design.

According to the domains of learning, these objectives are set. In the cognitive domain, the course aims to develop an understanding of project management, software process models and the ability to select the suitable model in using software development, to develop an understanding of requirements in information process and to determine the different types of requirements. However, its affective domain focuses and empowers the presentation, and teamwork management skills. Finally, the psychomotor domain should develop students' ability to analyze, design, and develop the system models using object oriented methodology for software development; ability to prepare the software requirements specification documentation for a software project; demonstrate the ability to research a particular topic; and develop it for a specific audience and purpose. At the end of the semester, learners are expected to develop computerized information system.

In teaching methodology, teachers have an option to deviate and innovate the mode of delivery. To maximize the use of ICT, they have used BL as one of the strategies. To see the effectiveness of this mode of delivery, this must be evaluated by the learners to assure its quality. However, the research study only focused on the evaluation of online aspect of BL implementation.

Research Problem

The study assessed the Blended Learning mode of delivery of Software System Development in Information Communication Technology program in the Polytechnic University of the Philippines Institute of Technology.

Specifically, the study aimed to answer the following questions:

1. What is the level of appropriateness of BL as mode of delivery to the objectives of the course Software System Development?

2. What is the capability of learners in the implementation of BL in terms of resources?

3. What is the respondents' evaluation in the implementation of BL in teaching-learning process?

4. What is the effectiveness of BL in the knowledge and skill acquisition of the students according to the course competencies?

III. STUDY FRAMEWORK

Daniel L. Stufflebeam's Context, Input, Process, and Product (CIPP) Model is a decision-focused approach in evaluating and emphasizing the systematic provision of information for program management and operation. In the approach, information is valuable in helping program managers to make better decisions. Data collection and reporting are then undertaken in order to promote more effective program management. Since programs change as they are implemented, decision-makers need to adapt with these changes to ensure continuous focus on appropriateness and efficiency of the development and performance over time.

In the model, the four aspects of evaluation were emphasized. Context evaluation involves collecting and analyzing needs assessment data to determine goals, priorities and objectives. In the study, the context evaluation is the appropriateness of BL to the cognitive, affective and psychomotor objectives of the course SSD.

This is followed by Input evaluation which involves the steps and resources needed to meet the new goals and objectives and includes identifying successful external programs and materials as well as gathering information. With that, the researcher knew the capability of learners in the implementation of BL in terms of resources namely internet connection and gadgets.

In the Process evaluation, decision-makers provide information about how well the program is being implemented. To assess the implementation of BL in teaching-learning process of the said course, it includes evaluation of the learners' capabilities in using files, difficulties in taking quizzes and assignments, finishing the given tasks with the assigned time frame, and understanding lectures online.

Finally, Product evaluation measures the actual outcomes and comparing them to the anticipated outcomes. Decision-makers shall be able to decide if the program should be continued, modified, or dropped altogether. In the study, the researcher measured the effectiveness of learning and skills acquisition in SSD.





These are the Development Methodologies; Requirement Analysis and Design Method; Programming Language; Programming Techniques; Test and Review Methods; Development Environments; Development Management; and Software Packages.



Fig. 1: CIPP Model as Applied in the Study

IV. RESEARCH METHODOLOGY

In this portion, the methods of research, sampling techniques, research instrumentation and the statistics used were explained.

A. Method of Research

The study used the descriptive method. Shuttleworth (2006) defines it as a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. In the study, the researcher defined the assessment on BL mode of delivery in the course SSD specifically in the appropriateness of the course objectives, availability of the learners' resources, the BL implementation process and effectiveness of knowledge and skills to the learners according to the course competencies.

The research, a quantitative research approach, involves variable needs to be measured for the purpose of quantitative analysis through a survey (Hohmann, 2005). In addition to that, the researcher also utilized the qualitative research approach to generate more information.

B. Instrumentation

The instrument used was a researcher-made survey questionnaire composed of five parts: (1) the profile of the respondents; (2) the context evaluation which is applied through assessment of the respondents on the level of appropriateness of BL in the stated objectives of the course SSD; (3) the input evaluation which is applied in the evaluation of the resources in the implementation of BL; (4) the process evaluation which is about the implementation process in the said course through BL; and (5) the product evaluation which is on the effectiveness of the competencies in the course. Aside from the survey questionnaire for the respondents, Interview Guide was used to generate qualitative data for the instructor of the subject.

C. Sampling Techniques

Purposive sampling technique was utilized in choosing respondents whom undergone the subject.

There were 196 PUP Itech ICT students for the Academic Year 2013-2014 completed the said course. Using Sloven formula, 130 samples were computed as shown in Table 1.

TABLE 1 Distribution of Respondents Per Section

Section	Number of Students Enrolled	Percentage	Sample size
ICT III-1	47	24.35%	32
ICT III-2	49	25.39%	33
ICT III-3	34	17.62%	23
ICT III-4	29	15.03%	20
ICT III-5	34	17.62%	23
Total	193	100.00%	130

The researcher assigned target respondents in five sections. Portion of each section was computed to see the number of samples per section. The table below shows the number of students enrolled per section and the number of respondents.

From the total number of enrolled students, percentage was computed to get the portion of every section. There were 130 respondents consisted of the following: 32 ICT III-1 students, 33 ICT III-2 students, 23 ICT III-3 students, 20 ICT III-4 students, and 23 ICT III-5 students.

As far as the qualitative research approach is concern, the researcher also purposively selected the course specialist.

D. Statistical Treatment

In the data analysis and interpretation, the researcher used the percentage and weighted mean.

Percentage was used to see the portion of the total respondents. This was already used in computing the portion of the respondents per section in Table 1. In addition to that, this formula was used in treating the data of the input and process evaluation.

Other than that, the researcher also treated the data using Weighted Mean or WM. This used in order to determine the average responses of the different options in the aspects of evaluation. In this study, weighted mean used to know the assessment of the respondents in the quality of SSD through BL particularly in the context and product evaluation.





V. RESULTS AND DISCUSSIONS

A. Context Evaluation

Table 2 shows the appropriateness level of BL in the course objectives of SSD. In the cognitive domain of the objectives of the course, the computed weighted mean is 3.09, which BL is appropriate.

On the other hand, the course specialist reveals that online discussion is easier than face to face discussion in terms of understanding. This is because learners found it difficult to absorb what the course specialist was talking about without trying the hands-on experience in SSD.

Other than that, it also reveals that online sources and coding are vital elements in developing system and software, and impossible to be discussed by the professor in the classroom. However, if the professor forced students to explain these competencies in the class, the learners have difficulty in understanding.

This finding can link to the result of the study of Akyol and Garrison (2011) which indicates that students in both online and blended courses are able to reach high levels of cognitive presence and learning outcomes. However, Akyol and Garrison's focuses on the context of the graduate study in British. Data show that respondents and the justification of the informants are in favor of the appropriateness of BL as teaching mode of delivery to facilitate learning.

In the affective domain of learning, the weighted mean is 3.32, very appropriate in enhancing learners' motivation, attitudes and values. Course specialist says, "Students are engaged to study because online class provided them freewill that can lessen the pressure to complete a task." In addition to that, pressure-free learning experience encouraged them to explore more applications and techniques in studying not only in the said course but also to other related-programming courses.

Improving students' engagement and motivation are two of the 10 drivers of BL enumerated by Classroom Aid (2013). These addresses the affective domain of learners in this mode of delivery. Accordingly, data and literature say that BL as mode of delivery in facilitating learning is very appropriate in addressing the affective domain of learning

Finally, in the psychomotor aspect, the weighted mean of 3.24 says that BL is appropriate in acquiring the needed skills in developing information systems.

Since it is mentioned that students are motivated and engaged in BL for the course SSD that lead them to better understanding, the application is also easier. As stated by the course specialist, students already produced acceptable and high-quality systems.

According to El-Sayed and El-Sayed (2012), psychomotor abilities not only facilitate the learner's practices but also motivate the learner to try different alternatives. A median level of mastery in the psychomotor domain skills can lead to a lower level of frustration, a higher level of motivation, and ultimately a higher desire and ability to innovate and create. Since the concepts of innovation and creativity are synonymous in developing information system or software, appropriate teaching strategy particularly BL as mode of delivery tends to increase motivation in learning while decreasing the level of frustration.

Generally, the overall mean on the level of appropriateness of BL to the course objectives of SSD is 3.22, appropriate. Commission on Higher Education and Technical Education and Skills Development Authority (2013) considered BL as input for K to 12 Basic Education Program to increase access to quality TVET programs in the Philippines.

TABLE II Weighted Mean Of the Appropriateness Level of BL in the

 Objectives of the SSD

Course Objectives of SSD	WM	Interpretation
Cognitive Domain	3.09	Appropriate
Affective Domain	3.32	Very Appropriate
Psychomotor Domain	3.24	Appropriate
Overall Mean	3.22	Appropriate

B. Input Evaluation

The input evaluation on the implementation of BL in the course SSD or the resources of the learners to participate in BL is revealed in Table 3. There are 101 or 77.69% of the respondents that have Internet connection at home while a small percentage of 22.31%, 29 students, don't have the Internet connection at home. As far as the Internet connection is concern, majority is capable to participate in BL.

Meanwhile, 100 or 76.92% of the respondents have gadgets to be used in BL while 30 or 23.08% of them don't have tools. In the aspect of gadgets, majority of the respondents were capable in participating BL in the course SSD.

It is mentioned in the study of Al-Hunaiyyan, Al-Huwail and Al-Sharlan (2008) that BL plays an important role with access to technology in which instructors can facilitate, provide, and control the provision and access to technology for learners. Hence, the TVET in the PUP is capable in the implementation of BL.

TABLE III Frequency and Percentage Distribution of the Respondents

 According to their Resources in the Implementation of BL

Resources in the Implementation	YES		NO		
of BL	f	%	f	%	
Do you have Internet connection at home?	101	77.69%	29	22.31%	
Do you have gadgets that can be used in learning purposes?	100	76.92%	30	23.08%	

C. Process Evaluation

The evaluation of the respondents on the implementation process of BL for the course SSD is





disclosed in Table 4. It is revealed that there are 105 or 80.77% of the respondents who easily open files uploaded by the professor online while only 25 or 19.23% of the learners find it difficult. In the statements of the student informants in the facilitated focused group discussion, online system where the conducted online class is users-friendly.

However, 101 or 77.69% of the respondents experience difficulties in taking quizzes and assignments online while there are 29 or 22.31% who don't experience difficulties. In the qualitative inquiry, it is acknowledged that there are students who took online quizzes while entertaining people in a social networking site at a time. On the other hand, it is explained by the course specialist that in answering online quizzes and assignments, students are also forced to do online research which is essential in the development of their higher-order thinking skills.

There are 88 or 67.79% of the respondents who finish the given online tasks on time while 42 or 32.31% of them fail to do the given online tasks. According to the student informants, time management is also important element in this course.

Lastly, there is a big percentage of respondents who easily understand the lectures online. This is composed of 94 or 72.31% of the respondents who answer "Yes" and 36 or 27.69% respond the "No" item. In connection with the statements of the students in the appropriateness of the cognitive domain of learning in the objectives of the said course, it is easier to understand lectures because of the actual learning opportunities provided through BL.

]	FABLE IV Frequency and Percentage Distribution of the Respondents	
ŀ	According to BL Implementation Process	

BI Implementation Process	Y	YES	NO		
BL implementation r rocess	f	%	f	%	
Can you easily open files uploaded by the professor online?	105	80.77%	25	19.23%	
Did you experience difficulties in taking quiz and assignments online?	101	77.69%	29	22.31%	
Can you finish the given tasks online with the assigned time frame?	88	67.69%	42	32.31%	
Can you easily understand lectures online?	94	72.31%	36	27.69%	

D. Product Evaluation

Table 5 presents the effectiveness of BL to the transfer of knowledge and skills to the students according to the course competencies of system software development. Overall mean of 3.14 indicates that the acquisition of learning of the respondents is effective through BL.

It is specifically shown that through BL mode of delivery, the following lectures in SSD are effectively acquired by the students because of weighted mean computations: 3.12, Development Methodologies; 3.16, Requirement Analysis and Design Method; 3.16, Programming Language; 3.17, Programming Techniques; 3.17, Test and Review Methods; 2.95, Development Environments; 3.23, Development Management; and 3.13, Software Packages.

The results say that BL is an effective mode of delivery in the TVET system of PUP. The learning innovation is recommended for other institutions offering TVET programs.

TABLE V Weighted Mean of the Effect of Knowledge and Skills Acquisition	ctiveness of BL in	n the Transfer
SSD Competencies	Weighted Mean	Interpretation

SSD Competencies	Mean	Interpretation
Development Methodologies	3.12	Effective
Requirement Analysis & Design Method	3.16	Effective
Programming Language	3.16	Effective
Programming Techniques	3.17	Effective
Test and Review Methods	3.17	Effective
Development Environments	2.95	Effective
Development Management	3.23	Effective
Software Packages	3.13	Effective
Overall Mean	3.14	Effective

VI. SUMMARY OF FINDINGS

Based on the data presented, the following are the findings:

1. The context, the objectives of SSD, which includes cognitive, affective, and psychomotor domain of learning, was generally appropriate in the implementation of BL in PUP ITech.

2. The input, the ICT students, was capable in the participation of BL in the course SSD.

3. Majority of the students easily opened the files uploaded by the professor, finished tasks on time and easily understood lectures online. However, majority of the students also experienced difficulties in taking quizzes and examinations online.

4. Finally, the product evaluation, competencies in the course SSD, was effectively acquired by the learners through BL.

VII. CONCLUSION

Based on the results, PUP ITech students assessed the quality of BL in TVET for the course SSD.

Specifically:

1. The evaluation on the level of appropriateness of BL to the learning domains – cognitive, affective and psychomotor – of the students varies.

2. In terms of input evaluation, students who are the respondents have materials needed in the implementation of BL.

3. Since BL implementation was an initiation, some learners found it easier while some found it difficult for the course SSD

4. Learners can evaluate the effectiveness of the transfer of knowledge and skills based on the SSD course competencies.





VIII. RECOMMENDATIONS

Based on the conclusions, the following are the recommendations:

1. For PUP, it is important to conceptualize innovations in teaching-learning process that will improve the quality of education through activities, programs and strategies aligned in the context of the university with the vision in the transformation towards epistemic community. Aside from that, these innovations in education must always undergo evaluation to see its effectiveness, capability and appropriateness to the learners.

2. Through the collaboration with the Research and Development sector, a task-force that will monitor and evaluate the implementation of the innovation must be created. This is to see the effectiveness of the innovations to the teacher-learning process.

3. For ITech, BL and other educational reforms should be conceptualized based on the needs of the learners not only for their major courses, but also in their general education courses. This is to respond with one of its goal of producing user's friendly instructional materials appropriate for the learners.

4. For the ITech Faculty members, active participation on workshop and trainings on educational reforms in Technical Vocational Education and Training must regularly done. This is followed by proposing programs and projects that will respond to both needs of the learners and the needs to achieve the university goal.

5. For the other TVET institutions administrators, other researches that will assure the quality of TVET in the country are recommended.

6. For both Commission on Higher Education and TESDA, a policy, standards and guidelines must be created to assure the quality of Technical Vocational Education and Training in the Philippines.

7. For education researchers, it is recommended to explore innovations in the teaching-learning process in the TVET context.

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Accessible online materials in Thai universities: awareness, attitudes and barriers to effective development

Rattanavalee Maisak Justin Brown Nattakant Utakrit

Edith Cowan University School of Computer and Security Science Perth, Western Australia

Abstract- Engaging higher education in the 21st century

is challenging. As education has become a strategic vector for sustainable and equitable personal and individual development, having the ability to access information and materials via the internet is necessary. This will enhance the quality of lifetime learning and create an equal opportunity for all students. This paper describes the perceptions of Thai university staff towards accessible online materials and web accessibility at university. The results shows that staffs have positive views towards providing accessible online materials, however they are unaware of accessible online materials and related fields. Moreover, the strongest barrier is the lack of knowledge of the needs of students with disabilities. Therefore training and integrating web accessibility as criteria in educational quality assessment are the key strategies to improving the equity of learning access for all students.

Keywords: accessibility, people with disabilities, e-learning, university

I. INTRODUCTION

The number of students with disabilities in postsecondary education has increased in during the last decade [1]. Students continue to study higher tertiary qualifications in order to achieve personal goals, increase employment opportunities, and/or achieve financial security [2]. Likewise, the number of Thai students with disabilities who enrolled in universities was as high as 4,049 people in 2013 however, the number of those students has increased by 10% in the first semester of 2014 [3]. In general, students with disabilities would want access to university websites for many purposes such as enrolling in subjects, retrieving information and learning from e-learning content. However, a majority of these university's homepages and web applications have accessibility problems [4], leading to students with disabilities not being fully supported by their institutions.

Given the necessity of equitable access to educational opportunities, the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) has been developed to protect the right and dignity of people with disabilities across the world. Thailand ratified the UNCRPD on 28 July 2008 [5]. Within the context of these humanitarian principles, the Thai government has supported the CRPD framework in creating legislation and policies to embrace the rights and dignity of all Thai citizens under the Rehabilitation of Disabled Persons Act 1991 [6] and Thailand Information and Communication Technology Policy Framework (2011-2020) [7]. The government encourages Thai educational institutions to partake in and provide facilities to support students with disabilities based on this international human rights treaty, such as by providing accommodation to students with disabilities at the same level as students without disabilities. However, research has found that Thai institutions are taking little or no action about the educational provisions and facilities for students with disabilities [8].

II. RESEARCH QUESTION

This paper examines the research question: What is the level of awareness of Thai university staff regarding web accessibility and accessible online materials for students with disabilities? The paper will describe participants' attitudes, level of awareness, barriers and their suggestions to improve the quality and levels of web accessibility for online learning.

III. LITERATURE REVIEW

A. Accessible online resources and special needs

Provision of accessible systems and content is essential so as to encourage students with disabilities towards better learning [9]. The programs, which have proven to be successful in improving flexible learning environments, can be promoted as accessible online courses to support hearing and visually impaired students [10]. However, many researches assume that learning materials can be quite complicated for students with disabilities if those materials are not fully aligned with the varying specialist needs of learners with disabilities [11], [12]. Visually impaired students may not be able to detect graphics or text content on websites, whilst hearing-impaired students may not always hear audio content that is delivered via the internet. Therefore, basic education and training as to the needs of students with disabilities has an important role to play in developing materials for equitable distance learning [13].

November 6, 2014 www.icteched.org Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand





B. Web accessibility and related work

The overall process in developing websites has evolved since web accessibility has been introduced and adopted on an international scale. Its purpose is to ensure that everyone can access online content, including people without disabilities, people with disabilities, and older people [14]. Examples of common web accessibility standards are the Web Content Accessibility Guidelines 2.0 (WCAG), ISO/IEC 40500 (basically WCAG 2.0) and Section 508 Amendment to the U.S. Rehabilitation Act 1973. Many countries have adopted one or more of these standards into their own governmental guidelines, with the Thai government developing its own Thai Web Content Accessibility Guidelines (TWCAG) based on the WCAG 2.0 guidelines [15]. WCAG 2.0 guidelines have three priorities levels of A, AA and AAA, with four principle assessments which include perceivable, operable, understandable and robust [16]. People can use these guidelines to assess websites automatically or manually. If a website fails to conform to WCAG 2.0 requirements, that site is defined as either being unusable, or of limit to use to a person with a disability. The Thai government is aware of this importance and has tried to promote TWCAG to all relevant web developers so that Thai websites should be accessible to all users, seemingly to little effect.

Other countries such as Canada and Brazil have also adopted web accessibility across government and public institutions. In Canada, the observation of e-learning in Canadian colleges and universities revealed four problems related to accessibility in the institutions, namely: inaccessible websites and course management systems (CMS), inaccessible media files (content), inappropriate time for online assessments and inadequate use of adaptive technologies [17]. The results indicated that the accessibility issues also existed in Canadian higher education, and that possible solutions included conducting training, adopting e-learning accessibility guidelines, and proactively engaging with on-campus accessibility experts (where they existed).

Another study examined the perceptions of Brazilian lecturers, government officials and industrial workers towards accessibility in terms of web development. It indicated that a lack of training and poor knowledge of accessibility law were major issues impacting the development of accessible web systems. More than half of the study participants claimed they had never received accessibility training or that they had never heard of Brazilian accessibility law. The researchers suggested effective solutions would be providing training in developing accessible websites and promoting the existing web accessibility law so that it may become recognized and adopted by relevant stakeholders [18].

C. Assistive technologies

Assistive Technologies (AT) may be classified as tools which help people with disabilities to communicate

and enhance their quality of life [19]. People with disabilities use technologies such as screen readers, speech recognition programs and screen magnifiers to interact with computing devices and the internet. People who are legally blind or visually impaired can listen to web content on screen with the assistance of screen readers. People with mobility impairments can use speech recognition, head or eye movement trackers to interaction with on-screen objects, whilst screen magnifiers help people with vision impairment to zoom in and out of any information on websites. Guyer and Uzeta [20] stated that assistive technologies help American students with disabilities learn in postsecondary education, such as searching library materials and that without such technologies people with disabilities would be limited in accessing further education.

IV. RESEARCH DESIGN

Data for this study was gathered via web questionnaires and face to face interviews. The role and background of participants were specifically selected, rather than using random sampling, because the questions were designed to find out the opinions and awareness of university staff towards accessible online learning materials, assistive technology, web accessibility standards and web accessibility policies in their university. The participants included those from one of three groups, lecturers, web administrators and senior managers in Thai universities, as these were the people responsible for developing learning content, learning systems and university policy.

Firstly, the web based questionnaire were sent via email to recruit participants who fit into one of the three groups, identified via their staff entry of their university website. Each group of participants received a version of survey with core questions and question the contextualized to their particular group. Secondly, the volunteer participants from each group participated in follow-up face to face interviews. Due to the large number of participants in this study, it was not possible to interview all volunteer participants so the selection of participants occurred based on work experience for each group, in order to ensure that specific questions could be answered in detail by participants. Thus, participants in the interview included those with the following practical experience: lecturers who have at least 10 years work experience or holding academic ranks such Assistance Professor, senior managers who are part of the university board and had experience of at least 10 years, and web administrators who were the university's web developer and have experience of at least 5 years.



V. RESULTS AND DISCUSSION

In this section, we describe three main topics: the perceptions, the barriers and the possible solutions to providing accessible online materials in the Thai highereducation learning environment. A total of 60 responses from the web questionnaire and nine voluntary participants in the interview were analyzed for this paper.

A. Perceptions of Thai university staff towards accessible e-learning development



Figure 1. Attitude towards having accessible e-learning

Figure 1 shows that 100% of web administrators, 94% of lecturers and 85% of senior managers expressed positive agreement with having accessible online materials available to all students, including those with disabilities. Moreover, most participants link their opinions with the idea of equality and social benefits. As one senior manager states:

"I agree because people with disabilities have equal rights. University websites should be available to all students including students with disabilities. Moreover, the university is able to serve internal and external individuals who search for information on the website. Apart from the Research Department, the university also operates Knowledge Management (KM) which seeks to disseminate knowledge of the university to any interested party and that may include people with disabilities."

However, they had yet to translate this awareness into action on their university's website. There were only 20% of web administrators, 10% of lecturers and 5% of senior managers whose roles included developing accessible online materials (see Figure 2). This implies that many Thai university websites failed to support students with disabilities in accessing online materials. The questionnaire then asked participants about actual support for development accessible materials.



Figure 2. Awareness of developing accessible online materials for students with disabilities

Participants attribute blame to the lack of knowledge of 'web accessibility' and 'the special needs of students with disabilities'. As one administrator pointed out:

"Personally, I take care of all aspects of the university website. I believe I can make web accessibility a reality. It's simply that I don't know what the standards of web accessibility are and what the needs of students with disability are with regards to their use of websites."

Thus knowledge of web accessibility (or lack of) and related fields is significant to developing accessible online materials in universities.



Figure 3. Familiarity with assistive technologies

Moreover, participants confirm that they had limited knowledge of assistive technology and how they were used by people with disabilities. The percentages of web administrators, lecturers and senior managers who were familiar with AT were only 25%, 45% and 50% respectively (see Figure 3). It implies that the university staff, and in particular web administrators, are unfamiliar with AT in a way that would lead them to produce accessible m aterials in their institutions' website.



Figure 4. Awareness of web accessibility concepts





Conversely, 50% of lecturers, 60% of web administrators and 65% of senior managers claimed that they were aware of the concepts of web accessibility (see Figure 4). The investigator then asked them to provide more details about what they knew regarding web accessibility. Surprisingly, one lecturer answered: "It is an open system which does not require registration." This shows that academic staff members, who have an IT background and should be more familiar in developing accessible online materials for their university, still had a misunderstanding about the concept of web accessibility. Furthermore, they were asked about their awareness of Thai government accessibility policies and laws.



Figure 5. Perception of Thai accessibility policies and laws

The results show that 72% of lecturers, 60% of web administrators and 75% of senior managers did not know or had never heard of the accessibility policy and law (see Figure 5). The concern about the lack awareness of academic staff about the Thai accessibility policy and law has been raised in the Thai Web Content Accessibility Guidelines [21] which was released in 2008, and the Thai government has agreed to providing equal educational opportunity for all Thai citizens in the National Education Act 1999 [22].



Figure 6. Perception of the university web accessibility policy

The final question emphasized the perception of each participants university's accessibility policy. Figure 6 shows that 69% of lecturers, 85% of web administrators and 80% of senior managers did not know about web accessibility policies regarding their university. Further information from the interview process found that some Thai universities did not have a web accessibility policy, as mentioned by one senior manager:

"The university needs to have a policy on web accessibility first. At this time, the university still lacks policies as well as physical facilities for students with disabilities such as walkways, ramps and lifts."

B. Indications of the important barriers in developing accessible online materials and web accessibility

This section presents the most important barriers to developing accessible online materials and web accessibility compliance for Thai universities. The participants were asked to rank the critical barriers in developing accessible online materials and web accessibility for their university.

TABLE I. RANK AND MEAN SCORES OF THE BARRIERS TOACCESSIBLE ONLINE MATERIALS ON THAI UNIVERSITYWEBSITES

Barriers	Rank	Mean (X̄)
Lack of knowledge of the needs of students with disabilities	1	8.46
Lack of knowledge of technologies to create accessible online materials	2	7.58
Lack of knowledge of Assistive Technologies (AT)	3	6.84
Lack of accessibility training and awareness	4	5.48
Lack of assistive technology equipment and software	5	5.44
Lack of financial support from a university	6	5.14
Lack of time	7	4.52
Lack of demand for accessible resources	8	4.06
Lack of commitment to accessible design standards and resources	9	3.92
Lack of supporting network	10	3.56

The results show that the lack of knowledge of the needs of students with disabilities was the most prominent issue, followed by the lack of knowledge of technologies to create accessible online materials, and lack of knowledge of AT with mean scores of 8.46, 7.58 and 6.84 respectively (see Table I). These issues not only occur in Thailand, but they also happen to other institutions across the world [23], [24]. By looking at the in-depth interview results, several participants also confirmed the importance of these problems. One IT senior manager stated that:

"...if one does not understand how a person with disabilities perceives the world or the relevant people do not have any experience on special needs, it will not be possible to develop web accessibility for the university."





It can be seen that knowledge of the needs of students with disabilities' is the most significant issue to developing accessible online learning materials.

C. Future strategies in developing accessible online materials and web accessibility for Thai university websites

Most participants strongly agreed (SA) with five strategies, which include: providing training (M = 5.00,SD = 0.70), allocating financial resources (M = 4.58, SD = 0.53), equipment and technology supports (M = 4.53, SD = 0.57), starting with university policies (M = 4.38, SD = 0.68), increasing cooperation among stakeholders (M = 4.36, SD = 0.59) and, rewarding (M = 4.04, SD =0.86) however, they were uncertain about increasing penalties in laws (M = 2.87, SD = 1.12) (see Figure 7). Thereby, training should be addressed to enhance people's knowledge in order to gain their awareness. Besides having a practical policy, appropriate financial and equipment support can also improve the quality of university websites in Thailand to facilitate students with special needs while increasing penalties in laws would be the least effective strategy.



Note: SD= Strongly disagree, D= Disagree, NA= Neither agree nor disagree, A= Agree, SA= Strongly agree

Figure 7. Future strategies to integrate accessible online materials and web accessibility on university websites

Moreover, all participants pointed to Key Performance Indicators (KPIs) for the educational quality assessment. For example, one lecturer stated that:

"All universities are required to be certified "Excellent" in the external quality assessment by The Office for National Education (ONESOA). The ONESOA has set of Key Performance Indicators (KPIs). If the ONESOA include web accessibility as one of their KPIs, the university will then be required to create web accessibility in order to pass the assessment."

The above suggestion reflects that accessibility policy may have a great influence in educational quality if it is addressed as a part of the selective evaluating assessment performance for Thai universities. This practical strategy could improve the quality of online materials within Thai university websites.

VI. CONCLUSIONS

With respect in equality in education, the Thai government has puts a great deal of effort into ensuring students with disabilities will have equal opportunities with other students. The results of this study indicate that the lack of awareness of accessibility policies and knowledge of people with disabilities is highly problematic for academic and other university staff. Training is the best way to enhance and put into practice their knowledge and awareness as apparent in other institutions [25]-[27]. It is recommended that accessibility should be one of the Key Performance Indicators (KPIs) in educational quality assessment in order to standardise and enhance equal opportunities in the Thai education system to all groups of students in the challenging environment.

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Conceptual Framework for Developing Thinking Skills by Learning Model on Research-Based Techniques in Pulse Techniques Subject.

Pitipark Pinrod

Northern Vocational Institute Lamphun Technical College, Thailand funnyfm@gmail.com

Abstract- This research is a qualitative research (Qualitative Research) aims to develop a model of learning that emphasizes thinking skills in Pulse technique subject. The research sampling populations (Purposive Sampling) are 15 school teachers in the Office of Vocational Education Commission. The research is two phases: Phase 1 study of documents (Documentary Research) for reviewing. Phase 2 the research process is followed by Focus group technique. Tape recorders and cameras are used for this. The data were analyzed by content analysis. The results were found that a model that is called TRBL Model (Thinking Research Based Learning) consist of 3 elements 14 Steps as follows Lesson plan (before instruction): the 4 steps are course analysis, learners Analysis, selecting how to get Thinking Skills in course and course orientation 2. In learning situation The study consisted of 2.1 to explore 2.2 for knowledge 2.3 to collect and manage the data. 2.4 Research Planning 2.5 Research 2.6 The discussion of the findings. 3. after learning include 3.1 Presentation. 3.2 Publication. 4. The Evaluation consists of 4.1 Evaluation of progress. 4.2 The evaluation process.

Key words: Research Base Learning, Thinking Skills, Pulse Technique

I. INTRODUCTION

National Economic and Social Development Plan No. 11 (2555-2559) has given priority to engage all sectors of development. At the community, regional and national levels in all stages of the plan. Extensive and continuous To work together to set the vision and direction of national development. And to prepare detailed strategic plan to advance "social harmony and happiness. With equality, fairness and immune to change "the country's development in the 11th Plan is the introduction immunity exists. And speeding in a stronger immune system. To prepare a social and economic system of the country to adjust to the impact of the change properly. By giving priority to the development of social and Thailand for quality. Have access to resources And benefit from economic development and social justice. As well as create economic opportunities in technology, innovation knowledge-based creative production and and consumption that is environmentally friendly. (Office of National Economic and Social Development: 2555.)[1] So learning is essential in developing countries, to learn that the students need in today's society. Can be divided into 5 groups: 1 knowledge in core subjects. 2. moral and

Features 3 Cognitive Skills This includes communication skills, critical thinking and creativity. 4 Social Skills This includes the responsibility to themselves and society, and technology skills 5. Which of the five skills that are necessary to Aphiwat teachers are learning to develop skills in three main groups: intellectual skills. Social skills, and technology skills. Because these skills have been analyzed and accepted in academia that is an essential skill for children to lead a life of quality in the 21st century whereby teachers are needed to attain. bring skills such as integration with content to support academic learning even more successful. (Titsana Kakmanee : 2557) [2] Bloom's Taxonomy Discusses the classification according to Bloom's theory, which is divided into three aspects: cognitive, psychosocial domain and range of skills. Each side will have a seamless ability levels, from the lowest to the highest, such as the cognitive domain. Start of knowledge, comprehension, application, analysis, synthesis and evaluation of the concept has been revised concept. Anderson and Krathwohl (2001) [3] Remembering Understanding Applying the analysis, evaluation, and Creating the Group are classified as awareness, responsiveness, creating value, and creating a system of attribute values. Skills Recognition is the body's motor skills, movement skills two or more organs simultaneously, communication skills using gestures. And behavioral skills, such as show Figure1



Figure 1 comparison of the learning approach. Bloom's Taxonomy and Anderson and Krathwohl.

Figure 1 shows a comparison of the learning approach. Bloom's Taxonomy and Anderson and





Krathwohl. Bloom's Taxonomy and Anderson and Krathwohl , The concept of learning Bloom's Taxonomy , To that end, the assessment of learning. When the results of learning, the students have to apply the knowledge gained to create awareness, knowledge, and create new jobs. Unlike the concept of Anderson and Krathwohl .That has improved the learning from the evaluation of learning the first step is to create new knowledge, which is the ultimate goal of learning concluded that it is important to develop. the classes that affect the development of self and Nation.

The teaching process is used as a base for research (Research Base Learning: RBL) is a form of teaching process.fmFocused on the learners Which focuses on how students learn and practice their own quest for knowledge. An important aspect of learning using research-based strategy is a combination of a variety of teaching and learning methods. The research used as a basis for learning to achieve maximum efficiency. The key elements of the research. To be taught include. The research findings research. And research context,(Griffiths:2004)[4]

Office of Vocational Education Commission The agency responsible for the production of semi-skilled and skilled manpower levels are important in developing countries. In teaching vocational skills required in the teaching process, because it allows the students to use their thinking skills to solve problems. Work plan, analysis of work affecting product resulting from the use of thinking skills to enable the students to think systematically Lange researching for answers and decisions.

The researchers are interested in the learning process for the students to use their skills in cognitive learning processes in the course of this research, a pulse technique, which makes the content of the participants who are not familiar. with the calculation results in unhappy to learn as they should. In the past academic year showed low signal jewels learning and student motivation in learning. So learning the RBL will make the students participate in the learning process that uses research as a base, which will help the students towards the achievement of a desirable and happy. learning For this reason the research was to develop patterns of teaching and research as a base for development of thinking skills which will contribute to development of the next class.

II. RELATED LITERATURE

2.1 Couse Outline Pulse Technique

Course pulse technique is a Diploma Course of the Office of the Vocational Education Act 2546. Ministry of Education The objectives of the course are as follows:

A. In order to analyze the electrical signals and circuits.

- B. Pulse and Switching in electronics.
- C. To be able to perform according to design pulse.

Terms In order to have a solid introduction to working with care. Discreet, safe, aware of the quality of the work. Professional and ethical The standard course is

- A. Create an electrical signal with different requirements.
- B. Circuit converts the electrical signal requirements.
- C. Measuring and testing cycle pulses.
- D. Application circuit in the electronic pulses with.

The course consists of The operating principles and design and construction of various electrical waveform converter circuit. Clippers and clamper circuit. Integrated attenuation Differential circuit Switching circuit Schmitt trigger circuit. Multi-vibrator circuit Trigger circuitry Times based signal generation circuit Sync and synchronization. (Pitipark Pinrod : 2556) [5]

2.2 The concept of learning through research-based. The learning process as a research base (Research Base. Learning) is a method of teaching that focuses on learning and acquiring knowledge by integrating research with teaching. (Healey : 2005) [6] The learning process as a research base. The learner-centered learning. Which focused on learning a variety. By combining different learning strategies through teaching and research. (Bliuc more : 2007) [7]

The research is based on the following steps. (Department of Curriculum and Instruction Development : 2544) [8]

Step 1 Planning learning. Teacher education is a process that analyzes elements and factors. Related to the curriculum, including link analysis curriculum standards. Standards and scope of learning. As well as to analyze the individual and the group, taking into account the following elements is the nature of the learning experience and basic knowledge. Learning methods (Learning Style) of the students who applied to the data in the target field of planning and design programs.

Step 2 learning activities. The procedure is the teacher-led activities. Specified in the learning plan into practice by focusing on the learners. To allow students to learn and have the desired goals. Including the ability to use research as part of the learning process. The teachers and students are learning together. Meanwhile, the teacher's evaluation of learning and collecting information. About the features of the learning that occurs during a learning activity.

Step 3 assessment for learning. Ensuring that the students are learning the skills and moral values, behavior or other features. As expected or not, the outcome of the assessment is partly derived from the evaluation together with the activities learned by observations from the interviews and the preparation of the file. collection of learners This assessment is based





on authentic And the other to evaluate student achievement.

2.3 Concept of Thinking Skills.

Thinking Skills (Sarinton Witayasirinun et : 2544) [9] Refers to small To think in terms of student behavior that indicates the level of thinking. Divided into two levels: the level of thinking.

1. Basic Thinking Skills include

1.1 Communication Skills

1.2 Core or General Thinking Skills

2. Higher order or more Complexed Thinking Skills

2.4 Concept of HCL Model (Hyflex Constructionism Learning Model)

Is a flexibility model for learning environment and emphasized on the learners construct knowledge for themselves, which can learn in both of in and outside the classroom, anywhere and anytime. The model consists with 4 components as 1.Inputs 2.process 3. Output 4.feedback with 11 mainly steps and 23 sub-steps as 1) Analysis 1.1) curriculum analysis 1.2) content analysis 1.3) learners analysis 1.4) basis system analysis 2) design and development 2.1) learning targeted 2.2) objective development 2.3) collecting, designing and creative content. 2.4) identify learning activities as learner created teaching & learning participated 2.5) communication methods 2.6) identify method for content transfer. 2.7) identify education resource and related reference resources 3) preparation 3.1) orientation. 3.2) acknowledge the target and objective 3.3) Scope 4). knowledge searching 5) data collection 6) Planning 7) Implementation 7.1) search 7.2) experimental 7.3) experiment result 7.4) traceability 8. evaluation 8.1) in progress 8.2) process 8.3) product) 9) presented 10) published works 11) Check 11.1) progress and 11.2) process. (Pitipark Pinrod : 2014) [10]





Figure 2 The conceptual framework of the research.

III. METHODS

This research is a qualitative research (Qualitative Research) is divided into two phases: Phase 1 study of documents (Document Research) theory of secondary data from primary research reports, theses, books, electronic media, online media to frame the thesis. the death of a Phase 2 process research focus group (Focus Group) population were teachers in schools under the Office of Vocational Education Commission. The sample Professionals who are vocal skills, systems thinking courses, 15 were selected purposively (Purposive Sampling) tool. Tape recorders, cameras recording field. The data were analyzed using content analysis (Content Analysis)

IV. RESEARCH RESULT

Found that the model developed is called TRBL Model (Thinking. Research Base Learning) is a 3element 14 Step 1 Before classes are offered. 1.1 Analysis Course 1.2 Analysis of Learners 1.3 Choosing how to convey an Thinking Skills. 1.4 Orientation 2. The study consisted of 2.1 to explore 2.2 for knowledge 2.3 to collect and manage the data. 2.4 Research Planning 2.5 Research 2.6 The discussion of the findings. 3. after learning include 3.1 Presentation. 3.2 Publication. 4.The Evaluation consists of 4.1 Evaluation of progress. 4.2 The evaluation process.



Figure 3 The development of thinking skills and research base. (TRBL MODEL : Thinking Research Base Learning)





V. DISCUSS FINDINGS

Learners with conceptual model developed learning skills. Skip to pulse technique with the research process is based on thinking skills. The instructor must provide knowledge of principles and research skills. Integration of learning activities that focus on the learners using research as a learning process. Then write lesson plans that focus on thinking skills by using research as a base, with the teacher as a facilitator and guide more closely aligns with your research. Kutreeya Ratanavimon et.(2556) [11] Found that in the instruction. You must change the culture of teaching and learning from the teacher gave. Changed to allow students to create their own. The instructor must have the knowledge and experience and build a portfolio of their own. Overview of the institutional policy. Research-Based Learning and preparation facilities or related materials to support the learning process. Research-Based Learning and patterns developed in line with research. Varapon Pongsuvan (2553) [12] Found that a model built on knowledge developed consists of five components: 1) Team 2) the research process. 3) computer supported collaborative learning. 4) Sharing knowledge, and 5) evaluation.

VI. ACKNOWLEDGMENT

Thank club vocational skills, systems thinking courses. Office of Vocational Education Commission to support experts in the research. I competency of vocational teachers and vocational education and research and development in support of this research is to successfully achieve the objectives of the research.

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A Development of Electronic Media for 336269 Logistics I

Thithima ChuangChai and Supitcha Cheevapruk

College of Industrial Technology King Mongkut's University of Technology North Bangkok

Abstract- A development of electronic media for 336269 Logistics I was aimed to create an electronic instructional media for the students of Department of Production Technology and Information Technology in order to have their self - knowledge acquired or be able to have their self - studied and review the content of Logistics I by themselves as their needs.

The development of electronic media was developed by using Moodle, XAMPP, Adobe Flash CS, Adobe Photoshop and Adobe Audition whereas the academic achievement test was examined to find the accuracy of content by three logistic experts then the difficulty and easiness, discrimination power, and the reliability of the test based on the learners' experiences were all calculated. After that the qualified tests were selected and entered in the electronic media to be used as the learners' learning measure.

It was found that the research result could enhance the electronic media of subject 336269 Logistics I with the overall satisfaction of the learners based on electronic media usage graded as good.

I. INTRODUCTION

Limitless education partially enhances the learners to study the desired content as their wishes in all occasions whenever they want. This education channel arrangement is in accordance to the National Education Act of Parliament B.E 2542 (no. 2nd) section 2 "learning process arrangement of educational institution and related unit with the following procedures: (1) providing the content and activity in accordance with the learners' interest and skills based on individual differentiation (2) providing the skill, thinking process, management, facing situation, and knowledge application to protect and solve the problem (3) providing the learners the activity based on real life experience (4) providing the teaching and learning process combined with other contents proportionately and equally including morale, good value and desired features embedded in every subjects and (5) providing the learning process enabling in every place and occasion with the coordination with parents, guardian, and community people to develop the learners based on their potentiality"[1]

According to the College of Industrial Technology's policy to support the lecturers developing teaching and

learning media in the electronic media form and to be accordance with the strategic plan of College of Industrial Technology no.11th (2012-2016), Department of Production Technology Management and Information Technology developed the E-learning media as Logistic subject content is related to logistic management with the learning arrangement form of electronic media based on Learning Management System: LMS) in order to align the content of activities, exercises, and tests so that the differentiated students with various capacities and background could understand and be able to study further as their needs and strengthen their academic grades in their desired levels since they could learn as frequently as they want. Moreover, the pretests and posttest were provided to motivate them to study more if their test scores were undesirable.

According to the related literature reviews of Elearning preparation, it was found that academic achievement of the learners based on electronic media, most scored higher than the conventional learners (only studying with the teachers). In addition, learners' satisfaction was high as well. Therefore, the benefits of the program developing the lesson based on web with the standardized pattern of Sharable Content Object Reference Model : SCORM was applied to prepare the learning pattern presenting the learners the Logistics I content with unlimited time and place, and provide lesson arrangement, tests and activities inducing the students to exchange their knowledge based on web board or questioning and answering posts.

II. RELATED LITERATURE

Chalee Siripitakchai et. al. [2] conducted descriptive research of students' opinions related to teaching and learning based on E-learning of Anatomy and Physiology subject for Srimahasarakam Nursing College. The research was aimed to study the students' opinions on the teaching and learning management based on E-learning with the randomly sampling group of 140 from nursing students of Srimahasarakam Nursing College. The tool was questionnaire with 25 item verified by three experts, reliability 0.91 whereas the statistics used for data analysis was frequency, percentage, mean, and standard deviation. It was found that 1) most nursing students were female and used computer for educational purpose





during their studying process based on E-learning, most used computer 5-10 hours a week and without educational purpose fewer than 5 hours a week 2) nursing students highly rated the opinions related to teaching and learning based on E-learning overall benefit and design ($\bar{x} = 3.51$, 3.83 and 3.75, respectively) whereas the service was averagely rated ($\bar{x} = 2.82$)

Sunate Suebka [3] conducted the research on the students' satisfaction to teaching and learning based on web with the application of Moodle E-learning. The aim of this study was to create the subject of teaching and learning system based on web with the application of Moodle E-learning and to study the students' attitudes to the system based on the survey research conducted with 46 students registering in subject an341, Agricultural Engineer Principle, semester 2/2011 whereas the tool for data collection was questionnaire constructed by the researcher and statistics for data analysis was percentage, mean, standard deviation, and relation analysis. Regarding the time of using was found that the student spent 1 -3 hour per day for web browsing as shown for 41.30%. The satisfaction of teaching and learning based on Moodle was rated highly in almost every item except the part "enhancing more understanding of subject content" and "creating the classroom condition more interesting" were averagely rated. When compared with the personal description of the learners and satisfaction to the teaching and learning based on Moodle, it was found that gender and convenience of university web browsing had no influence on satisfaction of students to the teaching and learning based on Moodle: however, the year of studying had influence on the satisfaction of students to teaching and learning based on Moodle. Nevertheless the additional knowledge acquisition from different knowledge sources provided by the lecturer induced the learners more comprehensible in lesson, more responsible, and more supportive in term of all time communication. In addition, with or without personal computer had influence on the motivation of the students participating in the teaching and learning process whereas the web accessibility from the learners' residence and period of web browsing per day had influence on the learners' satisfaction to the teaching and learning process based on Moodle, lastly additional knowledge acquisition from various sources provided by the lecturers enhanced the learners more comprehensible in lesson and created more interesting of classroom condition.

In thira Paleenud [4] conducted the research on academic achievement and learners' satisfaction in the E-learning classroom. It was aimed to 1) test the academic achievement of E-learning learners based on Elearning media system 2) compare the academic achievement of E-learning learners and conventional learner 3) measure the learning durability of E-learning learners based on the creation of E-learning online system and (4) evaluate E-learning learners' satisfaction based on the creation of on-line teaching and learning system. With the sampling group recruited from third year students registered in the subject of database management system of 72 were divided into two groups each for 36: the first group as the subject group studying E-learning based on the creation of on-line teaching learning media system and the second as the controlled group studying in conventional classroom. The tools used were 1) creation system of on-line teaching and learning media 2) evaluation form for data collection. It was found that 1) academic achievement of E-learning students based on creation of on-line teaching and learning media was higher than the conventional classroom students; t=-4.35 at significant level <0.01 2) E-learning students based on the creation of on-line teaching and learning media system had higher academic achievement than the normal classroom students; t=7.61 at significant level =0.01 3) E-learning students based on the creation of on-line teaching and learning media system had learning durability not less than 30% 4) satisfaction of E-learning students based on the creation of on-line teaching and learning media system was averaged as 4.25 considered as high satisfaction. Therefore, it could be concluded that E-learning based on the creation of on-line teaching and learning media system could be applied in teaching and learning arrangement effectively.

III. METHODOLOGY

Electronic media was designed and the evaluation tool was tested with the trial group of 30 to find the efficiency of the tool before actual preparation of electronic media. The tool was evaluated by the electronic media users. The research was done by the following steps:

3.1 Studying data, content,

principle of media design, program for media development, and questionnaire design for the satisfaction of E-learning media users.

3.2 The population and selecting the sampling group

'was indicated to be the students of the Department of Information and Production Technology Management, College of Industrial Technology with the specifically selected sampling group.

3.3 The research tool construction

3.3.1 Content design was done by the following steps





a) Content analysis based on the description of the curriculum then the behavioral objective of each determined lessons were written individually.

b) Create network diagram by sequencing of prerequisite knowledge of the learners / the sequencing the difficulty or complexity of the content then design overall content into each minor ones as shown in figure 3 - 1.

3.3.2 Logistics test was designed by the following steps

a) The quantity of the test was analyzed to be used in each lesson and for all tests based on weighed analysis of desired behavior in each level and priority of learning unit.

b) Drafting the test based on each objectives which were written in each topic of seven lessons.



Figure 3-1 Network diagram of content of electronic media

c) The examination sheet was evaluated by 3 logistics experts to find Index of item Objective Congruence (IOC) value. The accepted value must be over 0.5 whereas the criteria of score were 3 levels: +1 means that the test content is positively congruence with the objective, 0 means that it was uncertain whether the test content is congruence with the objective or determined content and -1 means that it is positively certain that the test content is not congruence with the objective or determined content as shown in formula(1) [5].

$$IOC = \frac{\Sigma R}{N}$$
(1)

IOC = Index of item Objective Congruence between objectives and tests

 ΣR = Scores Summary from Experts

N = Number of Experts

Table 3-1 The result of the selected tests using in the system development based on the IOC analysis between the test and behavioral objective

Total test items	Number of the test items which had IOC value higher than 0.5	Number of the test items which had IOC value lower than 0.5 *correction needed
183 items	153 items	30 items

Table 3-1 showed number of test items which had IOC value higher than 0.5: 153 items. There were adequate and cover all the objectives of the lesson, therefore the 30 items could be eliminated.

3.3.3 The test analysis based on the 30 experienced learners of Logistics subject

a) The score result separation based on the high score group and low score group. It can ch which was 8 students [6] then sequencing the score from the highest and the next 8 students for the highest score group then sequencing the low score and the next for 8 students as the lowest score group.

b) The difficulty, easiness and discrimination analysis was done based on the specific difficulty value of 0.20-0.80 shown in the formula (2).

(2)

 $P = \frac{R}{N}$ P = Test Difficulty

R = Number of students who answer the questions correctly

N = Number of Students

The criteria for the discrimination above 0.20 as shown in the formula (3). [7]

 $D = P_H - P_L$ (3)

 $P_{\rm H}$ = The ratio of the upper – scored students

 P_{I} = The ratio of the lower-scored students

 Table 3-2
 The result of the selected tests using in the
 system development based on difficulty analysis

Total test items	Number of the test items which had score between criteria 0.20-0.80	Number of test lower than the criteria 0.20
153 items	153 items	None

Table	3-3	The	result	of	the	selected	test	in	the	system
develop	pme	nt ba	sed on	dis	scrin	nination a	analy	sis		

Number of total test items	Number of the test items which had higher value than 0.20	Number of the test items which had value lower than the criteria 0.20
153 items	140 items	13 items





Table 3-2 showed some tests using in the system development based on difficulty analysis. There were 153 items which had score between criteria 0.20-0.80. The table 3-3 showed the tests based on discrimination analysis was found that 13 items had value lower than 0.20, therefore they had to be improved before including in the test.

c) The test reliability was calculated based on the reliability coefficient of Kuder-Richardson (KR-20) and the 153 items of the test and results showed that the reliability was 0.97 considered as high reliability as show in the formula (4).[8]

$$r_{t} = \frac{n}{n-1} \left[1 - \frac{\sum pq}{\sigma_{1}^{2}} \right]$$
(4)

r_t = Test Confidence Coefficient

n = Number of tests

p = Ratio of students who answer the questions correctly

q = Ratios of students who answer the questionwrong)=1

 σ_1^2 = Variance of Test Scores

d) The test selection based on lessons' objectives for pre- test and post – test are shown in figure 3-2.

3.4 Developed electronic media

Instruction media developed by Moodle, XAMPP (X:cross-platform, Apache HTTP Server, MySQL, PHP, Perl), Adobe Flash CS, Adobe Photoshop and Adobe Audition.



Figure 3-2 Instruction Media and Test Items Construction

IV. EXPERIMENT AND DATA COLLECTION

4.1 Testing the developed media

by ploading the electronic media on the website of URL: http://Ims.cit.kmutbn.ac.th/logistics/ to get the learners tried.

e-Learning for Logistics I	Yes are est legged in	(Logn)
The second secon	Calendar 3 Souther 213 1 North A for the for 1 North A	570 <u>1</u> 1 1 1 1 1 1 1 1 1 1 1 1 1

Figure 4-1 Main Screen of Electronic Lesson

	You are logged in as Student KMUTNB (Logost)
e-Learning for Logistics I	
tons Wy control Programmer and B Programmer and B Profile (Control (Contro) (Contro)	Calendar El 4 Settember 2010 P. In the for for first to
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Figure 4-2 Main Menu of Electronic Lesson

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Figure 4-4 Electronic Lesson Content







Figure 4-5 Screen showing the video content



Figure 4-6 Animation Video Content Screen

4.2 The satisfaction evaluation

to the developed electronic media of the second year students registered for Logistic I subject semester 1 academic year 2013. The result as shown in table 4-1.

Table 4 - 1The learners' satisfaction evaluation resultafter using the electronic media subject of Logistics I336269

Item	Evaluation List	x	S.D	Meaning
1	Lesson Content Clarity	4.12	0.968	Good
2	Interest of Lessons	4.01	0.451	Good
3	Interest of Multimedia	4.17	0.687	Good
	(cartoon and video)			
4	Pattern of font, color and size	4.52	0.412	Very
	in the media			Good
5	Clarity of direction in the test	4.31	0.741	Good
6	How to report the test score in	4.22	0.359	Good
	each test and how to conclude			
	the total score			
7	Completeness of facility in	4.57	0.746	Very
	the lesson such as permission			Good
	of downloading document			
8	Interest and attractiveness of	4.02	0.841	Good
	lesson content			
9	Interest of overall screen	4.12	0.475	Good
10	Convenience, beauty, and	4.24	0.409	Good
	flexibility of overall lesson			
	usage			

V. CONCLUSION

According to the development of electronic media for subject Logistics I 336269 as the form of multimedia based on web browser http://Ims.cit.kmutnb.ac.th/ logistics, the content structure was considered as the independence media which the learners could select as they wish. In each content of lesson, the description of font, picture, video or animation were available whereas the content aims to notify the learners before they actually enter the lesson. In addition, exercise, and additional content were provided and prepared for the download. Moreover, the academic achievement test with pretest and posttest (the same copy of the pretest) were also available.

According to the satisfaction evaluation result of electronic media for subject Logistics I 336269, sampling group was from 30 students of Department of Information and Production Technology Management, College of Industrial Technology registering in semester 1 academic year 2012 with the following satisfaction aspects : clarity of content as good, interest of lesson as good, interest of multimedia (cartoon and video) as good, pattern of font, color and size in the media as good, clarity of direction in the test as good, how to report the score result of each test and how to conclude the overall score as good, the completeness of facility in the electronic lesson such as permission of document downloading for additional education as good, interest and attractiveness of content and interest of screen as good, and finally the convenience, beauty and flexibility of lessons usage as good.

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Development of Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students

J. Premsmith^{a,*} and P. Wannapiroon^b ^aKing Mongkut's University of Technology North Bangkok, Bangkok, 10800, Thailand ^bKing Mongkut's University of Technology North Bangkok, Bangkok, 10800, Thailand

Abstract-The research aimed to 1) analysis and synthesis framework of **Develop** Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education develop **Challenge-Based** Students. 2) Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students and 3) evaluate the developed Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students. Two phases of the research will be carried out: a development and an evaluation of the model. Samples are experts in the field of information technology, Challenge-Based Learning and leadership philosophy. five experts are selected by purposive sampling method. The obtained data are analyzed using mean and standard deviation. The research result demonstrates the following findings: 1) The results of the study show that model consists of 7 key steps: 1) Create Scheduler, 2) Brain storming, 3) Investigate, 4) Guiding, 5) Solution, 6) Assessment, and 7) Publish and Share. 2) The five experts have evaluated the model and commented that the developed model showed high suitability.

Keywords: Challenge-Based Learning, Cloud Computing, Leadership Philosophy

I. INTRODUCTION

Learning and Teaching in the 21st century in line with the National Education Act B.E. 2542 and 2545, Section 22, requires that provision of learning must be based on the principle that every student can learn and selfdevelop. Students should be encouraged to develop naturally to their full potential. Also, Section 24 specifies that educational institutions and relevant agencies must arrange activities, learning environment and facilities in line with interests and aptitudes of students [4].

Apple Classroom of Tomorrow (2009) explains that learning is an approach based on the challenge of applying the lessons in classes and workshops to challenge settlement to go through. Learning through challenges involved teaching and learning methods in order to motivate the students in various technologies and facilities around them to solve real-world problems. Through this approach, students should implement assignments based on skills and interests, while the lecturer or other experts with challenging questions posed by the students and the students are trained to be brave act on the knowledge gained and practice sharing information and experience. Among the key features of this challenge based learning is the diversity of possible solutions and strategies, natural resources and relationships, opportunities to develop self-attitude, talent, hone basic skills to management and production technology, opportunities for students to do something rather than learning in class or workshop only, documenting the experience gained from solving challenges and finding information 24 hours a day[9]. CBL encourages the use of web and mobile technologies, such as collaborative tools and wikis, that are available to students but not often used in coursework. This model is frequently interdisciplinary in its approach and encourages projects that involve the wider community. The combination of allowing students to choose their challenge and tying these challenges to community interaction raises student investment in a productive outcome [10]. A key feature of challenge-based learning is that it appropriates the networking tools and media production techniques already being used in daily life by many 21st century learners. In preparing the final products of their research presentations of their chosen solutions students draw upon photography, videography, audio recording, and writing skills that they may already be using as web content producers. If they are not already doing those things, challenge-based learning provides an engaging opportunity for them to hone these kinds of high-level communication skills [7]. The kind of learning that takes place in challenge-based projects is reinforced by action, and students will learn much from the implementation of their own ideas. Part of the attraction of the projects to the students was the opportunity to persuade their peers and the adults in their life to take part in activities they designed. In order for students to see that they can make a difference, they must be allowed to carry their solutions through to action. Implementation is accompanied by major outcomes in terms of acquisition of 21st century skills such as communication, leadership, civic literacy, and social responsibility, among many others[7].

A leadership philosophy is a set of beliefs and principles that strongly influence how we perceive ourselves within an organization and those that we lead.





It is an essential ingredient in forming our vision, goals and behavior within the organization that we lead. First it is useful to define leadership. Leadership is the individual phenomenon of influencing others, inspiring them to do their best, Giving them purpose, guidance and motivation. The best leadership style is one that is adapted to the situation, otherwise known as situational leadership. Leadership is different from management as management does not have to involve inspiring or motivating others. Most leaders in any role agree that vision, values, adapting to change, knowing oneself and others, professional knowledge and good communication are essential components of leadership. I believe that one of the most important elements of these is vision. Without vision a leader is lost[8]. When developing your leadership philosophy you must be aware that each individual's values and goals will differ, and so will that of the organization. Your leadership philosophy should reflect these differences. However there are some fundamental characteristics of effective leadership that are universal and considered essential to developing an effective leadership philosophy. Leadership philosophies provide foundations on which to build strategies for an organization from management to operational activities [7].

II.PURPOSE OF THE RESEARCH

- 1) To analysis and synthesis framework of Develop Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students.
- 2) To develop Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students.
- 3) To evaluate the developed Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students.

III. SCOPE OF THE RESEARCH

A. Population and Sample

Population is experts in the field of information technology, Challenge-Based Learning and Leadership Philosophy.

The samples in this research were five experts in the field of information technology, Challenge-Based Learning and Leadership Philosophy selected by Purposive Sampling method. The selection criteria at least 3 years of relevant

experience.

B. Variable

Independent variable is Challenge-Based Learning Instructional Model via Cloud Computing Environment. Dependent variable is Leadership Philosophy.

IV. LITERATURE REVIEW

A. Challenge-Based Learning [1]

Apple Computer Inc. has applied CBL to the collaboration project, Apple Classrooms of Tomorrow (ACOT), between public schools, universities, and research agencies with great success [1].



Figure 1. The CBL Framework

The CBL framework, as shown in Figure 1, is implemented in this study as follows:

2.1 Big Idea

Start by working with students to identify the big idea. A big idea is one that is important on a global scale and that students can work with to gain the deep multidisciplinary content knowledge and understanding that is required by the standards for their grade level. A good place to look for big ideas is in the major news stories of the day.

2.2 Essential Questions

which serves as the link between your lives and the big idea. The question should be answerable through research, help focus students' efforts, and provide a framework for the challenge.

2.3 The Challenge

The challenge turns the essential question into a call to action by charging participants with developing a local solution to a global problem. A challenge is immediate and actionable. Choosing and setting up the challenge is crucial. If it is interesting and sufficiently close to home, students will derive personal meaning and feel a sense of accomplishment upon proposing and implementing a solution. If the challenge also has greater global significance, students will gain confidence and self-



esteem as they engage with issues they know to be truly important.

2.4 Guiding Questions

Students can now generate their own guiding questions to identify the knowledge they will need to understand to develop a solution to the challenge.

2.5 Guiding Activities

Students identify and engage in guiding activities, including simulations, research, games, calculations, expert interviews, surveys, and other activities that help them acquire the knowledge needed to answer the guiding questions and to develop an innovative, insightful, and realistic solution.

2.6 Guiding Resources

Students did their research using books, class lecture notes, papers, the Internet and expert opinions in developing solutions to their guiding questions. They watched videos on the Internet to learn how to fend off social engineering tactics.

2.7 Solutions

They should select one solution through prototyping, experimentation, or other means. Next, they fully research, document, and develop that solution and then identify steps to carry out their implementation plan.

2.8 Assessment

Challenge Based Learning presents a wide variety of opportunities for assessment. Informative assessment of content and skills can be built in throughout the challenge, and the solutions to the challenge provide an excellent opportunity for summative assessment. Traditional assessment methods can be used at many different points during the process. However, the CBL experience provides the opportunity to integrate a variety of alternative and authentic assessment tools. These tools are performance based in that students are not only expected to know the information but apply it in realworld situations. They also provide a longitudinal source of rich data that can be used to assess depth of knowledge and change over time.

B. Cloud Computing

Cloud computing really is accessing resources and services needed to perform functions with dynamically changing needs. An application or service developer requests access from the cloud rather than a specific endpoint or named resource. What goes on in the cloud manages multiple infrastructures across multiple organizations and consists of one or more frameworks overlaid on top of the infrastructures tying them together. Cloud computing is new platform of technology model to be accessible through. Cloud Computing characteristics includes on demand self services, resource pooling, rapid elasticity, mutagenicity, and measured service (pay per use) [3], [6] There are three types of cloud providers that can be divided into Software as a Service (SaaS),

Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) but [6] they subdivided six groups are 1) Software as a service (SaaS) 2) Infrastructure as a Service (IaaS) 3) Platform as a Service (PaaS) 4) Data as a Service (DaaS) 5) Network as a Service (NaaS) 6) Storage as a Service (STaaS) than it was subdivided four types includes Private Cloud, Community Cloud, Public Cloud, and Hybrid Cloud. In this research emphasis SaaS because researcher will create the course management system in web-based format and that run on cloud computing environment.

C. Leadership Philosophy

A leadership philosophy is the way we see ourselves as leaders. This philosophy guides our actions, our behaviors, and our thoughts. Our philosophies are influenced by external and internal forces. We can change who we are as leaders by simply changing our philosophy of leadership. Leadership philosophies can change as you grow to understand yourself within the context of leading. Creating or finding your leadership philosophy means that you must explore and reflect upon your personal values, assumptions, and beliefs about leadership. Personal values are qualities or characteristics that you value. You would rather leave an organization or step down as a leader than violate your values. Your values guide your intentions and they influence how you lead. When your personal values are clear and you are conscious of them, you create a solid foundation for leading.

Assumptions are ideas that are assumed or believed to be true. As a leader it is important to understand what assumptions fuel your leadership thinking. Often leaders are not aware of the assumptions because they are operating from certain paradigms that will not allow them to see assumptions. Reflection into one's leadership is an excellent way to uncover assumptions. Beliefs are ideas that we hold to be true; they shape our realities. If a leader believes that the only individuals in an organization that can make decisions is the management staff, then that belief will influence how the leader treats others. Beliefs can also be unconscious; they are for us a habitual way of thinking and acting that it doesn't cross our minds that our beliefs may be prohibiting us.

D. Literature Review and Researches Related

(Marin, Hargis, & Cavanaugh, 2013)[2] were developed the structure of a Foundations English Language (FEL) course that integrates the use of Challenge Based Learning (CBL) and iPad mobile learning technology. the Center for Teaching and Learning (CTL) provided a follow up session of the CBL introduction solely to level three teachers in order to share the course outline with them and to familiarize them with how their current assessment structure would







fit into the CBL course. Then, one faculty member made stories of CBL initiatives in the classroom. The iFellow was asked to provide the course outline and to discuss the benefits and drawbacks the approach showed in practice. The predominant assessment approach used in the foundations program was summative and formative. Thus, the CBL approach was seen to add valuable Process-Based and informative assessment feedback to the learning process. The outcome of this sharing session was successful as two faculty members volunteered to participate in a pilot of the course, which will ultimately aim at providing reflective testimonials of the CBL experience at the end of semester one.

(Ronald, Joseph, Henry & Fabio, 2011)[5] were describes the application of the Challenge Based Learning (CBL) methodology to cybersecurity education. The overall goal is to improve student learning via a multidisciplinary approach which encourages students to collaborate with their peers, ask questions, develop a deeper understanding of the subject and take actions in solving real-world challenges. In this study, students established essential questions which reflected their interests in information security, formulated challenges on how to safeguard confidential information from cyber attacks and then came up with solutions to secure their information and network. For guiding activities, students participated in two cybersecurity competitions against their peers from other local universities. In these simulated real-life competitions, students were forced to work together, think on their own two feet and apply their knowledge to defend against cyber attacks. Assessments performed after the study showed improvement in students' computer and security skills, interest in learning security and ability to teach others

V. RESEARCH METHODOLOGY

The instructional model development is carried out in two phases.

A. Phase 1

Development of Challenge-Based Learning instructional model via cloud computing environment to enhance leadership philosophy for higher education students.

1.1 Relevant articles and research works are studied, analyzed, and synthesized to formulate a concept of the model development.

1.2 A model is developed based on the data obtained from the research study used in the formulation of the model development concept.

1.3 The model is presented to advisor for consideration and modified it as guided.

1.4 A tool is built to evaluate the model's suitability integrate the design of learning of ADDIE Model.

B. Phase 2

Evaluation and certification of the developed Challenge-Based Learning instructional model via cloud computing environment to enhance leadership philosophy for higher education students.

2.1 The model is submitted to the experts for review and evaluate the suitability.

2.2 The model is modified according to the experts' suggestions.

2.3 After modification, the model is presented in form of narrative diagram.



Figure 3. Explained the Challenge-Based Learning instructional model via cloud computing environment to enhance leadership philosophy for higher education students.




2.4 Evaluation result on suitability is analyzed using mean (\mathcal{K}) and standard deviation (S.D.). Five Likert-type levels of measurement are identified to assess the model's suitability, namely strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree.

VI. CONCLUSION

The research results are presented in two parts.

A. Part 1 Challenge-Based Learning Instructional Model via Cloud Computing Environment to Enhance Leadership Philosophy for Higher Education Students The instructional model consists of 3 main elements: 1) Challenge-Based Learning 2) Cloud Computing and 3) Leadership Philosophy; as shown in Figure 2 and Figure 3.



Figure 2. Illustrates the Challenge-Based Learning instructional model via cloud computing environment to enhance leadership philosophy for higher education students.

B. Part 2 Evaluation result of the developed Challenge-Based Learning instructional model via cloud computing environment to enhance leadership philosophy for higher education students

The evaluation is carried out by submitting the developed model to the five experts for a certification on the suitability of its components, methodology, steps, activities, and for a test.

The evaluation result by the expert has shows that the Could Learning Activity have high suitability ($\mathcal{X} = 4.48$, S.D. = 0.51) see table 1, the leadership philosophy have the high suitability ($\mathcal{X} = 4.40$, S.D. = 0.48) see table 2.

TABLE I : Could Learning Activity						
Variable	Mean	S.D.	Level of suitablility			
Create Scheduler	4.60	0.52	Highest			
Brain storming	4.30	0.48	High			
Investigate	4.50	0.53	High			
Guiding	4.60	0.52	Highest			
Solution	4.50	0.53	High			
Assessment,	4.30	0.48	High			
Publish and Share	4.60	0.52	Highest			
Total	4.48	0.51	High			

The expert has shows high suitability (z = 4.48, S.D. = 0.51).

TABLE II : Leadership Philosophy

Variable	Mean	S.D.	Level of suitablility
Personal values	4.89	0.49	Highest
Assumptions	4.11	0.43	High
Beliefs	4.33	0.54	High
Reflecting	4.30	0.48	High
Total	4.40	0.48	High

The expert has shows high suitability ($\overline{\alpha} = 4.40$, S.D. = 0.48).

VII. DISCUSSION

The research results in the following points for discussion.

6.1 The experts' evaluation demonstrates that the components, steps, and activities of the model are highly suitable. The result also aligns with the research finding of suggesting that the Challenge-Based Learning instructional model via cloud computing environment activities consists of seven key steps: 1) Create Scheduler, 2) Brain storming, 3) Investigate, 4) Guiding, 5) Solution, 6) Assessment, and 7) Publish and Share.

6.2 The experts' evaluation also reveals that the model is highly suitable for the leadership philosophy development.

6.3 Challenge-Based Learning activities following Tajuddin, S. M., & Jailani, A [9], several follow-up should be done by the parties concerned. Human resource is the main driving force in the implementation of learning based on these challenges. The lecturer should always be prepared with challenging questions that will be raised by the students. Facilities with broadband internet speed, equipped with video streaming are essential in order to make room for the students to find information more easily, and to facilitate presentations by students. Besides this institutional relationships with industry should also be developed so that students get the original reference.





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Evaluation of Research Institute based on AERES Standards: A comparative study between GREEN and RERC

Sukanjana Lekapat^{1,4}, Panarit Sethakul^{1,2}, Sombat Teekasab³ and Boonmee Kavinseksan⁴

¹Thai-French Innovation Institute
 ²Fuculty of Technical Education,
 King Mongkut's University of Technology North Bangkok,
 1518 Pracharat 1 Road, Wongsawang, Bangsue, Bangkok 10800, THAILAND
 ³Faculty of Engineering, Eastern Asia University
 200 Rangsit-Nakhon Nayok Road, Pathumthani 12110, Thailand
 ⁴Faculty of Science and Technology, Bansomdejchaopraya Rajabhat University
 1061 Isaraphab Road, Dhonburi, Bangkok, 10600 THAILAND

Abstract- This paper presents the evaluation method proposed by Agence d'Evaluation de la Recherche et l'Enseignement Supérieur (AERES) for French higher education and research institutions involving important criteria, which can be applied to Thai's research centers for evaluation the conformity to the French standard. Moreover, this can be utilized as a tool for developing outstanding ASEAN research centers. An example of evaluation results of Groupe de Recherche en Électrotechnique et Électronique de Nancy (GREEN) in 2012 was chosen to compare with the results from Renewable Energy Research Centre (RERC) laboratory. Discussion of those results will also be given.

INTRODUCTION

Research plays an exponentially important role in the world not only for today but also for future. Research results give systematic answers to the questions requested from the users. In engineering domain, the questions should be aroused from industrial sectors problems. Whereas, research should be conducted in a reliable research centre, to find the reasonable solutions, usually established in university.

In Thailand, however, mainly research questions give by the policy of agencies of the government such as National Research Council of Thailand (NRCT), Thailand Research Fund (TRF), Office of the Higher Education Commission (OHEC), etc [1]. Therefore, the evaluation criteria for the research centers in Thailand are proposed and are conducted by the Office of National Educational Standard and Quality Standard (NESQA), which are an autonomous agency supervised by the Prime Minister's Office. The evaluation criteria are the scientific output of the research institutes such as peerreviewed journal and conference paper [2]. The information from the mentioned works can be used to form a research institute. However, for further development of the research institute, comparing with other research institutes is necessary, especially with the research institutes in well-developed country.

The evaluations of activities in a research unit in a university are very important. The results of the evaluations fulfill several needs such as for government decisions (e.g. allocating funds and human resources, and etc.), for future research unit development, for students to choose the right studies, for the manpower utilization staff selection and etc.

In this paper, a laboratory in France, which is GREEN, and a laboratory, RERC in Bangkok, is introduced in section II and III respectively. While AERES is introduced in section IV. The AERES evaluation criterions are presented in section V. And method for evaluating research bodies of AERES and its guideline is presented in section VI. The evaluation results of GREEN provided by AERES and some results of RERC evaluation, which has been done in the same manner as AERES did will also presented.

GREEN [3]

GREEN is a research centre under Lorraine University, situated in Nancy, Lorraine, France. Director of GREEN is a 5 years elected-position. Research activities of GREEN fall within the context of developing new concepts and operating performance materials for electrical energy production and utilization. The laboratory's researches activities are always response to society's demands particularly dedicated to industrial and transportation applications at large. Contributions cover a significant and original work spectrum on materials for electrical systems such as modeling and applications of superconductors, modeling of electrochemical sources of electrical energy (fuel cells, super-capacitors) and stability and stabilization of power grids.





Regionally, the GREEN Lorraine works closely with laboratories in the energy sector within the Research Federation Jacques Villermaux. This federation carries the Lorraine Region Energy Materials-Processes-Products (EMPP) projects. GREEN Fuel Cell project actively associated with PPF fuel cell and Institut Carnot (Energy and Environment in Lorraine (ICEEL).

Nationally, the GREEN active in three projects (GDR, SEEDS and ACAP (Fuel Cell Systems)), which allows GREEN to cooperate with the most national research institutes in the field.

Internationally, the GREEN has strong links with several foreign university laboratories (Thailand, USA, Canada, Algeria, and Iran).

RERC [4]

The Renewable Energy Research Center (RERC) was established in 2006 by the collaboration between Thai-French Innovation Institute, Faculty of Technical Education, King Mongkut's University of Technology North Bangkok and Institut National Polytechnique de Lorraine, France. The objectives of the center are to do research and perform technology transfer activities in Renewable Energy for supporting Great Mekhong Sub Region industries.

The research areas of the Renewable Energy Research Center are as follows:

- 1. Fuel Cells (PEMFC and SOFC)
- 2. Hybrid DC Distributed System of Fuel Cell/Solar Cell/Battery
- 3. Wind turbine
- 4. Energy storage components such as battery and supercapacitor
- 5. Others Renewable Energy Applications.

Even the RERC research center is still small and do not have very high experience staffs, but, its shows a promise of good success due to their existing works create by the team. The solid link between Thai-French Innovation Institute and University of Lorraine and the preceding outcomes of the collaboration also can guarantee the future.

AERES

The AERES was created by mean of the 2006 French national research programme and running since March 2007. Its organization chart is shown in Fig. 1. The AERES intends to improve the quality of the French research and higher education system according to the context of the Bologna Process [5]. It is committed to implementing an evaluation policy based on three principles; independence, transparency and impartiality. Moreover, the AERES also intends to conduct its missions in accordance with key values, specified in its evaluation charter.

In 2012, the AERES's budget is 12 M€ and it has 71 permanent administrative staffs, 125 part-time scientific staffs and 1738 experts on call.

The goals of the evaluations carried out by the AERES are as follows [6]:

- 1. Give higher education and/or research institutions information for developing their future strategy in terms of both training and research
- 2. Give teaching and research teams' comparative elements with a view to improving the quality of service provided
- 3. Provide the supervising ministries with the information they need to make decisions (allocating funds and human resources, accrediting programmes or research units, etc.)
- 4. Give students the information they need for choosing the right studies
- 5. Meet the information requirements of businesses on the quality of programmes and degrees and on graduates' skills
- 6. Provide civil society with reliable and transparent information about the activities of higher education and research institutions.

AERES EVALUATION CRITERIONS

Methodology for evaluating research and higher education, chosen by AERES is based on the following principles: peer evaluation, using explicit criteria, and evaluation based on observable facts and assesses their value [7].

TABLE I : AERES CRITERIA STANDARD [7]

No.	Criteria
1	Scientific production and quality
2	Academic reputation and appeal
3	Organization and life of the institution
4	Strategy and research perspectives for the next contract

Details for each criterion are provided as follows:

Criterion 1: Scientific production and quality

By observation, not only the number of scientific production such as international peer-reviewed journal, national peer-reviewed journal, invited-paper, papers in proceeding of international and national conferences, patent, etc., but also the quality of those productions, a mark based on this criterion will be provided. *Criterion 2: Academic reputation and appeal*

This criterion deals with the ability of the research center to get itself known in research communities using





a reputation and visibility. However, this criterion includes the structuring bodies on regional, national and international level and the capacity of the center to be an attractive research center. The observable facts will be gathered and then, the quality indicator will be provided. *Criterion 3: Organization and life of the institution* scientific and material condition of staff, the management and pooling of financial resources, the decision-making process, the existence of a scientific plan, the use of tools for monitoring progress, and things that contributes to the smooth operation of the center.

This criterion is used to assess the overall functioning of the research center. This covers the organization of the



Figure 1. Organization chart of AERES in September 2013 [5].

Criterion 4: Strategy and research perspectives for the next contract

This criterion should be used to assess the scientific quality of the research perspectives in the research center's field and their relevance to the context in which the center fulfills its mission. The proposed changes and strategies to archive its objectives are assessed.

AERES EVALUATION METHOD [8]

The evaluation of a research unit consists of several stages, which are preparation, visit and post-evaluation stages detailed as follows:

Declaration: by the institution of which units are to be evaluated.

Dispatch: by the supervising bodies of their specific questions

Submission: The "common applications" and communication of these dossiers to the experts must be submitted to enable the expert committee evaluates every aspect of the activities conducted by the research bodies of the institutions and organizations concerned, by referring to the documents supplied and through an onsite visit. The evaluations must factor in the result, self-evaluation and scientific prospects of each team as well as those of the body.

Because the aim of evaluation is for gauging the quality of the activity conducted in the research bodies. The state or institutions concerned remain fully responsible for the decisions regarding recognition and allocation of human and financial resources.

A unit seeking renewal should examine the activity reports of the past five years and the scientific prospects, and identify the strengths and areas for improvement overall and on a team-by-team basis. A research unit that is new or undergoing a change in staff should examine the scientific prospects and analyze the prospective study as well as the objectives and strategy defined for the next five years overall and on a team-by-team basis. In the case of a change in staff, the result of the teams making up the new body will also be looked at.

Expert committee visit: The visit committee consists of experts, including a chairperson, representative(s) of the staff evaluation body of each institution to which the evaluated body is affiliated. The list of experts is published. For small research units, the size of the committee may be reduced. The experts can be researchers, professors, engineers and technicians from the academic or industrial research communities in France or other countries. The list of experts who are contacted is sent before to the institutions concerned, which may particularly make comments about any conflict of interest. The presidents or directors of organizations or their representatives attend meetings





with the body director or with the teams and provide contextual explanations or clarifications about the strategy of organizations at the request of the expert committee chairperson.

During the visit, the expert committee is accompanied by a scientific delegate who represents the AERES and makes sure the evaluation process is carried out correctly and in accordance with procedures. The AERES representative is not a member of the expert committee. Then, the draft report due to the visit will be written by the expert committee.

Validation: The report must be validated by the AERES.

Dispatch of the report: The validated report must be sent to the research unit to research organizations for comments prior to the scoring meeting.

Scoring meeting: After the visit, grading meetings are organized at AERES by subject-based panel. The expert committee of the panel's research bodies shall attend each meeting along with the AERES. The participants shall have all of the panel's research bodies' reports to hand prior to the meeting.

Communication: Reports and scores will be sent to the research center and their supervising body.

Publication of the reports: The report with comments attached and scores will be published on the AERES website.

RESULTS

The four mentioned criteria are tabulated in Table I for both GREEN and RERC. The data for GREEN is collected from the GREEN's report, which is submitted for AERES for evaluation. These data was collected during January 2007 - June 2011. In order to present comparative data obviously, the data from Table I has been shown in Fig. 2 and Fig. 3 for the first and second criteria, respectively. One can observe in Fig. 2 (top) that the value of the scientific production and quality, including international peered review journal, international conference paper, patent, and thesis defense, for GREEN is much higher than that of RERC, especially for the journal and conference paper. It is because the RERC's researchers have just graduated in 2005. Moreover, there is no any Ph.D. student to do research and to help researchers to make more theoretically explorations and experiments. Importantly, GREEN has more than 10.5 times the researchers than RERC. In order to fairly compare, the comparison will be fairly done under an assumptions that the number of researchers for both laboratory are the same.

TABLE I : Comparative data for GREEN	and RERC for the Mentioned
Criteria	

No	Criteria	GREEN	RERC
1		OKEEN	KEKC
1.	Scientific production and quality	1	
	1.1 Researcher-Lecturer	21	2
	1.2 International peered review journal	124	21
	1.3 International conference	177	22
	1.4 Patent	4	0
	1.5 Thesis defense	31	1
2.	Academic reputation and appeal		
	2.1 Participation in national and		
	international collaborative research projects	16	1
	2.2 Participation in national and international networks	19	5
	2.3 Organization of national and international conference	12	1
	2.4 Prizes and distinctions awarded to members of the institution	5	3
	2.5 The existence of collaborations with other laboratory	5	1
	2.6 Participation in thesis defense	69	1
	2.7 Scientific review bodies	21	2
3.	Organization and life of the instituti	on	
	3.1 The presence of objectives or a scientific strategy for the past period	Yes	No
	3.2 Organization of the research institution into teams or themes	Yes	Yes
	3.3 The existence of shared platforms or resources (e.g. documentary collections)	Yes	No
	3.4 Scientific coordination and interactions between teams, themes and disciplines	Yes	No
	3.5 The decision-making process and personnel involved; existence of a laboratory council, a functional organizational chart	Yes	No
	3.6 The role of engineers, technicians, administrative staff, temporary personnel (e.g. on fixed-term contracts) in the research system of the institution	Yes	Yes
4.	Strategy and research perspectives f	for the nex	t
	4.1 The existence of a scientific policy based: understanding of the future evolution	Yes	No
	4.2 Strategy to achieve these	Yes	No







The number of scientific productions has been divided by 10.5. The results are illustrated in Fig. 2 (bottom) where one can see that the number of journals and conference papers of RERC is higher that of GREEN. However, for the two last production categories, GREEN has a number higher than RERC.

Fig. 3 (top) shows academic reputation and appeal criterion including seven sub criteria, which are detailed in Table I. The distinct sub-criteria for GREEN is participating in thesis defense. It is because there are a lot of Ph.D. students who graduate each year. In contrast, the RERC members' are still young and without any academic rank; it is difficult to be invited to serve as a member of thesis or dissertation jury.

In Fig. 3 (bottom), the data of GREEN has been scaled by 10.5 as mentioned before.

due to the fact that some sub criteria do not exist in RERC before. However, the remaining criteria can be used as guidance for developing the laboratory to meet the AERES standard.

From the AERES criteria, the obtained grades of GREEN and RERC are no quite different. However, due to the different contexts in industrial research policy of the government, there is no heavy industries, which belongs to the local communities and do not promote research for industries for long times. On the contrary, it makes GREEN has got many contracts including Ph.D. students. From these results, if the number of researchers of RERC were increased with the same situations such as research support facilities, technicians, funds, etc.; the number of scientific productions and quality will be increased. And it can lead to other criteria.



Figure 2. Scientific production and quality of GREEN and RERC, (top) raw data, and (bottom) scaled data for GREEN.

Using the scaled data, one can conclude that since the RERC's research theme is renewable energy, which is the new research field and it draws much intentions from other partners in Thailand and other countries, RERC's members are invited to participate and to join the national and international conferences as committee, session chair, and program committee member.

From the results, GREEN has got grade A for all criteria from AERES detailed in Table II [9]. Using the same manner as detailed in the AERES report, RERC should be graded in the level of B for the first and second criteria whereas the remaining criteria cannot be graded



Figure 3. Academic reputation and appeal for GREEN and RERC, (top) raw data, and (bottom) scaled data.

TABLE II : RESULT GRADE USING AERES CRITERIA

Criteria	No. 1	No. 2	No. 3	No. 4
RERC	В	В	-	-
GREEN	А	А	А	А





CONCLUSION

AERES is a research and higher education evaluation agency for France. Before 2012, it promoted to evaluate the research and higher education institutes using four criteria. In 2012-2013 campaign, two more criteria, which are mentioned from the precedent evaluation year, have been added. Therefore, for the next evaluation round, the criteria detailed in Table III will be used [7]. These criteria are graded on a four-tier scale: A+, A, B and C. Using the AERES criteria in 2012, RERC the laboratory in Thailand has been compared to GREEN the laboratory in France. Because the number of researchers, professors, budget, research funds, and industrial research communities are important different; RERC has got lower grade compared with GREEN for the two first criteria, which are scientific production and academic reputation and appeal. Under the same number of researchers' assumption, the amount of research productions is not too much higher. For the

TABLE III : NEW AERES' CRITERIA FOR 2012-2013

No.	Criteria
1.	Scientific production and quality
2.	Academic reputation and appeal
3.	Interactions with the social, economic and cultural environment
4.	Organization and life of the institution
5.	Involvement in training through research
6.	Strategy and research perspectives for the next contract

two last criteria: 1) Organization and life of the institution and 2) Strategy and research perspectives for the next contract, they do not exist before for some sub criteria. So, one cannot evaluate them. However, they can be used for developing RERC to reach the French evaluation standard.

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ENGINEERING







Effect of Ensemble Size in Ensemble Kalman Filter Forecast of Cold Surge

S. Payakkarak, D. Sukawat

Department of Mathematics, King Mongkut's University of Technology Thonburi 126 Pracha Uthit Rd, Bang Mot Thung Khru, Bangkok 10140 Thailand

Abstract-Ensemble Kalman filter method (EnKF) is a popular method for data assimilation with high dimension by reconstruct the partial differential equations. EnKF is designed to provide estimation of the state of a system by blending information from a forecast model with observations. It maintains an ensemble of state estimates from which a single best state estimate and an assessment of estimation error may be calculated. The main purpose of this paper is apply EnKF to the single level primitive equation (SILEPE) model using the data of geopotential height (ϕ) from the National Center for Environmental Prediction (NCEP) for five stations in Thailand. Six cases of cold surge reaching Thailand are used as experiment cases. The results show that when the number of ensemble size grows, the accuracy of the EnKF increases.

Keywords: Ensemble Kalman Filter, Data Assimilation

I. INTRODUCTION

Data assimilation is a process of combining a model forecast with observation to produce an analysis of the state of the system which is the best possible estimation. This process could provide better estimation than that obtained by only the data or the model.

The Ensemble Kalman Filter (EnKF) which is originated from the Kalman Filter (KF) for problem with a large number of variables can be used for data assimilation [1]. It is developed as an option for the extended Kalman Filter (EKF) [2]. The EnKF uses pure Monte Carlo sampling when generating the initial ensemble, the model noise and the measurement perturbation [3]. The distribution of the system state is shown using a random sample, called an ensemble, and the covariance matrix is replaced by the sample covariance computed from the ensemble [4]. This ensemble is then integrated forward in time [5]. One advantage of EnKF is that advancing the probability density function (pdf) in time is achieved by simply advancing each member of the ensemble [4]. EnKF has been used also in engineering [6,7].

This paper is interested in the root mean square error (RMSE) of the forecast of cold surges for five stations in Thailand (Chaing Mai, Ubon Ratchathani, Phuket, Songkha and Bangkok) with one-day and two-day

forecasts before cold surge reaching Thailand. Data from the National Center for Environmental Prediction [8] with resolution of $1^{\circ} \times 1^{\circ}$ are used for downscaling 500hPa geopotential height to a local scale with resolution $0.1^{\circ} \times 0.1^{\circ}$ using a single level primitive equation (SILEPE) model [9]. The performance of the EnKF is investigated with different ensemble size of 10, 50 and 100 members.

II. THEORY

A. The Ensemble Kalman Filter

The ensemble Kalman filter (EnKF) is a Monte Carlo approximation of the Kalman filter (KF). The analysis scheme in the EnKF uses traditional update equations of the KF, except that the Kalman gain is computed using the error covariances provided by the ensemble of model states.

Consider a discrete-time nonlinear system with dynamics.

$$x_{k+1} = f(x_k, u_k) + w_k$$
(1)

and measurements

$$y_k = h(x_k) + v_k, \tag{2}$$

where $x_k, w_k \in \mathbb{R}^n, u_k \in \mathbb{R}^m, y_k$, and $v_k \in \mathbb{R}^p$. Assume that W_k and v_k are stationary zero-mean white noise processes with covariance matrices Q_k and R_k , respectively.

The EnKF method is presented in three steps.

The first step is the forecast step: to represent the error statistics, it is assumed that at time k, an ensemble of q forecasted state is estimated with random sample errors. Denote the ensemble by $X_k^f \in \mathbb{R}^{n \times q}$, where

$$X_{k}^{f} = (x_{k}^{f_{1}}, x_{k}^{f_{2}}, ..., x_{k}^{f_{q}})$$
(3)

and the superscript f_i refers to the *i* -th forecast ensemble member. Then, the ensemble mean $\overline{x}_k^f \in \mathbb{R}^n$ is defined by

$$\overline{x}_k^f = \frac{1}{q} \sum_{i=1}^q x_k^{f_i} \tag{4}$$





Define the ensemble error matrix $E_k^f \in \mathbb{R}^{n \times q}$ around the ensemble mean by

$$E_k^f = [x_k^{f_1} - \overline{x}_k^f, x_k^{f_2} - \overline{x}_k^f, ..., x_k^{f_q} - \overline{x}_k^f]$$
(5)

 $E_{yk}^{f} \in \mathbb{R}^{m \times n}$ ensemble set with observation error defined by

$$E_{yk}^{f} = \left[y_{k}^{f_{1}} - \overline{y}_{k}^{f}, y_{k}^{f_{2}} - \overline{y}_{k}^{f}, ..., y_{k}^{f_{q}} - \overline{y}_{k}^{f} \right]$$
(6)

In the computation of the Kalman gain filter, the covariance matrices P_k^{f} , $P_{xy_k}^{f}$ and $P_{yy_k}^{yy_k}$ are introduced. In EnKF, the values can be estimated as

$$\hat{P}_{k}^{f} = \frac{1}{q-1} E_{k}^{f} (E_{k}^{f})^{T},$$

$$\hat{P}_{xy_{k}}^{f} = \frac{1}{q-1} E_{k}^{f} (E_{yk}^{f})^{T}, \quad \hat{P}_{yy_{k}}^{f} = \frac{1}{q-1} E_{yk}^{f} (E_{yk}^{f})^{T}$$
(7)

Thus, the forecast ensemble mean is interpreted as the best forecast estimate of the state, and the spread of the ensemble members around the mean as the error between the best estimate and the actual state.

The second step is the analysis step: to obtain the estimates of the state, the EnKF performs an ensemble of parallel data assimilation cycles, where for i = 1, ..., q

$$x_{k}^{a_{i}} = x_{k}^{f_{i}} + \hat{K}_{k}(y_{k}^{i} - h(x_{k}^{f_{i}}))$$
(8)

The perturbed observations y_k^i is given by

$$\mathbf{y}_k^i = \mathbf{y}_k + \mathbf{v}_k^i, \tag{9}$$

where v_k^i is a zero-mean random variable with a normal distribution and covariance R_k . The sample error covariance matrix is computed from the v_k^i , which converges to R_k as $q \rightarrow \infty$. Approximate the analysis error covariance P_k^a by \hat{P}_k^a , where

$$\hat{P}_{k}^{a} = \frac{1}{F_{k}^{a-1}} E_{k}^{a} (E_{k}^{a})^{T}$$
(10)

and $\vec{x}_k^{f_i}$ is defined by (5) with $x_k^{f_i}$ replaced by $x_k^{a_i}$ and \vec{x}_k is also replaced by the mean of the analysis estimate ensemble members, $\vec{x}_k^{a_i}$. Use the classical Kalman filter gain expression and the approximations of the error covariances to \vec{x}

determine the filter gain \hat{K}_k by

$$\hat{K}_{k} = \hat{P}_{xy_{k}}^{f} (\hat{P}_{yy_{k}}^{f})^{-1}$$
(11)

The last step: the prediction of error statistics in the forecast step which is given by

$$x_{k+1}^{f_i} = f(x_k^{a_i}, u_k) + w_k^i$$
(12)

where the values W_k^i are sampled from a normal distribution with average zero and covariance Q_k . The sample error covariance matrix is computed from when the W_k^i converges to Q_k as $q \to \infty$ [10].

There are many different types of EnKF, and these methods are different in the analysis step. [3] describe

the perturbed observation for EnKF that is the error statistics of the observation and assimilates these into each ensemble member.

B. Shallow Water Equations

In this paper, the shallow water equation called Single Level Primitive Equation (SILEPE) model follows [9] is used to represent the equations of motion in one pressure level of the atmospheric. The model equations can be written as

$$\frac{du}{dt} - fv + g \frac{\partial \phi}{\partial x} = 0 \tag{13}$$

$$\frac{dv}{dt} + fu + g\frac{\partial\phi}{\partial y} = 0 \tag{14}$$

$$\frac{d\phi}{dt} + \phi \left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right) = 0$$
(15)

The total time derivative operator is defined by $d = \frac{1}{2} \frac{1}{2}$

$$\frac{d}{dt} = \frac{\partial}{\partial t} + u \frac{\partial}{\partial x} + v \frac{\partial}{\partial y}$$
(16)

In (13)-(15), u and v are the wind speeds along x and y components, respectively, $^{\varphi}$ is the geopotential height, g is the acceleration of gravity and f is the oriolis force ($^{f} = 2\Omega \sin \theta$, where Ω is the angular speed of the earth and $^{\theta}$ is the latitude).

III. EXPERIMENT

The single level primitive equation (SILEPE) model is used in this paper for initial downscaling of climate data. The initial conditions for the shallow water model are obtained from the National Center for Environmental Prediction (NCEP) for zonal wind component (*u*), meridional wind component (*v*), and geopotential height (ϕ), at 500 hPa. The resolution of the NCEP data is about 1° ×1° (1° grid is about 100 km). Then the SILEPE is run to downscale the data to 0.1° ×0.1° resolution. The EnKF is used to adjust the simulation from SILEPE.

The EnKF with 10, 50 and 100 ensemble members, and w_k and v_k are zero-mean white noise processes with covariance matrices $Q_k = 0.05$ and $R_k = 0.05$ are used.

A. Experiment Domain

The latitude and longitude of the points of interest; Chaing Mai, Ubon Ratchathani, Phuket, Songkha and Bangkok (see Table I).

TABLE I: Locations of the five meteorological stations used in the experiments.

Stations	Latitide (°N)	Longitude (°E)
Chiang Mai	18.4	98.5
Ubon Ratchathani	15.1	104.5
Phuket	8.8	95.1
Songkha	7.1	100.3
Bangkok	13.4	100.3



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B. Data

The first stage in this research is to test the performance of the single level primitive equation model (SILEPE) that is used in this study. The summary of the cases that cold surge reaching Thailand (see Table II).

TABLE II Summary of case for testing the

Case of Cold Surge Reaching	Case
Thailand	
21 Dec 1999	A. One-day before the event
	B. Two-day before the event
23 Nov 2000	C. One-day before the event
	D. Two-day before the event
06 Dec 2002	E. One-day before the event
	F. Two-day before the event

In Table 2, the performance of the SILEPE is tested. The initial data, the 500hPa geopotential height at t = 0 (00hr) and there are data for every 6hr is linear interpolated from the coarse resolution NCEP, 2014 data to high resolution; from $1^{\circ} \times 1^{\circ}$ resolution to $0.1^{\circ} \times 0.1^{\circ}$ resolution. Each case consists of two experiments: Experiment 1, run SILEPE one-day before the cold surge



Ubon Ratchathani Phuket Songkhla Bangkok

event and Experiment 2, run SILEPE two-day before the cold surge event.

IV. RESULTS AND DISCUSSIONS

A. The performance of SILEPE

The performance of the SILEPE in the forecast is analysed using the root mean square error (RMSE). The model is run for 24hr and 48hr forecasts with $0.1^{\circ} \times 0.1^{\circ}$ resolution for the five stations with one-day and two-day before cold surge reaching Thailand.

The RMSE is calculated from the values of the forecast geopotential heights at 500hPa which are simulated by SILEPE model are compared with data from the NCEP. The RMSE for the experiments of cases A to F are shown in Figure 1.

Figure 1, show that RMSEs of all experiments are under 5% (the average geopotential height at 500 hPa is about 5,500 m, 5% is 275 m). Thus, the SILEPE can be used to forecast cold surge.





Chiang Mai













Figure 1. RMSE the cold surge of the one-day and two-day forecasts before the event of cases A to F.



Figure 2 RMSEs of the experiments with EnKF using different ensemble sizes with 10, 50 and 100 ensemble members of Case A.









Figure 3. RMSEs of the experiments with EnKF using different ensemble sizes with 10, 50 and 100 ensemble members of Case B. **Case C:** One-day before the event





Figure 4. RMSEs of the experiments with EnKF using different ensemble sizes with 10, 50 and 100 ensemble members of Case C.

Case D: Two-day before the event



November 6, 2014 www.icteched.org Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand







Figure 5. RMSEs of the experiments with EnKF using different ensemble sizes with 10, 50 and 100 ensemble members of Case D. **Case E**: One-day before the event





Figure 6. RMSEs of the experiments with EnKF using different ensemble sizes with 10, 50 and 100 ensemble members of Case E. **Case F**: Two-day before the event









Figure 7. RMSEs of the experiments with EnKF using different ensemble sizes with 10, 50 and 100 ensemble members of Case F.

B. Ensemble Kalman Filter of SILEPE

The comparison of RMSEs for the experiments between the SILEPE as mentioned in part A and the estimation obtained from the ensemble Kalman filter (EnKF) estimator with 10, 50 and 100 ensemble members are compared with outputs from the NCEP for five stations in Thailand (Chaing Mai, Ubon Ratchathani, Phuket, Songkha and Bangkok). The results of RMSE of case A to case F are shown in Figures 2 to 7.

Figures 2 to 7, show that the value of the RMSEs of all experiments are decreased when the ensemble member increases.

V. CONCLUSIONS

The EnKF is a Monte Carlo approximation of the Kalman filter, representing the distribution of the system state by using random samples (ensemble) and computes the covariance from the ensemble.

The accuracy of the EnKF increases when the number of ensemble members grows. RMSE is decreased as the ensemble sizes increase. That is, as the ensemble size grows the performance of the ensemble Kalman filter improves.

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Thai Poetry Machine Translation to English Automated Evaluation VS Human Post-Edit

Sajjaporn Waijanya Faculty of Information Technology King Mongkut's University of Technology North Bangkok, Bangkok, Thailand sajjaporn.w@gmail.com

Abstract- Poetry Machine Translation output is very important, the output of poetry translation should still be poetry. The evaluation of translation will present the quality of translator but Evaluation is still a research topic in itself. The reference of evaluation is very important for automated evaluation method. It is very difficult to prepare original reference for the poetry. The result of Human Post-Edit can use for reference. This paper will focus on the Thai poetry type "Klonn-Pad" and aim to translate into English keeping terms of prosody. The results of translation between Forward and Backward translation will be compared by Automatic Evaluation and Semi-Automate by using Human Post-Edit. The Human Post-Edit Evaluation use HBLEU (Human-Targeted Bilingual Evaluation Understudy) HMETEOR (Human-Targeted Metric for Evaluation of Translation with Explicit Ordering) and HTER (Human-Targeted Translation Error Rate). The HBLEU score of Forward equal 0.977, Backward equal 0.982. The HMETEOR score of Forward F-Measure equal 0.896. For Backward F-Measure equal 0.922. The HTER (Human-Targeted Translation Error Rate) score of Forward equal 0.195 For Backward equal 0.167. Based on this study, it can be concluded that the Human-Targeted by Post-Edit can create the references and it is necessary for Poetry Machine Translation.

Keywords—Thai poetry translation; Human Post-edit; Poetry Translator Evaluation

T

INTRODUCTION

The Poetry Translation is always challenging in groups of Linguistic researcher and Machine Translation (MT) researcher. Robert Lee Frost (March 26, 1874 - January 29, 1963) [1] was an American poet said "The poetry is what gets lost in translation". Since when human translator or MT try to translate the poetry in original language to destination language they should translate poetry to be poetry. However, it is very difficult to keep original meaning with aesthetics of language. Moreover, each of poetry has a specific prosody. How to translate the poetry from original language to destination language with original prosody is very important. It is not only translation techniques but the necessary evaluator tools use for evaluation the translation result are also challenge. The evaluation of phase base content or prose will concern about quality of meaning correctness and percentage of grammar completion (path of speech) but the evaluation of poetry translation will be different. It

Anirach Mingkhwan Faculty of Industrial Technology and Management King Mongkut's University of Technology North Bangkok, Prachinburi, Thailand anirach@ieee.org

will not concern only the quality of the meaning correctness, it should concern to the quality of the prosody and correctness as well. In case of the poetry translation, Thai poetry has the complex prosody and Thai language is more complex than other languages. Even through many researchers try to translate the poetry but there are a few published of The Thai poetry translation by human in other languages and not found in MT world.

The previous researches by authors have presented an algorithms of Thai Poetry Translation to English with prosody keeping [2] and has analyst the quality of model compare with statistical MT by BLEU and METEOR with Forward and Backward Translation [3,4,5]. BLEU and METEOR are automatic evaluation tools and they would have reference for comparing and calculating. However, BLEUE and METEOR cannot present the score of aesthetics of language and beautiful words. To prepare the reference of Thai Poetry in English translated by expert translator is very difficult. It must translate to English with Thai Poetry prosody keeping. Another way to create the reference is Post-edit rate. HTER(Humantargeted Translation Error Rate) is the methodology that use to evaluate the quality of translator, result of post-edit by human will be used for reference.

This research will present design of Post-edit interface. The evaluated result by Automatic Evaluation is calculated by original reference and compared with Human Post-Edit. The evaluation methods BLEU, METEOR and TER which are compared to HBLEU, HMETEOR and HTER

II. RELATED WORK

A. The Best Lexical Metric for Phrase-Based Statistical MT System Optimization

Daniel Cer, Christopher D. Manning and Daniel Jurafsky were published "The Best Lexical Metric for Phrase-Based Statistical MT System Optimization"[6]. This paper will compare the different evaluation metrics (BLEU, METEOR, NIST, TER) with 2 training sets that are Arabic to English system and Chinese to English system. In this paper, authors systematically explore







these four issues for the most popular metrics available to the MT community. Authors of this paper examine how well models perform both on the metrics on which they were trained and on the other alternative metrics. Multiple models are trained by using each metric in order to determine the stability of the resulting models. Select models are scored by human judgment in order to determine how performance differences obtained by tuning to different automated metrics related to actual human preferences.

Human results indicate that edit distance trained models such as WER and TERp tend produced lower quality translations than BLEU or NIST trained models. Tuning to METEOR works out reasonably well for Chinese, but it is not a good choice for Arabic. Edit distance models tend to do poorly if evaluated on other metrics, as do models trained using METEOR. However, training models to METEOR can be made more robust by setting α to 0.5 which balances the importance the metric assigns to precision and recall Sentence-level MT evaluation without reference translations: Beyond language modeling

B. Estimating Machine Translation Post-Editing Effort with HTER

Lucia Speciaand and Atefeh Farzindar [7] described about an approach to estimate translation post-editing effort at sentence level in terms of Human-targeted Translation Error Rate (HTER) based on a number of features reflecting the difficulty of translating the source sentence and discrepancies between the source and translation sentences. HTER is a simple metric and obtaining HTER annotated data can be made part of the translation workflow. They use Pearson's Correlation to evaluate the performance of the CE (Confidence Estimation) system. Their datasets main dataset consists of English translations of French legal documents and English to Spanish, Spanish translations for English sentences have taken from the Europarl development and test sets provided by WMT08 (CallisonBurch et al., 2008). Then they compare TER and Human Score. Human's quality scores assigned by professional translators to each translation in a 1 to 4 ranges. Their conclusions, it is possible to obtain a good performance with simpler and cheaper annotations by collecting a small set of machine translations and their post-edited versions and computing HTER, a semi-automatic Translation Error Rate metric.

C. Exploiting Objective Annotations for Measuring Translation Post-editing Effort

Lucia Specia [8] continue research for Post-edit measurement. Researcher use 2 datasets, First is French to English news-test 2009 with 2,525 French news sentences and their Moses translations into English (corpus-level BLEU = 0.2447). Another dataset is English to Spanish news-test2010 with 1,000 English news sentences and their Moses translations into Spanish (corpus-level BLEU = 0.2830).

Researcher uses standard HTER, which looks for exact matches and Confidence Estimation Framework in this research use a Support Vector Machines regression algorithm. Researcher trained three CE models for each language pair using a random subset of 90% of the source translation sentence pairs. They have planned to use crowd sourcing mechanisms to include other datasets in their studies to ensure the quality of the post-editing by including multiple post-editors and reviewers for each dataset.

III. TOOLS AND METHODOLOGY

A. BLEU (Bilingual Evaluation Understudy)

BLEU (Bilingual Evaluation Understudy) [9] is an algorithm for evaluating the quality of text which has been translated from machine translator from one natural language to another language. Quality is considered to be the correspondence between a machine's output and that of a human. BLEU uses a modified form of precision to compare a candidate translation against multiple reference translations. Equation of BLUE is shown in equation (1) and (2).

$$BLEU = BP \bullet \exp(\sum_{n=1}^{N} w_n \log p_n)$$
(1)

When Pn: Modified n-gram precision, Geometric mean of p1, p2,..pn.

BP: Brevity penalty (c=length of MT hypothesis (candidate),r=length of reference)

$$BP = \begin{cases} 1 & if \quad c > r \\ e^{(1-r/c)} & if \quad c \le r \end{cases}$$
(2)

In this baseline, N = 4 and uniform weights wn=1/N are used.

B. METEOR: an IR-inspired metric

METEOR (Metric for Evaluation of Translation with Explicit Ordering) [10] is a metric for the evaluation of machine translation output. The metric is based on the harmonic mean of unigram precision and recall, with recall weighted higher than precision. It also has several features that are not found in other metrics, such as stemming and synonymy matching, along with the standard exact word matching. The metric was designed to fix some of the problems found in the more popular BLEU metric, and also produce good correlation with human judgment at the sentence or segment level. This





differs from the BLEU metric in that BLEU seeks correlation at the corpus level.

The alignment is a set of mappings between unigrams. A mapping can be thought of as a line between a unigram in one string, and a unigram in another string.

Word-to-word alignment between hypothesis and reference show in figure 1.

Life	is	just	like	a bo	ox of	tasty	c	nocolate
\backslash						5		
Life	is	of	one	nice	choco	olate	in	boxes

Figure 1.Word-to-word alignment between hypothesis and reference

Then evaluation by n-gram precision and recall. Equation of METEOR Precision is showed in equation (3) and METEOR Recall is shown in equation (4).

$$R = \frac{m}{w_r} \tag{3}$$

$$P = \frac{m}{w_r} \tag{4}$$

When *m* means number of is matched, W_t is words in hypothesis and W_r is words in reference. A measure that combines precision and recall is the harmonic mean of precision and recall, the traditional F-Measure or balanced F-score. There are several reasons that the F-score can be criticized in particular circumstances due to its bias as an evaluation metric. Equation of F- Measure is shown in equation (5)

$$F - Measure = \frac{2 \times Precision \times Recall}{(Prcision + Recall)}$$
(5)

C. TER (Translation Error Rate)

TER (Translation Error Rate) [11] was created by Matthew Snover, Bonnie Dorr, Richard Schwartz, LinneaMicciulla, and John Makhoulon 2006. TER is an error metric for machine translation that measures the number of edits required to change a system output into one of the references. TER addresses the possible edits include the insertion, deletion, and substitution of single words as well as shifts of word sequences. Equation of TER is shown in equation (6)

$$TER = \frac{\#edits}{average \#reference_words} \tag{6}$$

Possible edits include the insertion, deletion, and substitution of single words as well as shifts of word sequences. A shift moves a contiguous sequence of words within the hypothesis to another location within the hypothesis. All edits, including shifts of any number of words, by any distance, have equal cost.

D. HTER (Human-targeted Translation Error Rate)

HTER (Human-targetedTranslation Error Rate) [12] is a semi-automatic evaluation. Human in loop evaluation involves a procedure for creating targeted references. The targeted reference is the only human reference used for the purpose of measuring HTER. However, this reference is not used for computing the average reference length. Equation of TER is shown in equation (7)

$$HTER = \frac{\#edits}{\#words_postedit_version}$$
(7)

IV. OUR PROPOSED APPROACH

Reference the previous published researches of authors. Forward and Backward Translation Thai Poetry have measure by BLUE and METEOR. Both of evaluation must have reference but Thai Poetry translated to English has a few references. This paper authors propose the human post-edit way to evaluate the quality of Poetry Machine Translator. And the comparison will be TER, BLUE, METEOR and HTER, HBLUE, HMETEOR. The interface of editor has designed and present in this paper as well.

A. Case Study of Thai-Poetry Klonn-8

In this research use case study from Book "Oh-Chao-Dok-Mai-Aoy"[13]. This book has poetries about flowers and for case study, this research select poetry title name "Duenshine" to present. Thai-Poetry Klonn-8 Prosody structure will show in figure 2 and the case study will show in figure 3.









Figure 2. Thai-Poetry Klonn-8 Prosody structure

Thai Poetry (Klonn-Pad)	Phonetic of Thai Poem (Klonn-Pad)
เป็นพันธุ์ไม้ ล้มลุก ปลูกแสน <u>ง่าย</u>	(Pěn phạnțhù mị Îmluk plūk šæn nàāy)
ชื่องามเด่น "เดือน <u>ฉาย</u> " ใจ <u>ถวิล</u>	(Chѿx ngām dèn "deѿxn <u>c̄hāy</u> " cı <u>Ìhwil</u>)
สีเหลืองบ้าง แดงบ้างช่างโศ <u>ภิน</u>	(Sĩ ĥelūxng bāng dæng bāng chāng şo phin)
ดอกเฉิด <u>ฉิน</u> สล้างบานทั้ง <u>วัน</u>	(Dxk čheid <u>ēhin</u> slāng bān thậng <u>wạn</u>)
"เดือนฉาย" ใช่จะแข่งแสงเดือน <u>ส่อง</u>	("Deụxn chāy" chì ca ƙhảng sæng deụxn 🗽ng)
เพียงชื่อ <u>พ้อง</u> เพราะพริ้งสมจริง <u>นั้น</u>	(Pheīyng chūx plīxng pherāa phrîng smcring <u>nàn)</u>
ยิ่งได้ใส่ปุ๋ย "เดือนฉาย" ยิ่งพราย <u>พรรณ</u>	(Yîng di si pǔy "deụxn chāy" yìng phrāy phạn)
เกินจะ <u>สรร</u> เสกพร่ำคำเยินยอ	(Kein ca <u>šan</u> šek phřá khá yeinyx)

Figure 3. Thai-Poetry Klonn-8 "Duenshine"

B. Post-edit Interface Design

To collect data from post-edit process and calculate by HTER, authors have design the interface of system in modification module after Thai Poetry Klonn-8 translated by translation module. The Modification module has designed to 2 ways modification are "Edit Words" and "Edit Wak". In case of "Edit Words", human can change, insert, remove and shift words. In case of "Edit Wak", human can re-write by each Wak. Words from Post-edit will calculate by HTER. An example of interface to modify will show in figure 4. An example of "Edit Word" is shown in figure 5.

Be annual grow very easy	Edit Words	Edit Wak
Name beauty Duenshine my hearth think	Edit Words	Edit Wak
Colour Yellow, Red really charming	Edit Words	Edit Wak
Flower be pleasing bloom thoroughly	Edit Words	Edit Wak
Duenshine will not race moonlight shine	Edit Words	Edit Wak
Name coincide melodious truthfully	Edit Words	Edit Wak
More fertiliser Duenshine more beauty	Edit Words	Edit Wak
Too many searches for words repeated praise	Edit Words	Edit Wak

Figure 4. An Example of Interface Design for Human

Be annual grow very easy	Edit Words	Edit Wak
Name beauty Duenshine my hearth think	Edit Words Edit Words	Edit Wak
Colour Yellow, Red really charming		Edit Wak
Flower be pleasing bloom thoroughly	Edit Words	Edit Wak
Duenshine will not race moonlight shine	Modify Words	Edit Wak
Name coincide melodious truthfully	Edit Words	Edit Wak
More fertiliser Duenshine more beauty	Edit Words	Edit Wak
Too many searches for words repeated praise	Edit Words	Edit Wak

Figure 5. Interface Design for Human Post-Edit "Edit Words"

C. Thai Poetry Translation Process Flow

Referring to propose of this research to compare the evaluated result between automated evaluation and postedit evaluation. 2 inputs of evaluation will be forward and backward of "Thai poetry translated to English". The process flow is shown in figure 6.



Figure 6. Thai-Poetry Forward and Backward Translator Process





V. MEASUREMENT AND EXPERIMENT RESULTS

A. Evaluate by BLEU Score for Forward and Backward Translation.

To compare the result of Forward Translation and validate by Backward Translation this research will measure and evaluate L2out, the original English poetries is used for references (From the owner of this Thai poetry) which is then compared to L2out translated by Dictionary Base with tuning. Example of the calculated BLEU score is shown in Table I.

The Backward Translation this research will measure and evaluate L1out, the original Thai poetries (L1) is used for a reference which is then compared to L1out translated by Dictionary Base with tuning. Example of the calculated BLEU score is shown in Table II.

TABLE I THE EXAMPLE OF CALCULATED BLEU SCORE OF L2OUT

Reference	Candidate	BLEU
Seasonal plant very easy	Be annual grow very easy	0.737
grow		
Name melodious	Name beauty "Duenshine"	0.928
"Duenshine" alluring	my heart think	
Some Yellow some Red be	Color yellow, Red really	0.538
pleasing	charming	
All day, blooming flower	Flower be pleasing bloom	0.538
very pretty	thoroughly	
"Duenshine" never compete	"Duenshine" never race	0.946
with moonlight	moonlight shine	
Both names sound alike	name coincide melodious	0.654
pleasingly	truthfully	
More fertilizer "Duenshine"	More fertilizer "Duenshine"	0.760
bloom many	bloom beauty	
Difficulty describe words	Difficulty search for words	0.905
emblazon.	repeated praise	
AVERAGE BLEU SCORE		

TABLE II THE EXAMPLE OF CALCULATED BLEU SCORE OF L1OUT

Reference	Candidate by L1out	BLEU
Pĕnphạnțhù	PĕnphụchÎmlukpluksænng	0.976
milmlukplūksænngay	āy	
chū៉ុx ngāmdèn"	chūx	0.962
deūxnchāy" cıthwil	khwāmngāmdeūxnchāycık	
	hidthung	
sīheluxngbangdængbangch	sīhelūxdængmīsehh	0.887
āngṣophin	doytrātrung	
dxkēheidēhinslāngbānthận	dxkmį́	0.674
gwạn	sùngbānxxkdxkxudm	
" deūxnēhāy" chì	deūxnchāycami	0.946
cakhængsængdeuxn sxng	khængsængcanthr sxng	
pheīyngchūx	khūxchūx	0.905
pĥxngpherāaphrîngsmcring	pĥxngkạnphịreāahēmāasm	
nàn		
yìngdį šì pŭy" deūxnchāy"	mākpŭydeūxnchāymākkh	0.905
yìngphrāyphrrņ	wāmhā chm	
keincasrrsekphråkhåyeinyx	keinmākmāykĥnhākhåŝåy	0.823
	kyx	
AVERAGE BLEU SCORE		

B. Evaluate by METEOR: an IR-inspired metric for Forward and Backward Translation

In other method to evaluate the results of Thai Poetry Forward Translation and Backward Translation is The evaluation of METEOR. The result of L2out Forward Translation evaluation is shown in Table III and the result of L1out Backward Translation evaluation is shown in Table IV.

Wak No.	М	Wt	Wr	Р	R	F-measure
1	4	5	5	0.800	0.800	0.800
2	4	4	6	1.000	0.667	0.800
3	4	6	5	0.667	0.800	0.727
4	5	6	5	0.833	1.000	0.909
5	5	5	6	1.000	0.833	0.909
6	4	5	4	0.800	1.000	0.889
7	4	5	5	0.800	0.800	0.800
8	3	3	7	1.000	0.429	0.600
Average			0.863	0.791	0.804	

TABLE IV IR-INSPIRED METRIC OF BACKWARD TRANSLATIO

WakNo.	Μ	Wt	Wr	Р	R	F-measure
1	5	5	5	1.000	1.000	1.000
2	4	4	4	1.000	1.000	1.000
3	4	6	6	0.667	0.667	0.667
4	3	6	5	0.500	0.600	0.545
5	5	5	5	1.000	1.000	1.000
6	5	5	5	1.000	1.000	1.000
7	4	5	5	0.800	0.800	0.800
8	5	6	6	0.833	0.833	0.833
Average			0.850	0.863	0.856	

C. Evaluate by TER (Translation Error Rate)

In other method to evaluate the results of Thai Poetry Forward Translation and Backward Translation is the evaluation of TER. The Translation Error Rate of L2Out and L1Out are shown in Table V

TABLE V TER S	SCORE OF FORWARD A	ND BACKWARD	TRANSLATOR
---------------	--------------------	-------------	------------

Translation	#EDIT	#Ref	TER
Forward	20	40	0.500
Backward	19	42	0.452

D. The results of Human Post-Edit

In the Post-Edit process, this research use 2 results (candidates) from Forward and Backward to request an editing from 2 Poets. The Forward translation result was edit by senior Thai-poet who's live in United State 20 years. And the backward translation result was edit by Thai-poet whose owner of the original poem. The both results of post-edit will show in table VI-Post-edit forward translation and VII-Post-edit backward translation.



TABLE VI POST-EDIT FORWARD TRANSLATION RESULT				
Translation Result	Post-Edit			
Be annual grow very easy	Annual plant grow very easy			
Name beauty "Duenshine"	Name beauty "Duenshine" my			
my heart think	heart think			
Color yellow, Red really	Color yellow, Red really charming			
charming				
Flower be pleasing bloom	Flower be pleasing bloom			
thoroughly	thoroughly			
"Duenshine" never race	"Duenshine" never race with			
moonlight shine	moonlight			
name coincide melodious	name coincide melodious			
truthfully	truthfully			
More fertilizer "Duenshine"	More fertilizer "Duenshine" bloom			
bloom beauty	beauty			
Difficulty search for words	And many words to give a praise			
repeated praise				

Translation Result	Post-Edit
PěnphụchÎmlukpluksænngay	Pĕnphạnthù
	phụchÎmlukplūksænngay
chū៉x khwāmngāmdeūxnēhāy	chū៉x ngdngāmdeūxnchāy
cıkhidthung	cıkhidthung
sīhelūxdængmīsenh doytrātrung	sīhelūxngdængmīsenh
	tidtrātrung
dxkmi̇́ sùngbānxxkdxkxudm	dxkmi sùngbānxxkdxkxudm
deūxnchāycami khængsængcanthr	deūxnchāycami
šxng	khængsængcanthr sxng
khūxchūx	khūxchūx
pĥxngkạnphireāahēmāasm	pĥxngkạnphireāahēmāasm
mākpŭydeūxnēhāymākkhwāmhā	mākpŭydeūxnchāymākkhwām
chm	hā chm
keinmākmāykĥnhākhåŝåykyx	phelinxārmņ
	kĥnhākhåphråyeinyx

From both of post-edit results, authors will use the post edit result as new reference to compare between Automated Evaluation with Human-Post-Edit by apply BLEU to HBLEU, METEOR to HMETEOR and TER to HTER. All evaluation results will show in table VIII.

TABLE VIII THE RESULT OF EVALUATION BY HUMAN POST-EI

Evaluation	Score
HBLEU Forward	0.977
HBLEU Backward	0.982
HMETEOR Forward (F)	0.896
HMETEOR Backward (F)	0.992
HTER Forward	0.195
HTER Backward	0.167

VI. CONCLUSION AND FUTURE WORK

This research proposes the comparison of an automatic evaluation and human post-edit. The Human Post-edit in this research focus on the calculated score without Human judgment ranking. After human edit the results of poetry the post-edit result will be a new reference. The evaluation score by using human post-edit will higher than the reference from original poetry.

The BLEU score in this paper used 1 reference poem with 1 candidate poem for Forward Translation and 1 reference poem with 1 candidate poem for Backward Translation after it was translated by Thai Poetry MT using a dictionary with tuning. The evaluation via Wak which calculated the average of Bot. L2out (Forward) and L1out (Forward) gained BLEU 0.795 and 0.885. After post-edit, the result of HBLEU for Forward and Backward are 0.977 and 0.982.

The METEOR score in this paper uses the same reference with BLEU score. It presents the score of Precision value, Recall value and F-Measure value of both translation. The different between BLEU and METOR is METOR and it will be concerned in matching of direct words and synonym words together. The evaluation via Wak which calculated the average of Bot. L2out (Forward) gained F-Measure 0.804. And L1out (Backward) gained F-Measure 0.856. After post-edit the result of HMETEOR for Forward and Backward are 0.896 and 0.992

The TER score in this paper uses the same reference with BLEU and METEOR score. It presents the score of edit rate when compare with the reference. TER score near 0 mean the quality of MT is high. L2out (Forward) gained TER 0.500 and L1out (Backward) gained TER 0.452. After post-edit the result of HTER for Forward and Backward are 0.195 and 0.167

The original reference can be used to evaluate the MT quality score but the prosody and meaning of the translator result are very important. The translator cannot use direct meaning in many times because it does not match with the prosody. Human-Post-Edit base on the translator result will correct the wrong meaning and Human will create the new sentence with prosody as need. The editors are very importance for post-edit poetry because the poetry is art. If editors cannot understand the poetry prosody they may be cannot edit with prosody keeping. In this research the editors are Thai poet who expert in prosody, arts, linguistic, feeling and meaning of poetry.

The Post-Edit concept must be proven extensively with more poetry and more expert poets. Moreover, in the future, it should develop word sense mapping and implicitly word by poetry domain to improve more quality.

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Application of the Generalized Complex Step Method for Determination of Von-Mises Two-Dimensional Contact Stress State

Sacharuck Pornpeerakeat Department of Teacher Training in Civil Engineering, Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand sacharuckp@kmutnb.ac.th

Abstract-The generalization of the complex step method (GCSM) becomes increasingly employed for numerical calculations of derivatives in many applications. An approximation of derivatives obtained from GCSM provides the superior accuracy and stability in comparison to conventional numerical derivative approximations. In this present work, GCSM and its efficiency is explored and illustrated. An application of GCSM with the Newton-Raphson's method to an engineering problem of finding 2-D von-Mises contact stress for return mapping algorithm is demonstrated. The solution obtained from the proposed method is found to be unconditionally stable, robust and fast to converge.

I. INTRODUCTION

First order derivative of a function is a very important mathematical foundation in science and engineering. In the case of simple functions such as polynomials, the first order derivatives can be obtained directly. Correct mathematical solutions in many engineering problems require accurate determination of the first order derivatives, for an example, when applying Newton-Raphson method. Unfortunately, in most of the cases, they cannot be found analytically without applications of numerical methods. To obtain the first derivative of a function numerically, we can start from Taylor's series expansion of that function by an infinite sum over its derivative terms as follows

$$f(x+h) = f(x) + \frac{\partial f(x)}{\partial x}(h) + \frac{1}{2!} \frac{\partial^2 f(x)}{\partial x^2}(h)^2 + \frac{1}{3!} \frac{\partial^3 f(x)}{\partial x^3}(h)^3 \cdots \frac{1}{n!} \frac{\partial^n f(x)}{\partial x^n}(h)^n$$
(1)

By neglecting higher order terms, the first order derivative can be obtained from Taylor's series as

- The first order forward approximation

$$\frac{\partial f(x)}{\partial x} = \frac{f(x+h) - f(x)}{h}$$
(2)

- The first order backward approximation

$$\frac{\partial f(x)}{\partial x} = \frac{f(x) - f(x-h)}{h}$$
(3)

Arisara Chaikittiratana Department of Mechanical and Aerospace Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Thailand acn@kmutnb.ac.th

- The first order central approximation

$$\frac{\partial f(x)}{\partial x} = \frac{f(x+h) - f(x-h)}{2h} \tag{4}$$

The centered derivative approximation eq. (4) allows for computing the 2nd degree of accuracy. Where the parameter h is the size of perturbation. For the exact calculation the derivative, the size of perturbation should approach to zero.

II. THE GENERALIZATION OF THE COMPLEX STEP METHOD

Most naturally, derivatives of real functions are evaluated using real numbers but approximation errors are often inviable which can lead to seriously wrong solutions. The use of complex variables in numerical differentiation of real functions has been shown capable of reducing approximation error. The complex step method (CSM) is first introduced by Lyness et al. [1] and Lyness [2]. In those work, mathematical fundamentals of the use of complex variables for numerical differentiation were explored. Rigorous numerical differentiation tests were carried out by Abreu et al. [3] with the limit $h \rightarrow 0$ serious numerical errors were found using real part approximations but errors can be largely improved using imaginary part approximations. CSM is increasingly applied to many fields of engineering. In numerical engineering, Kim et al. [4] employed CSM to Eigen-problems. In computational solid mechanics, Kiran [5] CSM is applied for a numerical calculation of tangent moduli of hyperelastic constitutive models and Voorhees [6] for shape sensitivity of finite element models.

Corresponding Taylor's series expansion based on a complex variable which can be presented using generalization of complex step method (GCSM) with $z = h + \delta i$ as follows Abreu et al. [3]

$$f(x+z) = f(x) + \frac{\partial f(x)}{\partial x}(z) + \frac{1}{2}\frac{\partial^2 f(x)}{\partial x^2}(z)^2 + \dots O(\Delta x^2)$$
(5)

$$f(x+h+\delta i) = f(x) + \frac{\partial f(x)}{\partial x}(h+\delta i) + \frac{1}{2}\frac{\partial^2 f(x)}{\partial x^2}(h+\delta i)^2 + \dots O(\Delta x^2)$$
(6)





In general, a simple and efficient approximation of the first order derivative is a central difference. Thus, considering eq.(5) with $x-z = x-h-\delta i$

TABLE I Continue

$$f(x-h-\delta i) = f(x) - \frac{\partial f(x)}{\partial x}(h+\delta i) + \frac{1}{2}\frac{\partial^2 f(x)}{\partial x^2}(h+\delta i)^2 + \dots O(\Delta x^2)$$
(7)

Eq. (6) – Eq. (7)

$$f(x+h+\delta i) - f(x-h-\delta i) = 2\frac{\partial f(x)}{\partial x}(h+\delta i)$$
(8)

The imaginary part on both sides of eq.(8) becomes

$$\operatorname{Im}\left\{f\left(x+h+\delta i\right)-f\left(x-h-\delta i\right)\right\}=\operatorname{Im}\left\{2\frac{\partial f\left(x\right)}{\partial x}\left(h+\delta i\right)\right\}=2\delta\frac{\partial f\left(x\right)}{\partial x}\tag{9}$$

The first order central difference derivative thus can be written as

$$\frac{\partial f(x)}{\partial x} = \frac{\operatorname{Im}\left\{f\left(x+h+\delta i\right) - f\left(x-h-\delta i\right)\right\}}{2\delta}$$
(10)

Eq. (10) provides the second order accuracy according to the truncation error term $O(\Delta x^2)$. To improve degree of accuracy, Lai et al [7] and Abreu et al. [3] considered a complex perturbation $\delta = \sqrt{3h}$ which gives the truncation error of $O(h^2)$. Let us consider the following functions

$$f(x) = \frac{e^x}{\sin(x)^3 + \cos(x)^3}$$
(11)

With function derivative $\frac{df(x)}{dx}$ at x = 1.5, Abreu et al. [3] proposed the derivative approximations of the test function eq. (11) whose the exact solution is 3.22. To implement eq. (11) into a complex variable, this function can be considered with the following relations

$$e^{z} = e^{a+ib} = e^{a}e^{ib} = e^{a}(\cos(b) + i\sin(b))$$
 (12.1)

 $\sin(z) = \sin(a+ib) = \sin(a)\cosh(b) + i\cos(a)\sinh(b)$ (12.2)

$$\cos(z) = \cos(a+ib) = \cos(a)\cosh(b) - i\sin(a)\sinh(b) \qquad (12.3)$$

The results of numerical solutions are listed in the table I as follows

TABLE I Results of Eq.	(11) With I	Errors = (Approx
Exact)/Exact			

	FCD			GCSM	
Perturbation(h)	Equatio n (3)	Error	Perturbation(h)	Equatio n (10)	Error
1E-01	3.71818	0.0265543 9	1E-01	3.60055	0.00592214 1
1E-02	3.62298	0.0002705 7	1E-02	3.62203	8.28272E- 06
1E-03	3.62204	1.10436E- 05	1E-03	3.62203	8.28272E- 06
1E-04	3.62203	8.28272E- 06	1E-04	3.62203	8.28272E- 06
1E-05	3.62203	8.28272E- 06	1E-05	3.62203	8.28272E- 06
1E-06	3.62203	8.28272E- 06	1E-06	3.62203	8.28272E- 06

	FCD		GCSM		
Perturbation(h)	Equation (3)	Error	Perturbation(h)	Equation (10)	Error
1E-07	3.62203	8.28272E-06	1E-07	3.62203	8.28272E-
1E-08	3.62203	8.28272E-06	1E-08	3.62203	8.28272E-
1E-09	3.62203	8.28272E-06	1E-09	3.62203	8.28272E-
1E-10	3.62204	1.10436E-05	1E-10	3.62203	8.28272E-
1E-11	3.62204	1.10436E-05	1E-11	3.62203	8.28272E-
1E-12	3.62332	0.00036444	1E-12	3.62203	8.28272E-
1E-13	3.61933	0.00073716	1E-13	3.62203	8.28272E-
1E-14	3.59712	0.00686913	1E-14	3.62203	8.28272E-
1E-15	3.10862	0.14173937	1E-15	3.62203	8.28272E-
1E-16	0.	1.	1E-16	3.62203	8.28272E-
1E-17	0.	1.	1E-17	3.62203	8.28272E-
1E-18	0.	1.	1E-18	3.62203	8.28272E-
1E-19	0.	1.	1E-19	3.62203	8.28272E-
1E-20	0.	1.	1E-20	3.62203	8.28272E-
1E-21	0.	1.	1E-21	3.62203	8.28272E-
1E-22	0.	1.	1E-22	3.62203	8.28272E-
1E-23	0.	1.	1E-23	3.62203	8.28272E-
1E-24	0.	1.	1E-24	3.62203	8.28272E-
1E-25	0.	1.	1E-25	3.62203	8.28272E- 06

The equations (12.1-12.3) are referenced to Churchill [7]. The errors of the GCSM (eq.10) and FCD (eq.4) are plotted in the figure 1. It is clear that the convergence failure occurs due to large errors in FCD approximation during limits over 1E-10 in contrast of the GCSM method which gives stability of the solution even the limit of differential step approaches to zero. Hence, the GCSM is unconditionally stable without the limit of the smallest differential step.



Figure 1. Error analysis of the proposed GCSM method





The Newton-Raphson's method requires that the derivative is calculated analytically or numerically with the differential step as small as possible to guarantee the solution's convergence. From the above demonstration, it is clear that GCSM approximation of the first derivative is remarkably accurate even with the differential step approaching to zero and thus can be effectively employed in the Newton-Raphson's procedure to solve an engineering problem efficiently.

In this present work, an application of GCSM the Newton-Raphson method's to an engineering problem of finding 2-D von-Mises contact stress for return mapping algorithm is demonstrated.

III. ELASTO-PLASTIC CONSTITUTIVE RELATION

The elasto-plastic constitutive relation plays a major role in engineering material analysis for ductile and brittle failure materials. The elasto-plastic constitutive relation is defined according to a yield criterion, such as von-Mises failure criterion which is suitable for ductile materials or Mohr-Coulomb failure criterion which is suitable for brittle or frictional materials [8, 9, 10, 11]. The latter failure criterion is widely considered in applications of geotechnical engineering.

In this work, an application of GCSM in the Newton-Raphson's procedure is demonstrated for finding the contact stress using von-Mises's criterion which is an important step for return mapping algorithms.

The requirement of the return mapping procedure is that a stress state must be satisfied and located at the yield surface after mapping. Hence, the equilibrium condition is mainly under the elastic response which lies inside and on the yield surface, so called an elastic domain. The von-Mises's failure criterion in a twodimensional problem can be written in the principle plane Crisfield [8] following the figure 2.



Figure 2. Graphical Representation of Von-Mises's failure criterion

The failure criterion can be presented in the twodimension principle plane as

$$f(\sigma) = \left(\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2\right)^{1/2} - \sigma_0 = 0$$
(13)



Figure 3. Graphical Representation of return mapping algorithms with the contact stress state σa , current trial stress t+ $\Delta t \sigma t rial$, the contact stress state multiplier α

To obtain the contact stress state σa on the yield locus with the contact stress state multiplier α , we need to solve eq.(13) which can be written as

$$f({}^{t}\sigma + \alpha\Delta\sigma) = 0 \tag{14.1}$$

Corresponding to

$$\sigma_{a} = \sigma + \alpha \Delta \sigma \tag{14.2}$$

Substituting eq.(14.2) into eq.(13) with a definition of eq. (14.2)

$$f({}^{\prime}\sigma_{1} + \alpha\Delta\sigma_{1}, {}^{\prime}\sigma_{2} + \alpha\Delta\sigma_{2}) = \left[\left({}^{\prime}\sigma_{1} + \alpha\Delta\sigma_{1}\right)^{2} + \left({}^{\prime}\sigma_{2} + \alpha\Delta\sigma_{2}\right)^{2} - \left({}^{\prime}\sigma_{1} + \alpha\Delta\sigma_{1}\right)\left({}^{\prime}\sigma_{2} + \alpha\Delta\sigma_{2}\right)\right]^{1/2} - \sigma_{0} = 0$$
(14.3)

Fortunately, the relations in eq. (14.3) can be solved analytically. Crisfield [8] provided the numerical example by using an exact form of a two-dimensional von-Mises's criterion function in principle planes as follows

$$a\alpha^2 + b\alpha + c = 0 \tag{15.1}$$

$$a = f_{\sigma_e}(\Delta \sigma_1, \Delta \sigma_2) \tag{15.2}$$

$$b = \lfloor \Delta \sigma_1 \quad \Delta \sigma_2 \rfloor \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} \begin{Bmatrix} \sigma_1 \\ \sigma_2 \end{Bmatrix}$$
(15.3)

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$$c = f_{\sigma} \left(\sigma_1, \sigma_2 \right) - \sigma_0^2 \tag{15.4}$$

Where

$$f_{\sigma_{e}}(p,q) = p^{2} + q^{2} - pq$$
(15.5)

Hence, the contact stress state multiplier α can be solved with a simple polynomial form to obtain the root α 1 and α 2 which the root α of α 1 and α 1 locates within the range $0 \le \alpha \le 1$.

The solutions of α obtained analytically will be compared with the solutions obtained by Newton-Raphson's procedure with GCSM as will be illustrated below.

IV. THE GENERALIZED COMPLEX STEP METHOD FOR SOLVING THE CONTACT STRESS STATE MULTIPLIER α

To solve a non-linear equation effectively, the full Newton-Raphson iterative with GCSM is employed. Considering eq. (14.1) with Taylor's expansion to the first order.

$$f({}^{t}\sigma + \alpha\Delta\sigma) = f({}^{t}\sigma + \alpha_{i-1}\Delta\sigma) + \left(\frac{\partial f({}^{t}\sigma + \alpha\Delta\sigma)}{\partial\alpha}\Big|_{\alpha = \alpha_{i-1}}\right)\Delta\alpha = 0$$
(16)

In the complex plane

$$f({}^{t}\sigma + \alpha \Delta \sigma) = f({}^{t}\sigma + \alpha_{i-1}\Delta \sigma) + \left(\frac{\partial f({}^{t}\sigma + \alpha(\alpha_{i-1}, z)\Delta \sigma)}{\partial \alpha}\Big|_{\alpha = \alpha_{i-1}}\right)\Delta \alpha = 0$$
(17)

In which, the first order derivative is in the complex central difference as follows

$$\frac{\partial f({}^{i}\sigma + \alpha(\alpha_{i-1}, z)\Delta\sigma)}{\partial\alpha}\Big|_{\alpha = \alpha_{i-1}}$$
(18)
= $\frac{f({}^{i}\sigma + (\alpha_{i-1} + h + \delta i)\Delta\sigma) - f({}^{i}\sigma + (\alpha_{i-1} - h - \delta i)\Delta\sigma)}{2\delta}; \delta = \sqrt{3}h$
Solving eq. (17) to obtain $\Delta\alpha_{i}$

S

$$\Delta \alpha_{i} = \frac{-f({}^{t}\sigma + \alpha_{i-1}\Delta\sigma)}{\frac{\partial f({}^{t}\sigma + \alpha(\alpha_{i-1}, z)\Delta\sigma)}{\partial \alpha}\Big|_{\alpha = \alpha_{i-1}}}$$
(19)

Updating the Contact Stress State Multiplier α can now be

$$\alpha_i = \alpha_{i-1} + \Delta \alpha \tag{20}$$

V. NUMERICAL EXAMPLE OF FINDING THE CONTACT STRESS STATE MULTIPLIER a

Crisfield [8] proposed a numerical example with a two-dimension plane stress problem, the problem define the initial stress $(\sigma 1, \sigma 2) = (120, -80)$ N/mm2 with applying an elastic increment ($\Delta \sigma 1$, $\Delta \sigma 2$) relating a strain increment $\Delta \epsilon = (0.0009, 0.0009)$ mm/mm. The material properties are E = 200000 N/mm2, v = 0, $\sigma 0 = 200$ N/mm2. Hence, the elastic stress increment becomes $(\Delta \sigma 1, \Delta \sigma 2) = (180, 180)$ N/mm2.

The equations (15) are calculated in the form of $32400\alpha^2 + 7200\alpha - 9600 = 0$ which α can be determined which α can be determined analytically as 0.444444. The numerical solutions proposed in eqs. (18, 19 and 20) with h = 1E-25 are given in the table II with plotting an error versus convergence iterations corresponding to figure 4.

TABLE II Numerical Errors = ||(Approx.-Exact)/Exact||

	Starting Point [a] α_0 = 0.0			
Iterations	$\Delta \alpha \qquad \alpha_{i+1}$		Errors	
1	1.24200E+00	1.242000	1.794503E+00	
2	-6.73480E-01	0.568000	2.780013E-01	
3	-1.15599E-01	0.452415	1.793477E-02	
4	-7.92800E-03	0.444487	9.675010E-05	
5	-4.21256E-05	0.444444	0.	
	Starting Point [b] $oldsymbol{lpha}_{0}$ = 0.5			
Iterations	Δα	$\alpha_{_{i+1}}$	Errors	
1	-5.37880E-02	0.446291	4.155754E-03	
2	-1.84463E-03	0.444447	6.750007E-06	
3	-2.29297E-06	0.444444	0.	
4	-3.54892E-12	0.444444	0.	
5	0.	0.444444	0.	
	Starting Point [c] α_0 = 1.0			
Iterations	Δα	$\alpha_{_{i+1}}$	Errors	
1	-4.74583E-01	0.525417	1.821894E-01	
2	-7.72495E-02	0.448168	8.379008E-03	
3	-3.71420E-03	0.444540	2.160002E-04	
4	-9.28043E-06	0.444444	0.	



Figure 4. Errors of starting values a0 and convergence iterations

(10)





It can be seen from the results above that the numerical solutions obtained using Newton-Raphson's with GCSM are converging to the exact solution within a few iterations regardless of the starting points or initial guesses.

VI. CONCLUDING REMARKS

An example of an application of the concept of the generalized complex step method GCSM with Newton-Raphson's procedure in determining the contact stress state multiplier α for return mapping algorithms is demonstrated. The multiplier α for two-dimensional von-Mises's criterion yield loci can be accurately determined numerically with the application of GCSM. The solution obtained from the proposed method is found to be unconditionally stable, robust and fast to converge. For the future work, it is interesting to implement this scheme to general three dimensional elasto-plastic constitutive relations with more complicated criteria functions which the multiplier α is difficult to be determined.

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Chaotic Analysis of Meridional Circulation over Southeast Asia by a Forced Meridional-vertical System in the Case of Fx = 0, Fy = rF and Fz = 0

Nattapong Wareeprasirt1 and Dusadee Sukawat2

1,2Department of Mathematics, Faculty of Science, King Mongkut's University of Technology Thonburi 126 Pracha-Uthit Road, Bang Mod, Thung Khru, Bangkok 10140, Thailand 1luecss@gmail.com, 2dusadee.suk@kmutt.ac.th

Abstract. The objective of this paper is a chaotic analysis of Meridional circulation over Southeast Asia. Meridional circulation is influenced by winter monsoon. The forced meridional-vertical system is applied to analyse chaotic behavior of meridional circulation. This paper concentrates on the case with forcing terms of Fx = 0, Fy = rF and Fz = 0. Bifurcation analysis of the forced meridional-vertical system is used to study chaotic behavior. The result of chaotic analysis shows that this system has chaotic behavior between two fixed points P- and P+ in some ranges of the parameter F which represents an independent factor term (i.e. land surface temperature) and important parameter r which represents dimensionless temperature difference term.

Keywords—Chaotic analysis, Meridional circulation, Forced meridional-vertical system, Land surface temperature.

I. INTRODUCTION

Meridional circulation over Southeast Asia is influenced by winter monsoon. The circulation flows from continent to ocean. A meridional-vertical system can be applied with meridional circulation because the direction of meridional circulation is meridional flow. This system is derived from the convection problem [1]. Practically, the meridional circulation is also influenced by other factors. These are the independent factor term Fx, Fy and Fz. This research concentrates on case of Fx =0, Fy = rF and Fz = 0 where F represents forcing term (i.e. land surface temperature). Bifurcation analysis is the tool that is used to investigate chaotic behavior of the meridional-vertical system. The chaotic behavior in some ranges of the parameter F and r are studied.

[2] study the Lu's system by adding a constant forcing term in the first equation. They investigate local bifurcation structure of the forced Lu's system. Moreover, they identify the chaotic region of the forced Lu's system and classify the different types of chaotic attractor by using return map. Results show that such transitions take place when chaotic behavior comes very close to a one dimensional manifold on which the time derivatives of two of the variables vanish and the Jacobian at the point on the manifold close to the attractor has a pair of comlex roots. [3] uses Routh-Herwitz method and Cardan method to investigate stability and bifurcation behavior of pan chaotic system which theoretical and numerical methods. He find that both methods give the same result. [4] study mathematical analysis of Lu's system of monsoon intra-seasonal oscillation (ISO) by adding a forcing term. Lu system is an example of generalized Lorenz system which is different in linear parts. This study shows the bifurcation structure of the system when changing the value of parameters and forcing parameter. Besides, they use statistical skill to calculate score of prediction. They find that Lu's system with the forcing term can be a good prototype in the prediction of monsoon ISO.

II. THEORIES

A. Characteristic Equation

Characteristic polynomial of a matrix A is

$$|A - \lambda I| = \lambda^n + a_{n-1}\lambda^{n-1} + \dots + a_1\lambda + a_0. \quad (1)$$

where λ is the eigenvalue and I is an identity matrix.

The order of a characteristic polynomial of a $n \square n$ matrix is n and the coefficient of the term that has the highest order is 1. The fundamental theorem of algebra states that characteristic polynomial has precisely n roots (not necessary unequal). Therefore, the characteristic equation can be written are

$$\lambda^{n} + a_{n-1}\lambda^{n-1} + \dots + a_{1}\lambda + a_{0} = 0$$
⁽²⁾

B. Stability of Fixed points

Let x = 0 be an fixed point of a nonlinear system $\dot{x} = f(x)$ [5]

where $f: D \to \mathbb{R}^n$ is continuously differentiable and *D* is the neighborhood of the origin.

Let the Jacobian matrix A at x = 0 be: $A = \partial f / \partial x \Big|_{x=0}$

Let λ_i , i = 1,...,n be the eigenvalues of A. Then, the origin is asymptotically stable if $\operatorname{Re}(\lambda_i) < 0$ for all





eigenvalues of A. Conversely, the origin is unstable if $\operatorname{Re}(\lambda_i) < 0$ for any eigenvalues of A.

C. Meridional-vertical System

The meridional-vertical system is a dynamical system that derived from the governing convective system to develop meridional-vertical form. The meridionalvertical system assumes incompressible fluid motion contained in a cell which has a constant higher temperature at the bottom and a lower temperature at the top while the upper and lower boundaries temperature are constants.

The meridional-vertical system is a mathematical system which describes Meridional Circulation that is reduced to nonlinear ordinary differential equations system by the steps based on Lorenz system.

The meridional-vertical system is

$$\frac{dX}{d\tau} = -Z - \sigma X - YZ,$$

$$\frac{dY}{d\tau} = -b\sigma Y + XZ,$$

$$\frac{dZ}{d\tau} = XY - rX - Z.$$
(3)

where X is the speed of the convective motion, Y is the speed of the convective motion in vertical direction, Z is the horizontal temperature variation, σ is Prandtl number, b is the horizontal wave vector of the convective motion and r is a proportion of Rayleigh number and critical Rayleigh number. The super-dot describes derivative of variable with respect to dimensionless time (τ). The chaos occurs in the meridional-vertical system when values of parameters are $\sigma = 0.16$, b = 8/3 and r = 2.89.

D. Routh-Hurwitz Theorem

Let
$$p(\lambda)$$
 be a polynomial:
 $p(\lambda) = \lambda^n + a_1 \lambda^{n-1} + ... + a_{n-1} \lambda + a_n$

where a_i are the constant, $i \square \mathbb{N}$. The matrices of *n*-Hurwitz polynomial:

$$H_{1} = [a_{1}], H_{2} = \begin{bmatrix} a_{1} & 1 \\ a_{3} & a_{2} \end{bmatrix}, H_{3} = \begin{bmatrix} a_{1} & 1 & 0 \\ a_{3} & a_{2} & a_{1} \\ a_{5} & a_{4} & a_{3} \end{bmatrix},$$

and

$$H_{n} = \begin{bmatrix} a_{1} & 1 & 0 & 0 & \dots & 0 \\ a_{3} & a_{2} & a_{1} & 1 & \dots & 0 \\ a_{5} & a_{4} & a_{3} & a_{2} & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots & \dots & \vdots \\ 0 & 0 & 0 & 0 & \dots & a_{n} \end{bmatrix}$$

The characteristic equation is $p(\lambda) = 0$. All roots λ of $p(\lambda) = 0$ are negative real part when the determinants of all Hurwitz matrices are greater than zero:

$$\det H_{i} > 0, j = 1, 2, ..., n.$$
(4)

when n = 2, the Routh-Hurwitz method is simplified to det $H_1 = a_1 > 0$ and

$$\det H_2 = \det \begin{bmatrix} a_1 & 1 \\ 0 & a_2 \end{bmatrix} = a_1 a_2 > 0$$

or $a_1 > 0$ and $a_2 > 0$. For polynomial of degree n = 2, 3, 4 and 5, the Routh-Hurwitz method can be summarized as follows

$$n = 2: a_1 > 0 \text{ and } a_2 > 0.$$

$$n = 3: a_1 > 0, a_3 > 0 \text{ and } a_1 a_2 > a_3.$$

$$n = 4: a_1 > 0, a_3 > 0, a_4 > 0 \text{ and } a_1 a_2 a_3 > a_3^2 + a_1^2 a_4.$$

$$n = 5: a_i > 0, i = 1, 2, \dots, 5; a_1 a_2 a_3 > a_3^2 + a_1^2 a_4.$$
and
$$(a_1 a_2 - a_3)(a_2 a_3 - a_2^2 - a_3^2 a_3) > a_1(a_2 a_3 - a_3)^2 + a_2 a_3^2.$$

III. METHODOLOGY

This section describes the methodology which consists of forced meridional-vertical system and chaotic analysis of the forced meridional-vertical system.

A. Forced meridional-vertical system

Practically, the meridional circulation over Southeast Asia has key independent factor terms Fx, Fy and Fz are the forcing terms associated with X, Y and Z, respectively. Meridional circulation has intraseasonal oscillation between heavy rainfall and lack of rainfall [6]. This paper indicates that the heavy rainfall is represented by positive X-Z and the lack of rainfall is represented by the negative X-Z of the forced meridional-vertical system. The meridional-vertical system with forcing terms is given as





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$$\frac{dX}{d\tau} = -Z - \sigma X - YZ + F_x,$$

$$\frac{dY}{d\tau} = -b\sigma Y + XZ + F_y,$$

$$\frac{dZ}{d\tau} = XY - rX - Z + F_z.$$
(5)

The forced meridional-vertical system is mathematically analyzed for chaotic behavior study. This paper concentrates on the case of Fx = 0, Fy = rF and Fz= 0. The parameter F corresponds to land surface temperature.

The forced meridional-vertical system yields

$$\frac{dX}{d\tau} = -Z - \sigma X - YZ,$$

$$\frac{dY}{d\tau} = -b\sigma Y + XZ + rF,$$

$$\frac{dZ}{d\tau} = XY - rX - Z.$$
(6)

where $\sigma = 0.16$, b = 8/3 and $r_c = 2.89$ is a critical value of r [1].

B. Chaotic Analysis of the Forced Meridionalvertical System

Steps of chaotic analysis of the forced meridionalvertical system consist of

Finding the fixed points of the forced meridionalvertical system,

Finding the characteristic equation of the forced meridional-vertical system,

Analyze stability of the characteristic at fixed points.

First, finding the fixed points, this system has three fixed points

$$x_{e_{1}} = \left(0, \frac{Fr}{\sigma b}, 0\right), x_{e_{2}}, x_{e_{3}} = P_{\pm}\left(x_{P\pm}, y_{P\pm}, z_{P\pm}\right) \text{ where}$$
$$x_{P+} = \frac{\sqrt{\Delta_{F}}}{\sigma^{2}b + \sigma rF} \left[rF - \Delta_{F} + \sigma b + r^{2}F - \sigma^{2}b + \sigma br\right]$$

$$x_{P_{-}} = \frac{\sqrt{\nabla_{F}}}{\sigma^{2}b + \sigma rF} \Big[rF - \nabla_{F} + \sigma b + r^{2}F - \sigma^{2}b + \sigma br \Big]$$

$$y_{P+} = \frac{1}{\sigma b + rF} \left[-\frac{rF}{2} - \frac{\sigma b}{2} + \frac{r^2 F}{2} + \frac{1}{2} rF\sqrt{r^2 + 2r - 4\sigma + 1} \right]$$

$$+\frac{1}{2}\sigma b\sqrt{r^2+2r-4\sigma+1}+\frac{\sigma br}{2}]$$

$$y_{P_{-}} = \frac{1}{\sigma b + rF} \left[-\frac{rF}{2} - \frac{\sigma b}{2} + \frac{r^{2}F}{2} - \frac{1}{2}rF\sqrt{r^{2} + 2r - 4\sigma + 1} - \frac{1}{2}\sigma b\sqrt{r^{2} + 2r - 4\sigma + 1} + \frac{\sigma br}{2} \right]$$

$$z_{P_{+}} = \sqrt{\Delta_{F}}$$

$$z_{P_{-}} = \sqrt{\nabla_{F}}$$

and

$$\begin{split} \Delta_F &= \frac{rF}{2} + \frac{\sigma b}{2} + \frac{r^2 F}{2} - \sigma^2 b + \frac{1}{2} rF\sqrt{r^2 + 2r - 4\sigma + 1} \\ &+ \frac{1}{2} \sigma b \sqrt{r^2 + 2r - 4\sigma + 1} + \frac{\sigma b r}{2} \\ \nabla_F &= \frac{rF}{2} + \frac{\sigma b}{2} + \frac{r^2 F}{2} - \sigma^2 b - \frac{1}{2} rF\sqrt{r^2 + 2r - 4\sigma + 1} \\ &- \frac{1}{2} \sigma b \sqrt{r^2 + 2r - 4\sigma + 1} + \frac{\sigma b r}{2} \end{split}$$

Next, The fixed point is represented by $x_e = (x_0, y_0, z_0)$. The characteristic equation is

$$\begin{split} \lambda^{3} + (\sigma b + \sigma + 1)\lambda^{2} + (-x_{0}^{2} + y_{0}^{2} + z_{0}^{2} - ry_{0} + y_{0} + \sigma - r + \sigma b \\ + \sigma^{2}b)\lambda + (x_{0}z_{0} - rx_{0}z_{0} + 2x_{0}y_{0}z_{0} - \sigma x_{0}^{2} + z_{0}^{2} + \sigma by_{0}^{2} + \sigma by_{0} \\ - \sigma bry_{0} + \sigma^{2}b - \sigma br) = 0 \end{split}$$

Then, substituting fixed points into the characteristic equation for stability analysis, with the characteristic equation obtained it is not easy to find eigenvalues. To solve this problem, the Routh-Hurwitz theorem is used and the parameters Prandtl number and b are fixed as 0.16 and 8/3 respectively.

IV. RESULTS AND DISCUSSION

The results of chaotic analysis show that the behavior of the forced meridional-vertical system has a chaotic behavior in some of its parameter ranges as analyzed by bifurcation diagram in the r-F plane, as shown in Figure 1.





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 $F_x = 0, F_y = rF$ and $F_z = 0$

The solutions of the forced meridional-vertical system with F = 0 and r = 0.5 result in stability at P+ for 3,000 iterations as shown in Figures 2 and 3. The fixed points O, P+ and P- indicated by green, blue and red points, respectively.



Fig. 2 The trajectories of the forced meridional-vertical system with F = 0 and r = 0.5 (a) 3-dimensional perspectives, (b) X-Y plane, (c) X-Z plane and (d) Y-Z plane in phase space



Fig. 3 The time series of X, Y or Z for the forced meridional-vertical system with F = 0 and r = 0.5 (a) X-t plane, (b) Y-t plane and (c) Z-t plane

From Figures 2 and 3, the solutions of the forced meridional-vertical system result in stability at P+, which denotes the heavy rainfall of meridional circulation.

The solutions of the forced meridional-vertical system with F = 0 and r = 2 result in stability at P- for 3,000 iterations as shown in Figures 4 and 5.



Fig. 4 The trajectories of the forced meridional-vertical system with F = 0 and r = 2 (a) 3-dimensional perspectives, (b) X-Y plane, (c) X-Z plane and (d) Y-Z plane in phase space

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Fig. 5 The time series of *X*, *Y* or *Z* for the forced meridional-vertical system with F = 0 and r = 2 (a) *X*-*t* plane, (b) *Y*-*t* plane and (c) *Z*-*t* plane

From Figures 4 and 5, the solutions of forced meridional-vertical system result in stability at P-, which denotes the lack of rainfall for meridional circulation.

The solutions of the forced meridional-vertical system with F = 0.25 and r = 3 result in chaos occurs at P- and P+ for 3,000 iterations as shown in Figures 6 and 7.



Fig. 6 The trajectories of the forced meridional-vertical system with F = 0.25 and r = 3 (a) 3-dimensional perspectives, (b) X-Y plane, (c) X-Z plane and (d) Y-Z plane in phase space



Fig. 7 The time series of X, Y or Z for the forced meridional-vertical system with F = 0.25 and r = 3 (a) X-t plane, (b) Y-t plane and (c) Z-t plane

Meridional circulation can not be predicted when F = 0.25 and r = 3 which is one example over chaos region as shown in Figure 1. The result of trajectory in Figure 6 shows that there is oscillation between fixed points P+ and P-. The result of time series in Figure 7 shows non-periodic patterns and instability.

V. CONCLUSIONS AND SUGGESTIONS FOR FUTURE WORK

The forced meridional-vertical system is used for analysis of chaotic behavior of Meridional circulation over Southeast Asia. This paper concentrates on the meridional-vertical system with independent factor in case of Fx = 0, Fy = rF and Fz = 0 where F represents land surface temperature. Moreover, two parameters σ and b are fixed as 0.16 and 8/3, respectively. Meridional circulation has intraseasonal oscillation between heavy rainfall (represented by positive X-Z) and lack of rainfall (represented by the negative X-Z). The result of chaotic analysis for the forced meridional-vertical system shows that there are three fixed points. Bifurcation diagram results that the independent factor term F and dimensionless temperature difference term r influence meridional circulation. The chaotic behavior occurs between P- and P+ in some range of parameters when F and r are increased.

Further experiment cases should be applied for other scenarios. Different models for atmospheric circulation should be investigated for the study of chaotic behavior of Meridional circulation.



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A Synthesis of Waveguide Capacitive Iris using WIM Algorithm

Pinit Nuangpirom and Somsak Akatimagool

Department of Teacher Training in Electrical Engineering, King Mongkut's University of Technology North Bangkok,

1518, Pracharat 1 Road, Wongsawang, Bangsue, Bangkok 10800

Abstract- This paper presents a synthesis of capacitive iris in the rectangular waveguide using new Wave Iterative Method (WIM) algorithm. WIM is a full wave analysis based on electromagnetic wave propagation and iterative method for synthesis and design of complex electromagnetic circuits. The developed WIM simulation is created on a graphical user interface of MATLAB program. The capacitive iris characteristic synthesis was proposed in this paper. The simulated results agree well with the theory and the classical simulation.

Keyword: Wave Iterative Method, EM Simulation, Capacitive Iris

I. INTRODUCTION

Presently, waveguides play important role in satellite communication system, and are often used between high power amplifier and transmitting antenna to obtained good matching [1]. Usually the kind of filter in rectangular waveguide is inductive coupling iris. However, the capacitive coupling iris is not applied and developed in satellite systems widely due to the difficulty and complexity of the design. In education and research, design and analysis of the waveguide irises are accomplished by numerical method [2]. Several computational methods related to electromagnetic wave have been extracted such as the Mode Matching Technique (MMT) [1], the Finite Difference Time Domain (FDTD) [3], that each method has its own advantages and disadvantages and is suitable for a class of problem [4]. In this paper, the capacitive iris characteristics using the Wave Iterative Method (WIM) algorithm are studied.

II. THEORIES

A. Capacitive Obstacle in Rectangular Guide[5]

Capacitive window formed by zero thickness obstacle with edge perpendicular to the electric field (H10-mode in rectangular guide) is illustrated in Figure 1.



(a) Cross sectional view (b) side view (c) Equivalent circuit Figure 1.The unsymmetrical capacitive obstacle.

Equivalent-circuit parameters, at the terminal plane T, for the unsymmetrical case $d' \neq b-d$ are follows,

$$B_{C} = Y_{0} \frac{4b}{\lambda_{g}} \left\{ \ln\left[a\right] + b + Q_{2}\left[c\right]^{2} \right\}$$
(1)

where

$$a = \csc\frac{\pi d}{2b}\csc\frac{\pi}{2b}(d'+d),$$

$$b = \frac{2Q_1\cos^2\frac{\pi d}{2b}\cos^2\frac{\pi}{2b}(d'+d)}{1+Q_1\sin^2\frac{\pi d}{2b}\sin^2\frac{\pi}{2b}(d'+d)},$$

$$c = 3\cos^2\frac{\pi d}{2b}\cos^2\frac{\pi}{2b}(d'+d) - \cos^2\frac{\pi d}{2b} - \cos^2\frac{\pi}{2b}(d'+d)$$

$$Q_n = \frac{1}{\sqrt{1 - \left(\frac{2b}{n\lambda_g}\right)^2}} - 1, \ \lambda_g = \frac{\lambda}{\sqrt{1 - \left(\frac{\lambda}{2a}\right)^2}},$$

$$\lambda = \frac{c}{f\sqrt{\mu_r \varepsilon_r}}$$



(a) Cross sectional view (b) side view (c) Equivalent circuit Figure 2.The Symmetrical capacitive obstacle.

For the symmetrical case d' = b - d (Figure 2.), we have





$$B_{c} = Y_{0} \frac{4b}{\lambda_{g}} \left\{ \ln\left(\csc\frac{\pi d}{2b}\right) + \frac{Q_{2}\cos^{4}\frac{\pi d}{2b}}{1 + Q_{2}\sin^{4}\frac{\pi d}{2b}} + \frac{Q_{2}\cos^{4}\frac{\pi d}{2b}}{1 + Q_{2}\sin^{4}\frac{\pi d}{2b}} \right\}.$$
 (2)

Window formed by a zero thickness obstacle with its edge perpendicular to the electric field (H10-mode in rectangular guide) is shown in Figure 3.



(a) Cross sectional view (b) side view (c) Equivalent circuit Figure 3. Window Formed by One Obstacle.

Equivalent circuit Parameters are same as Equation 2, except that λ_g is replaced by $\lambda_g/2$.

A symmetrical obstacle of zero thickness with its edges perpendicular to the electric field (H10-mode in rectangular guide) is shown in Figure 4. The equivalent circuit parameters are same as Equation 2.



(a) Cross sectional view (b) side view (c) Equivalent circuit Figure 4. The Symmetrical Obstacle.

B. Wave Iterative Method

Several years ago, the efficiency of WIM has been developed by using the wave concept iterative procedure (WCIP) [6]. Thus, in this paper we demonstrate an optimized WIM analysis approach for apply to capacitive iris circuits. The principle of WIM is calculating the amplitude and direction of incident wave, reflected wave and transmitted wave, in the waveguide, depicted in Figure 5.



(a) The principle of WIM. (b) Iterative Procedures. Figure 5. Iterative Procedures.

The excited wave $(A^{0}_{(x,y)})$ in the real domain of waveguide source can be done as follows:

$$A_x^{(0)} = \sqrt{\frac{2}{ab}} \cos \frac{\pi x}{a}, \ A_y^{(0)} = \sqrt{\frac{2}{ab}} \sin \frac{\pi y}{b}$$
(3)

where, "a" and "b" are the width and the height of the waveguide. The matrix of x and y directions is obtained as.

$$x = \left(\frac{a}{2m} : \frac{a}{m} : a\right), \quad y = \left(\frac{b}{2n} : \frac{b}{n} : b\right)$$
(4)

and m, n are number of $m \times n$ pixels.

$$I_{1} \xrightarrow{} E_{1} = E_{2} \xrightarrow{} I_{2}$$

$$E_{1} \xrightarrow{} E_{2}$$

$$I_{1} \xrightarrow{} E_{1} = E_{2} \xrightarrow{} I_{2}$$

$$E_{1} \xrightarrow{} E_{2}$$

$$I_{1} \xrightarrow{} E_{2}$$

$$E_{1} \xrightarrow{} E_{2}$$

$$I_{1} \xrightarrow{} E_{2}$$

$$I_{2} \xrightarrow{} E_{2}$$

$$I_{1} \xrightarrow{} E_{2}$$

$$I_{2} \xrightarrow{} E_{2}$$

$$I_{1} \xrightarrow{} E_{2}$$

$$I_{2} \xrightarrow{}$$

(a) Metal region

Figure 6. Equivalent circuit of discontinuity

The boundary conditions of tangential fields are expressed in terms of wave relationship of 2 equivalent discontinuity circuits, as shown in Figure 6, as following.

Case 1, on the metal regions (M), we have the field condition; $E_1 = E_2 = 0$, thus the wave relation in the region 1 and 2 can be represented as follows:

$$\begin{bmatrix} S_m \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix},\tag{5}$$

Case 2, on the dielectric regions (D), we have the field conditions; $E_1 = E_2$ and $J_1 + J_2 = 0$, the wave relation can be represented as follows:

$$S_D \left[= \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \tag{6}$$

The summation of equations (5) and (6) are as follows:

$$\begin{bmatrix} S \end{bmatrix} = \begin{bmatrix} S_m + S_D \end{bmatrix} = \begin{bmatrix} -C & D \\ D & -C \end{bmatrix}.$$
 (7)

The wave relation can be represented as follows:

$$\begin{bmatrix} B_{x,y}^{(n)} \\ B_{x,y}^{(n)} \end{bmatrix} = \begin{bmatrix} -C & D \\ D & -C \end{bmatrix} \begin{bmatrix} A_{x,y}^{(n-1)} \\ A_{x,y}^{(n-1)} \end{bmatrix} .$$
(8)

For simplify the calculation of the generalized $^{IE_{m,n}}$, $^{TM_{m,n}}$ mode wave description, the $^{Mode-FFT}$ pair permits movement the transverse filed components from the real domain to the spectrum domain, we can write the $TE_{m,n}$ mode wave equation as follows;

$$B_{x(m,n)}^{TE/TM} = \sum_{j=1}^{M} \sum_{k=1}^{N} B_{x(j,k)} \cos\left(\frac{m\pi x_j}{a}\right) \sin\left(\frac{n\pi y_k}{b}\right), \quad (9)$$

and, the $IM_{m,n}$ mode wave equation is defined as;

$$B_{y(m,n)}^{TE/TM} = \sum_{j=1}^{M} \sum_{k=1}^{N} B_{y(j,k)} \sin\left(\frac{m\pi x_k}{a}\right) \cos\left(\frac{n\pi y_k}{b}\right).$$
(10)

Thus, the modal transform matrix can be represented as follows:





$$\begin{bmatrix} B_{(m,n)}^{TE} \\ B_{(m,n)}^{TM} \end{bmatrix} = Q_{m,n} \begin{bmatrix} n/b & -m/a \\ m/a & n/b \end{bmatrix} FFT \begin{bmatrix} B_x \\ B_y \end{bmatrix}.$$
 (11)

Similarly, the Mode-IFFT pair permits movement the modal filed components from the spectrum domain comeback to the real domain, we can write the wave equation in x direction as follows:

$$A_{x} = \sum_{m=1}^{M} \sum_{n=1}^{N} A_{x_{(m,n)}}^{TE/TM} \cos\left(\frac{m\pi x}{M}\right) \sin\left(\frac{n\pi y}{N}\right), \qquad (12)$$

and, the wave equation in y direction is defined as;

$$A_{y} = \sum_{m=1}^{M} \sum_{n=1}^{N} A_{y(m,n)}^{TE/TM} \sin\left(\frac{m\pi x}{M}\right) \cos\left(\frac{n\pi y}{N}\right).$$
(13)

Thus, the wave matrix in x, y directions can be represented as follows:

$$\begin{bmatrix} A_x \\ A_y \end{bmatrix} = FFT^{-1} \left\{ \frac{1}{Q_{m,n}} \begin{bmatrix} n/b & -m/a \\ m/a & n/b \end{bmatrix}^{-1} \begin{bmatrix} A_{(m,n)}^{TE} \\ A_{(m,n)}^{TM} \end{bmatrix} \right\}, \quad (14)$$

where:

$$Q_{m,n} = \sqrt{\frac{ab}{2\Phi_{m,n}}} \frac{1}{\sqrt{(m/a)^2 + (n/b)^2}}, \Phi_{m,n} = \begin{cases} 2 \text{ if } m, n \neq 0, M, N \\ 1 \text{ if } m, n \neq 0 \end{cases}$$

refer the pixel or mode number, a, b refer the waveguide dimension.

The expression of reflection coefficient at the input and output side of waveguide in the spectrum domain is given by

$$\Gamma_i^{TE/TM} = \frac{1 - Z_{0i} Y_{m,n}^{TE/TM}}{1 + Z_{0i} Y_{m,n}^{TE/TM}},$$
(15)

where the $TE_{m,n}$, $TM_{m,n}$ mode admittances in the

waveguide are
$$Y_{m,n}^{TE} = \frac{\gamma}{j\omega\mu_0\mu_r}, Y_{m,n}^{TM} = \frac{j\omega\varepsilon_0\varepsilon_r}{\gamma}$$

respectively,

$$\gamma = \sqrt{\left(m\pi/a\right)^2 + \left(n\pi/b\right)^2 - k_0^2 \varepsilon_r} \text{ , and } k_0 = \omega \sqrt{\mu_0 \varepsilon_0} \text{ .}$$

The WIM procedure, as shown in Figure 5, is summarized by the following steps: 1.) Define the excited wave $A^0_{(x,y)}$ of waveguide

source.

2.) Calculate the reflected waves using the scattering parameters of iris circuit: $B_{i(x,y)} = [S](A_{i(x,y)})$.

3.) Convert the waves in the real domain to spectrum domain by the *FFT*: $B_{i(m,n)} = [FFT](B_{i(x,y)})$

4.) Apply the reflection coefficient $\begin{pmatrix} 1 \\ i \end{pmatrix}$ for reflected $\overset{\text{waves}}{A_{i(m,n)}} = \left[\Gamma_{i}^{\text{to}}\right] \left(B_{i(m,n)}^{n}\right)^{\text{obtain}}$ incident the waves:

5.) Transform the waves in the spectrum domain to using IFFT : domain by the real $A_{i(x,y)}^{n} = \begin{bmatrix} FFT^{-1} \end{bmatrix} (A_{i(m,n)}^{n}).$ 6.) Repeat the step 2 to step 5 until the response

results are converge.

After testing the convergence at the k iterations, the tangential electric field and current density in the discontinuity can be written as[6],

$$E_{(x,y)}^{k} = \sqrt{Z_{0i}} \left(A_{i}^{k} + B_{i}^{k} \right) \text{ and } J_{(x,y)}^{k} = \left(A_{i}^{k} + B_{i}^{k} \right) / \sqrt{Z_{0i}} .$$
 (16)
Thus, the admittance parameters of two ports network

Thus, the admittance parameters of two ports network are as following

$$Y = \sum_{x,y} \left(\frac{J_{(x,y)}}{E_{(x,y)}} \right),$$
 (17)

also, the impedance parameters can be written as

$$Z = \sum_{x,y} \left(\frac{E_{(x,y)}}{J_{(x,y)}} \right).$$
 (18)

Finally, the scattering parameters of circuit are given by

$$S = [1 - Z][1 - Z]^{-1}.$$
 (19)

III. WIM SIMULATION DESIGN

WIM is a full wave analysis for electromagnetic wave based on electromagnetic wave propagation and iterative method. The WIM simulation is created using a graphical user interface (GUI) of MATLAB program, as shown in Figure 7.



Figure 7. WIM Simulation program

IV. EXPERIMENTAL RESULTS

In this paper, we take advantage of the optimized WIM algorithm to analyze the proposed capacitive iris characteristics. We will show an iris analysis results, an efficient WIM simulation to compare with the CST simulation and theory.

Capacitive Obstacle. Α.

The vertical obstacle section transforms the capacitive equivalent circuit, as shown in Figure 8. The dimensions of rectangular waveguide consist of a width (a) equal to 48 mm, a height (b) equal to 32 mm a length (c) equal to 96 mm and the usable obstacle width (d) equal to 16 mm. The cutoff frequency of the waveguide is 4.687 GHz.



(a) Overall perspective (b) Cross sectional view (c) Equivalent circuit Figure 8. Capacitive obstacle structure.







Figure 9 presents the electromagnetic field on the capacitive iris circuit, the normalized electric field peak is at the metal edge, and minimum values are occurred in remote areas. On the other hand, the current density distributions on the conductor of windows will stabilize when the calculated result converges (Approximately 300 rounds or more).



Figure 10. Comparison of dB(S11) and dB(S21) with WIM, CST and Theory

Figure 10 presents the comparison of dB(S11) and dB(S21) of the capacitive obstacle using the WIM, CST simulation and Theory [5]. In this case, we can obtain the -3 dB cutoff frequency at 6.2 GHz. This comparison revealed good agreement. However, the error caused by the difference of pixel structure define appears a small, we observed that the shunt capacitive iris circuit is presented as a low pass filter.



Figure 11. The capacitance of capacitive obstacle.

Figure 11 presents the capacitance of capacitive obstacle in frequency range from 4.7-7 GHz following the width of obstacle of iris. We observed that the width of obstacle increased, the capacitance will decrease. The simulated result is consistent to the capacitor property.

B. Asymmetrical Window

The asymmetrical window section transforms the capacitive equivalent circuit, as shown in Figure 12. The

dimensions of rectangular waveguide consist of a width (a) equal to 48 mm, a height (b) equal to 32 mm a length (c) equal to 96 mm and the usable obstacle width (d) equal to 20 mm. The cutoff frequency of the waveguide is 4.687 GHz.



(a) Overall perspective (b) Cross sectional view (c) Equivalent circuit Figure 12. Asymmetrical Window structure .



Figure 13 presents the electromagnetic field on the asymmetrical capacitive iris structure, the normalized electric field peak is at the metal edge, and the minimum field values are occurred in remote areas. On the other hand, the current density distributions will appear on the conductor of the windows.



Figure 14. Comparison of dB(S11,S21) with WIM, CST and Theory

In Figure 14, the compared results of dB(S11) and dB(S21) among the WIM, CST simulation, and theory [5] are in agreement. We observed that the cutoff frequency is 6.35 GHz at -3 dB, and the shunt capacitive equivalent circuit is presented as a low pass filter.

Figure 15 presents the capacitance of the capacitive obstacle in frequency range from 4.7-6.7 GHz following the variable width of obstacle window. We observed that the obstacle width increased, the capacitance will decrease. The simulated results are consistent to the capacitor property.





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Figure 15. The capacitance of capacitive obstacle.

C. Symmetrical Obstacle.

The symmetrical obstacle section transforms the capacitive equivalent circuit, as shown in Figure 16. The dimensions of rectangular waveguide consist of a width (a) equal to 48 mm, a height (b) equal to 32 mm a length (c) equal to 96 mm and the usable metal width (m) equal to 18 mm. The cutoff frequency of the waveguide is 4.678 GHz.



(a) Overall perspective (b) Cross sectional view (c) Equivalent circuit Figure 16. Symmetrical obstacle structure.

Figure 17 presents the electromagnetic field on the symmetrical capacitive iris structure, the normalized electric field peak is at the metal edge, and the minimum field values are occurred in remote areas. On the other hand, the current density distributions will appear on the conductor of the windows.



Figure 17. Electromagnetic field on iris structure.



Figure 18. Comparison of dB(S11,S21) with WIM, CST and Theory

Figure 18 presents the dB(S11) and dB(S21) at the operating frequency of 4.7-8 GHz, we have seen that the -3 dB cutoff frequency is 6.5GHz of a low pass filter. The obtained results are good agreement among the WIM, CST simulation, and theory [5].



Figure 19. The inductance of inductive obstacle.

Figure 19 presents the capacitance of the capacitive obstacle in frequency range from 4.7-8 GHz following the width of obstacle of iris structure. We observed that the width of obstacle increased, the capacitance will decrease. The results are consistent to the capacitor property.

V. CONCLUSION

We have been demonstrated the full wave analysis tool based on the Wave Iterative Method (WIM) algorithm to analyze the capacitive iris characteristics. The WIM algorithm can provide a reasonably approximation values in comparing to conventional simulation tools, its accuracy is dependent on usable pixel size and mode number. The WIM algorithm can be developed to analysis and design of various microwave circuits technology. Additionally, The WIM simulation can be used effectively as a teaching media in the teaching of telecommunication engineering.

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Modeling of Multiple Reservoir Operation System for Water Supply using Genetic Algorithm

Panuwat Pinthong

Center for Water Engineering and Infrastructure Research King Mongkut's University of Technology North Bangkok 1518 Pracharaj1 Rd. Bangsue Bangkok 10800 Thailand panuwat.pinthong@gmail.com

Abstract- The problem of reservoir operation with the complexity of river basin management including multipurpose and multi-reservoir system is a challenging to find suitable operation. This paper proposed the genetic algorithm (GA), an optimization technique for deriving the optimal reservoir operation rule. The applicable of this modeling is demonstrated in multi-reservoirs namely upper Lam Chiang Krai (ULCK), Huai Prasart Yai (HPY) and lower Lam Chiang Krai (LLCK), Lam Chiang Krai River Basin, Thailand. Those reservoirs play an important role for providing water to irrigation area totally 13 projects. The objective function is formulated to minimize the deficit of water under the reservoir storage constraint, the release constraint for all purposes. The reliability, the vulnerability and the resiliency are employed as indicators to evaluate the model performance in meeting objectives of satisfying water demand. As a result, it is shown that the optimal reservoir rule gave higher reliability for water supply more than 96%. The vulnerability and the resiliency result in acceptable value. By using GA technique, the reservoir operation rule can be adopted for multi-reservoir operation of Lam Chiang Krai river basin.

Keywords: Optimization, Genetic Algorithms, Reservoir Operation, Multiple Reservoir System, Lam Chiang Krai

I. INTRODUCTION

The operation and management of multipurpose multireservoir in river basin system has a complexity in dealing with the variation of stochastic nature due to the changed in hydrological process, the demand from community and others. So, the reservoir rule curve has been developed as a tool for regulating the water level and storage in according to the demand and maximum capacity of reservoir. However, the management of multipurpose and multi-reservoir is especially challenged in term of the derivation of optimal operating rule. In this paper presents the modeling of multiple reservoir system for water allocation in order to minimize the deficits from irrigation area and to integrate the river basin management system.

The study area is demonstrated in Figure 1 namely Lam Chiang Krai River Basin. It is originated from mountainous area at Bamnet Narong district, Chaiyaphum province. The Lam Chiang Krai River which is the main river has approximately 145 kilometers length. The watershed area is estimated to be 3,752 square kilometers or around 2,345 rai. There are three reservoirs located on the Lam Chiang Krai River: upper Lam Chiang Krai (ULCK), Huai Prasart Yai (HPY) and Lower Lam Chiang Krai (LLCK).



Figure 1 Lam Chiang Krai River Basin

According to the physical characteristics of ULCK, HPY and LLCK, it is noticed that the active capacity of those three reservoirs is not capable of supplying to the demand. Due to demand for irrigation area is required 76.26 mcm. In the meanwhile, the active capacity of three reservoirs is totally 40.90 mcm as summarized in Table 1. For this reason, the multiple reservoir operation of Lam Chiang Krai River Basin need to be investigated in order to find out the proper alternatives which focus on the efficiency of water allocation and the severity of shortage period.

TABLE 1 Average inflow, Demand and Active capacity of ULCK,

 HPY and LLCK reservoirs

In I and ELCK reservoirs				
Peservoir	Avg. inflow	Demand	Active Capacity	
Reservoir	(mcm/year)	(mcm/year)	(mcm)	
Lam Chiang Krai (upper)	44.50	42.89	4.50	
Huai Prasart Yai	9.31	7.91	8.70	
Lam Chiang Krai (lower)	106.48	25.46	27.70	
Total		76.26	40.90	

The ULCK, HPY and LLCK reservoirs supply water for irrigation as a main purpose to irrigation area totally 13 projects. The water allocation system of Lam Chiang Krai River Basin is carried out by considering the priority from the downstream demand. The schematic





diagram of Lam Chiang Krai River Basin is demonstrated in Figure 2. HPY reservoir is responsible for supplying water to downstream of reservoir 5,126 rai and to irrigation area in sub-watershed 1,050 rai only. For ULCK reservoir, it allocates water to Dan-Khun-Thot waterworks and irrigation area 1,700 rai as the first priority. The LLCK reservoir mainly supplies water to irrigation area 21,000 rai. For the irrigation area 700 rai, 11,500 rai and 11,300 rai received the water supply from ULCK and HPY, respectively. The irrigation area of 500 rai, 700 rai, 6750 rai, 2264 rai and 2000 rai are supplied water from LLCK, ULCK and HPY respectively. Moreover, once LLCK reservoir has less storage, the downstream area of LLCK can be supplied water from the ULCK reservoir.



Figure 2 Schematic Diagram of Lam Chiang Krai River Basin

II. MODELING APPROACH

The optimization and simulation approach have been widely applied for reservoir operation study in order to minimize loss or maximize benefit with multipurposemulti reservoir system. Several techniques are developed for reservoir operation based on the objectives, constraints and problem conditions to find out the optimal plan in avoiding the deficit and mitigating flood. Linear Programming (LP) technique has been used for searching rule curve as the flood control purpose by Needham J.T. et al, 2000 and Abrishamachi A. et al, 2011. However, it is found that LP has restriction in applying to nonlinear problem. In other word, LP technique is suitable for solving the problem in which the relation of variables in objective function and constraint are linear only.

Another technique is dynamic programming (DP). DP technique is able to deal with the complex system by dividing the large problem into the stage (time). The optimal answer for each stage is determined and carried on to the next stage until the last stage so it can reduce the computation time (Zhao T. et al., 2011 and Talukdar B. et al., 2011). DP technique is applied in maximizing the reservoir performance for water supply purpose of Bhumibol and Sirikit reservoir. Thailand hv Chaleeraktrakoon C. et al, 2005. The result indicated that DP technique is successful in improving the reservoir performance of multi-reservoir by minimizing the shortage period and the excessive volume above maximum capacity of reservoir. Labadie, J.W. 2004 and Yeh et al, 1985 reviewed the nonlinear programming (NLP) which is the development and integration of LP and DP techniques and pointed out that NLP technique is more complicate than LP technique and consumes a lot of computation time than DP technique.

Artificial Intelligent (AI) is one technique which emphasis on the logic system and the imitation of human thinking. In the present, AI technique has been developed because it is able to elaborate the complex problem and the stochastic of nature such as Fuzzy logic (FL), Artificial neural network (ANN) and Genetic Algorithm (GA) (Labadie, J.W. 2004). Many researches applied genetic algorithm for reservoir operation optimization. J. Ahmed, and A. Sarma, 2004 compared Genetic algorithm and stochastic dynamic programming (SDP) technique in optimization reservoir operation for irrigation purpose and hydropower purpose. J. Ahmed, and A. Sarma found that GA technique can improve the irrigation performance while the SDP technique provide the better performance in hydropower aspect than GA technique. Furthermore, the GA and LP technique were compared by Raju K.S. and Kumar D.N., 2004. The result indicated that GA technique still provides the higher performance than LP technique under the continuity constraint. water requirement, crop diversification and reservoir storage constraint because GA technique is capable of dealing with nonlinear problem. Hence, Azamathulla et al., 2008; L.F.R. Reis, F.T. Bessler, G.A. Walters and D. Savic, 2005 have applied both technique (GA and LP) for reservoir operation. Their researches have focused on the minimization of shortage period by considering the constraint of crop diversification. From their result, it can be said that the combination of both technique provided the accuracy and reliable result and also save the computation time.





From the literature review, it is seen that the GA technique has been widely used and compared to other techniques in optimization reservoir operation by many researchers due to the advantageous of GA technique which is able to solve the complex problem invented by nature. Therefore, this research applied GA technique to optimize the multipurpose multi-reservoir operation in consideration of the demand for irrigation system of Lam Chiang Krai River Basin.

III. DEVELOPMENT OF GENETIC ALGORITHM MODEL FOR RESERVOIR OPERATION

GENETIC ALGORITHM TECHNIQUE

Genetic Algorithm is a tool which is one of the best and simplest evolutionary algorithm used for optimization problem based on the concept of chromosome encoding. There are five main steps following the procedure for searching the optimal result as shown in Figure 3. The parameter of the problem should be defined such as population size, crossover, mutation and generation. The initial population is generated and evaluated by using fitness function. The individual with high fitness value is selected to produce the offspring in the next generation, while the individual with low fitness value is rejected. The new generation of population is derived from the good generations of the previous generation by using the crossover and mutation method as demonstrated in Figure 4 and Figure 5, respectively. The process is terminated when the best individual is found with the specified minimum error or when the specified number of generation is reached.



Figure 3: Flow chart of genetic algorithm

DEVELOPMENT OF GENETIC ALGORITHM FOR RESERVOIR OPERATION

The genetic algorithm technique is developed for searching the optimal rule curve by considering the reservoir water level, demand from downstream and reservoir storage. The main objective is to minimize the amount of deficit for irrigation purpose of Lam Chiang Krai River Basin. From water allocation system of Lam Chiang Krai River Basin,



The objective function in this study is set as equation 1 and the constraints are shown in equation 2 and 3 respectively. The reservoir storage and reservoir release constraint as mentioned before are applied to every time step of simulation period.

Objective fur	nction	
Min TDF =	$\sum_{i=1}^{n} \sum_{t=1}^{T} DF_i(t)$	(1)

The reservoir storage constraint,

 $S_{\min} \le S_{R1}, S_{R2}, S_{R3} \le S_{\max}$ (2)

The reservoir release constraint,

$$R_{\min} \leq R_{R1}, R_{R2}, R_{R3} \leq R_{\max} \tag{3}$$

The continuity constraint

$$S_{t}(t+1) = S_{t}(t) + I_{t}(t) + MR_{t}(t) - E_{t}(t)$$
(4)

When **TDF** = Total Deficit of three reservoirs (mcm)

 $DF_i(t) = deficit at time t (mcm)$

 $R_i(t)$ = reservoir release (mcm)

S_i(t) = reservoir storage (mcm)

 $I_{1}(t) =$ inflow to reservoir (mcm)

 $E_{\rm f}(t)$ = evaporation of reservoir (mcm)





 $MR_i(t)$ = matrix n x m of reservoir release from reservoir to another reservoir

- i = number of reservoir
- t = time of simulation

IV. RESULTS AND DISCUSSION

The operation of reservoir release has been implemented by considering the designed rule curve or specified water level. Figure 6 demonstrated the reservoir operation rule which are divided into the number of zones based on the priority of downstream area. It can be explained that the reservoir has an ability in providing the demand requirement to all downstream areas when the water storage is in zone 1. If the water storage is in zone 2, it might have some reduction in releasing to downstream irrigation area. Furthermore, the reservoir release is operated on minimum requirement in case of water storage is in minimum operation level zone. Lastly, there is no any releasing from reservoir when the water storage is in dead storage zone.



The decision variables in Genetic algorithm technique (GA) which is used for monthly simulation of Lam Chiang Krai consist of reservoir storage for reserved demand totally 36 variables. From the 36 variables of reservoir storage variables, it can be constructed to three chromosomes following the genetic algorithm technique as described in third section. Each of chromosome comprises of 12 genes and the size of population is 50.

The crossover probability in this study is defined as 0.5, 0.6, 0.7, 0.8, 0.9 and 0.95. The population size is 50. Mutation probability is equal to 0.01 and Generation is 100 based on the roulette selection method and single point crossover method as showing in Figure 7 and Figure 8, respectively. It is shown that crossover probability which is given the minimum deficit is 0.80. In general, the mutation probability is defined in the range 0.01 to 0.20. So, this research analyzed the suitable mutation probability equivalent to 0.01, 0.025, 0.05, 0.10, 0.15 and 0.20 and using the crossover probability equal to 0.80.







Figure 8: Minimum fitness of mutation probability





The Generation is defined to be 100, 300, 500, 700, 1000 and 3000 with using crossover probability and mutation probability equal to 0.80 and 0.01, respectively. By defining population size as 50 and using the roulette selection method and single point crossover method, it is found that the number of generation has increased. So, the result has been converged to the optimal solution. In this case, the minimum deficit is taken place at generation 3000 as demonstrated in Figure 9.

The parameter defining in genetic algorithm which is used for optimal reservoir operation is summarized as following:

- Population size = 50
- Fitness scaling = Rank
- Selection = Roulette
- Crossover = 0.80
- Mutation probability = 0.01
- Crossover = Single point
- Generation = 10,000

The optimization for reservoir operation of Lam Chiang Krai River Basin has been done by the





combination of simulation and optimization technique. In optimization technique, the genetic algorithm has bring into implementation as a tool for searching the optimal result. The hydrological data and meteorological data such as rainfall, runoff, and evaporation including reservoir characteristics are taken into consideration within the period 1976 to 2005.

The schematic diagram for reservoir operation is demonstrated in Figure 10. The runoff, rainfall, reservoir characteristic, water demand and downstream condition is fed into the model as input data to reservoir simulation model based on the water balance concept. After that, the performance evaluation such as reliability, vulnerability and resiliency are evaluated by minimizing the amount of water deficit at downstream condition.



Figure 10: Diagram for reservoir operating rule

The reservoir operating rule of upper Lam Chiang Krai, Huai Prasart Yai and lower Lam Chiang Krai reservoirs derived from genetic algorithm in existing case and diversion case for irrigation area as shown in Figure 11, respectively. Table 2 summarizes the reservoir release rule of ULCK, HPY and LLCK reservoir following the demand requirement and priority of downstream area.

The ULCK and HPY reservoirs provide water according to the demand requirement from all downstream area in case water storage is in Zone 1 or reserved storage for demand 1 as shown in Figure 6. However, if water storage is in zone 2 or reserved storage for demand 2, the ULCK and HPY supply water equally to demand to first priority of downstream area and provides only 80 percent of demand to second and third priority of downstream area. In case water storage is in zone 3, the ULCK and HPY provide water 80 percent of demand and 20 percent of demand to the first and second priority of downstream area, respectively without supplying water to third priority area. Lastly, if water storage is in zone 4, only the first priority of downstream area received the demand while others lacking.

		Release (mcm)			
Water	1 st Priority	2 nd Priority	3 rd Priority		
Storage	of	of	of		
Zone	downstream	downstream	downstream		
	area	area	area		
	Upper Lam C	Upper Lam Chiang Krai (ULCK)			
Zona 1	100% of	100% of	100% of		
Zone 1	demand	demand	demand		
72	100% of	80% of	80% of		
Zone 2	demand	demand	demand		
7	80% of	20% of			
Zone 3	demand	demand	-		
7	20% of				
Zone 4	demand	-	-		
	Huai Prasart Yai (HPY)				
Zana 1	100% of	100% of	100% of		
Zone 1	demand	demand	demand		
Zono 2	100% of	80% of	80% of		
Zone 2	demand	demand	demand		
Zono 3	80% of	20% of			
Lone 3	demand	demand	-		
Zono 4	20% of				
Zone 4	demand	-	-		
Lower Lam Chiang Krai (LLCK)					
Zona 1	100% of	100% of			
Zone 1	demand	demand	-		
Zono 2	100% of	80% of			
Zone 2	demand	demand	-		
Zono 3	80% of	20% of			
Zone 5	demand	demand	-		
Zono 4	20% of				
Zone 4	demand	-	-		

TABLE 2 The release rule of ULCK, HPY and LLCK reservoirs

For LLCK reservoir, it is responsible for first and second priority of downstream area. The water is supplied to all downstream area of LLCK equally to the demand requirement in case water storage is in zone 1. If water storage is in zone 2, the LLCK reservoir provides water to second priority area only 80 percent of demand while the first priority of downstream area is gained 100 percent of demand. In case water storage is in zone 3, the first priority and second priority of downstream area received 80 percent and 20 percent of demand, respectively. Finally, if water storage is in zone 4, the LLCK reservoir provides water to first priority area 20 percent of demand without supplying to other any areas.

The optimal rule curve of three reservoirs are derived with simulation period during 1976-2005 as shown in Figure 12. It is found that the average deficit of Lam Chiang Krai river basin was estimated to be 28.60 million cubic meters per year or 20 percent of total demand. The deficit mostly has been taken place during rainy season (May to October). Moreover, the drought year of upper Lam Chiang Krai and Huai Prasart Yai reservoir were 8 years out of 30 years simulation periods and the drought year of lower Lam Chiang Krai happened 2 years or 6 percent as summarized in Table 3





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c) Lower Lam Chiang Krai

Figure 11: Reservoir Operation Rule Curve of multi-reservoir system

TABLE 3 Comparison of demand, release and deficit of Lam Chiang

 Krai River Basin

Month	Average monthly volume (mcm)		
wonth	Demand	Release	Deficit
Apr	3.29	2.8	0.49
May	2.14	1.74	0.4
Jun	1.86	1.52	0.34
Jul	38.83	23.66	15.17
Aug	29.12	20.54	8.58
Sep	20.89	20.45	0.44
Oct	22.83	22.37	0.46
Nov	5.16	5.13	0.03
Dec	1.97	1.96	0.01
Jan.	3.18	2.63	0.55
Feb	5.62	4.55	1.07
Mar	5.14	4.08	1.06
Wet	115.67	90.29	25.38
Dry	24.35	21.13	3.22
Annual	140.02	111.42	28.6



The simulation of monthly reservoir storage is showing in Figure 13. It can be concluded that the water storage of upper Lam Chiang Krai, Huai Prasart Yai and lower Lam Chaing Krai had been nearly reached to the normal capacity of reservoir in January which is consistent with the strategy for reservoir operation. On the other word, the reservoir operators have to keep avaliable storage during rainy season in order to reserve water uses in dry season. The water storage of upper Lam Chaing Krai has an average monthly 3.54 mcm or 78 percentage of normal capacity. For Huai Prasart Yai and lower Lam Chaing Krai, the water storage are 5.07 and 21.82 mcm or 58 and 79 percentage of normal capacity, respectively. Furthermore, the minimum water storage of those three reservoir are found to be 1.65, 2.87 and 12 mcm or 36, 33 and 43 percentage of normal capacity, respectively.







Figure 13: Average monthly reservoir volume

V. CONCLUSIONS AND SUGGESSION

The conclusion of this research can be made that the simulation of water allocation for multi reservoir sytem by using genetic algorithm is able to improve the reservoir operation plan as seen in the evaluation of reservoir performance. The reliability for water supply is more than 96 percent. The vulnerability is 20 percentage of total demand occurring ordinarily in rainy season. The resiliency of upper Lam Chaing Krai and Huai Prasart Yai reservoir is discovered to be 26 percent from total 30 years simulation periods. The resiliency of lower Lam Chaing Krai reservoir is 6 percent which is acceptable. In addition, this research explored that the reservoir operaing rule derived from genetic algorithm can rise the capability of water supply to the deficit irrigation area.

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Query and Answering on Computer Science Documents base on Ontology

Thanyaporn Boonyoung Faculty of Information Technology King Mongkut's University of Technology North Bangkok Bangkok, Thailand thanyaporn.b@rmutt.ac.th

Abstract— The limitations of information retrieval systems traditionally are not enable us to understand the meaning of user's query. Most existing assignment based on the information retrieval term frequency (tf) that appear in the document. In this paper, we have presented the answering for Computer Science documents using Computer Science Ontology that significantly improve the accuracy of recall. The results can answer about popular researching of Computer Science Knowledge area in country and can shows document similarity score with Computer Science areas. For instance, the most similarity score of the document #115 is Software Engineering and Social and Professional Issue (46.512%).

Keywords—Document Similarity; Query and Answer; Ontology;

I. INTRODUCTION

The rapidly growth of information technology are improved to brought new challenges for research paper retrieval. While most of existing research paper databases use matching search technology based on exactly keyword and purely statistical techniques, this retrieval processing does not consider any semantic information. The limitations of pure keyword based search are not enable us to understand the meaning of keyword and the ability to distinguish between relevant and irrelevant keywords that became important for user's query. Semantic search can solved the limitations of keywordbased search by semantic measuring among words, concepts or ontologies and became methods to understanding keyword meaning. The nature of keyword meaning is what it refer to and reference to things (entities, relations).

In some situations in which semantic search can help, such as When user can't remember exactly what they was looking for or can't remember how to spell the search term. For example, when user interested research document about "decision making", keywords similarity or keywords related cannot considered e.g., decision tree, decision making and supporting decision making that similarity keywords are not able to include in user's query. Another problem is the difference in the word usage, for example, United Kingdom, UK and England Anirach Mingkhwan Faculty of Industrial and Technology Management King Mongkut's University of Technology North Bangkok Prachinburi, Thailand anirach@ieee.org

may refer to the same country. Semantic search uses language processing to assess the "meaning" of content to return more relevant results. Semantic search technique, as an application of Semantic Web in the field of information retrieval, improve performance of retrieval.

Ontology engineering is involved with making representational choices that capture the relevant distinctions of a domain at the highest level of abstraction while still being as clear as possible about the meanings of terms. The importance of ontology operation is computing semantic similarity between terms such as mapping aligning, and integrating. The goal of ontology is to catch the knowledge in the correlation domain; provide common understanding about knowledge and determine the approval glossary in this domain; and produce the clear definition about these terminologies and the relations between the glossaries from the formalized pattern in different levels [1].

Several researches propose about ontology construction based on semantic similarity ontology matching and semantic indexing referring to semantic closeness or nearness. It computes similarity between different search terms. OWL (Web Ontology Language) defines any instance of a term in RDF (Resource Description Framework) triples instead of keywords. The form of RDF triples is submitted in the query which is expanded through synonyms and semantic neighborhood using the distance based approach [2]-[3].

In this paper, we adopt structure of research paper ontology and apply to semantic search using Computer Science ontology [4]-[6]. In addition, we compute document similarity with knowledge of Computer Science and proposed the process for finding popular keywords in country. The result is presented in infographics.

The rest of this paper is organized as follows : A review related work on document similarity measure in Section 2; Computer Science document ontology, ontology design, RDF triple and Computer Science knowledge taxonomy used in this work, Section 3; a query and answering process in Section 4; and the experiment results of our approach following by Conclusion in Section 5.



II. RELATED WORK

The recently-emerging ontology and the information retrieval are reviewed in this section.

A. Ontology

Boanergers Aleman-Meza proposed SwetoDblp ontology of Computer Science publications in RDF from an XML document. The following guidelines for the creation of SwetoDblp are creation of URIs that can be easily recognized and/or reused on other applications or datasets; usage of existing vocabulary whenever is possible and integration of relationships and entities from additional data sources [7].

Furthermore, Tim Berners-Lee[8] recommended four principles in order to link data around the world below.

1. Use URIs as name for things (resources) in order to identify them.

2. Use HTTP URIs, so that people and machines can look up those URIs.

3. When someone looks up an URI, they provide useful information about the URI by using the standards such as RDF and SPARQL.

4. Include links to other resources in order to enable the discovery more data.

Sung Shun Weng designed ontology construction system architecture using information retrieval terms, such as term parsing, and calculating weight of related term[9].

Xiaomei Xu proposed query expansion and ontology construction algorithm query system for digital libraries. It has been used widely in natural language processing (NLP) and information retrieval applications. The core concept in WordNet was synsets, which was a set of synonyms [10].

The OWL Web Ontology Language extends the RDFS vocabulary with additional resources that can be used to build more expressive ontologies for the Web. OWL introduces added restrictions regarding the structure and contents of RDF documents in order to make processing and reasoning more computationally decidable. OWL uses the RDF and RDFS, XML Schema datatypes, and OWL namespaces. The system provides a searching module to match between keyword and user's query based on the search semantic algorithm, including applying the SPARQL[11], which is a query language to exact RDF.

B. Information Retrieval

Term-frequency (tf) Weight [12] in the given document is simply the number of times a given term appears in that document. This count is usually normalized to prevent a bias towards longer documents (which may have a higher term frequency regardless of the actual importance of that term in the document) to give a measure of the importance of the term t_i within the

particular document can be calculated by formula (1). The matching scores cannot show what we want because the relevance document does not increase with more term frequency. So we use log frequency weighting (2) instead.

$$tf_{i,j} = f_{i,j} / (\max_{\nu} f_{k,j})$$
(1)

$$w_{t,d} = \begin{cases} 1 + log_{10}tf_{t,d} , & \text{if } \text{tf}_{t,d} > 0 \\ 0, & \text{otherwise} \end{cases}$$
(2)

III. COMPUTER SCIENCE DOCUMENT ONTOLOGY

We set up structure of the computer science research paper ontology using a set of relations and a set of terms. In addition, we collected documents in field of Computer Science from Scopus database.

A. Ontology Design

We designed computer science research ontology. Ontologies are specifications of vocabularies and relations

1) Ontology Structure

The structure of the Computer Science paper ontology has been designed from six important parts on research document: Title, Author, Affiliation, Keyword, Conference Name, and Year. The structure is shown on Figure 1.

2) Define Vocabularies and relations

We made the usage of existing vocabulary or namespace whenever is possible such as dublin core,FOAF. For namespaces are shown on Table 1. Figure 2. An ontology fragment representing computer science research Entity terms and their relationships. In this graphical notation, ellipses denote terms, arrows denote relationships and cardinallity.

Table 1 : Namespace and URI

Metadata	Namespace	Namespace URI
Title	dc:Title	http://purl.org/dc/elements/1.1/
Author	foaf:person swrc:author	http://xmlns.com/foaf/0.1/ http://swrc.ontoware.org/ontology#
Affiliation	foaf:Organization swrc:affiliation	http://xmlns.com/foaf/0.1/ http://swrc.ontoware.org/ontology#
Keyword	dc:Subject	http://purl.org/dc/elements/1.1/
Year	dc:Date	http://purl.org/dc/elements/1.1/
Document Type	foaf:Document	http://xmlns.com/foaf/0.1/#Document
Reference	dc.Reference	http://purl.org/dc/elements/1.1/



Figure1. Illustration of Computer Science Research Entity Concepts and Relationships







B. RDF Triple

We represented with three values for RDF is called the triple. The identifier for the row was called the domain (subject) of the triple. The identifier for the column was called the object property (predicate) of the triple and the value in the cell was called the range (object) of the triple. Table 2 shows example for the triple in article.

Domain	Object Property	Range
Class : dc:Title	dc:Subject	Class : dc:Subject
Class : foaf:Person	swrc:Author	Class : dc:Title
	CoAuthor	
Class : foaf:Person	swrc:Affiliation	Class :
		foaf:Organization
dc.Subject	data mining torong tem tem tem tem tem tem tem tem tem tem	de:Title rightspe Multi-source Data Muscaensent on Internet



Figure 2 Example of Concepts and Relationships Related a Research Paper *B. Computer Science Knowledge Taxonomy*

Thanyaporn and Anirach (2012) adopted ontology for knowledge of computer science, reference from computer science curricula 2013 draft report [13] that had been endorsed by the Association for Computing Machinery (ACM) and IEEE Computer Society. Computer Science Curricula 2013 (CS2013), represented a comprehensive revision. 11 CS2013 redefined the knowledge units in Computer Science (CS).



Figure 4 Illustration of Computer Science Ontology Hierarchy

The last complete Computer Science curricular volume was 9 released in 2001 (CC2001), and an interim review effort concluded in 2008 (CS2008). The CS2013 Body of Knowledge was organized into a set of 18 Knowledge Areas (KAs) in Figure 3, 70 corresponding to topical areas of study in computing. The taxonomic hierarchy (ontology) model of computer science keywords(terms) was organized in Is-A relationships (Hyponym/Hypernym) with more general terms (e.g. "Operating System and Digital Forensic", "Information Management and Database System") higher in Information Management taxonomy than more specific terms (e.g. "Object-oriented model", "Indexing"). A keyword (term) may appear in more than one taxonomy, such as "Information Retrieval" term of Information Management and Intelligent Systems is shown in Figure 4. There was four levels, eighteen taxonomies and more than 200 terms.

As an example, Keywords in Research document about : "Data Model". We extracted possible meaning of keyword based on Computer Science ontology. Finding synonym, hypernym/ hyponym meronym/holonym and related term shown that in Figure **5**.

Hypernym Term : Information Management

Hyponym Terms are : Conceptual models, Objectoriented model, Relational data model, Semi structured data model



Figure 3 Knowledge Area of Computer Science



Figure 5 Illustration Data Model Context





IV. QUERY AND ANSWERING PROCESS

In previous experiment, we introduced a new weighting method based on semantic similarity using Computer Science ontology [4] for support semantic search in Computer Science document repositories. The next experiment, we proposed document similarity using Computer Science Ontology based on Edge Counting and N-Grams for a re-ranking process of search results. The last experiment, we represented using the vector-space model (cosine similarity) for semantic ranking [6]. In the model, we used Term-Frequency (TF) for compute document as vector and considered hierarchy relationship using Computer Science ontology for compute query as vector.

This section described the query and answering process to Computer Science Knowledge. In the document keyword set, a document was represented by a keyword vector, i.e., document = $(keyword_1, \ldots, keyword_j, \ldots, keyword_n)$ ($1 \le i \le n$). We described the process for answering from two user' questions.

• For the question 1, we computed by formula (3)

$$SimCS_{area} = \frac{\sum ft_{i,d} \times 100}{N}$$
(3)

where SimCS_{area} was Document Similarity in Area of Computer Science; area was the body of knowledge in Computer Science Ontology; f_t was number of terms where the term t d appeared in area of Computer Science Ontology; N = Total number of term frequency in document (d); i was a term(keyword) in document;

V. EXPERIMENTS

In this section we summarized the main experiments and the results obtained in the study. The 1769

Computer Science Ontology and Computer Science documents were used to test

the proposed system.

For example 1, user's question : User want to find the document similarity of Document #115 to the Computer Science areas.

(Document Title : Decision making during a tendering procedure : Case studies of restricted European tenders in Architecture)

We also computed document similarity in Computer Science areas by formula (3), the results shown in Table 3 and figure 6.

Table 3 Document Similarity with Computer Science Areas

		*
No.	Computer Science	Document
	Areas	Similarity (%)
1	SE	46.51163
2	SP	46.51163
3	CN	34.88372
4	PL	23.25581
5	IS	13.95349
6	IAS	11.62791
7	IM	9.302326
8	SF	4.651163



Figure 6 Illustration Document Similarity with Computer Science Areas



Figure 7 Illustration Popular Computer Science Knowledge Areas in England

For example 2, user's question: What is a <u>*Computer*</u> <u>Science knowledge areas</u> that most popular researching in <u>*England*</u>?

For Semantic Search, We considered related word that found United Kingdom Set = {United Kingdom, UK, England}

Some authors may identified their difference country name, such as England, United Kingdom and UK.

Country Name	Number of Doc	Precision	Recall	F-Measure
United Kingdom	80	0.684	1	0.812
UK	36	0.308	1	0.471
England	1	0.008	1	0.017
United Kingdom Set	117	1	1	1

After retrieving relevant documents, we also count all maximum keyword that found of all, the results show in Table 4,5 and figure 7.





Computer Science Knowledge Areas	Abbr.	Total of Document Related	Computer Science Knowledge Areas	Abbr.	Total of Document Related
Software Engineering	SE	25	Social and Professional Issues	SP	3
Operating Systems	OS	15	Platform-based Development	PBD	2
Computational Science	CN	13	Parallel and Distributed Computing	PD	2
Human-Computer Interaction	HCI	9	Systems Fundamentals	SF	2
Information Management	IM	8	Architecture and Organization	AR	1
Intelligent Systems	IS	6	Graphics and Visual Computing	GV	1
Programming Languages	PL	4	Security and Information Assurance	SIA	1

VI. CONCLUSION

In this paper, we have presented the answering for Computer Science documents using Computer Science Ontology, such as, document similarity with Knowledge of Computer Science and the finding a popular terms in Country.

The results in table 3 show the percentile of document similarity with Computer Science knowledge areas. The similarity score of the document #115 are Software Engineering (46.512%), Social and Professional Issue (46.512%), Computational Science (34.884%), Programming Languages(23.256%), Intelligent Systems (13.953%), Security and Information Assurance (11.628%), Information Management(9.302%) and Systems Fundamentals (4.651%).

The results in Table 4 show the semantic similarity measure significantly improve the accuracy (F-measure of 1) and Table 5 show the total of document related with Computer Science Knowledge in England.

Future studies should apply the proposed method to applications of semantic search using Computer Science ontology, and display the results using information visualization technique.

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A Comparison of Classification Algorithms on the O-NET Scores

Thanrat Sintanakul¹, Charun Sanrach²

Department of Computer Education: Faculty of Technical Education King Mongkut's University of Technology North Bangkok, Bangkok, Thailand

(¹thanrats@kmutnb.ac.th, ²jsr@kmutnb.ac.th)

Abstract- In this study, we compared 3 classification algorithms, i.e. Decision Tree, Naïve Bayes, and k-Nearest Neighbour on the O-NET (Ordinary National Education Test) Scores. There are 10 attributes in our dataset – divided into 5 input attributes and 5 class attributes. We performed deleting missing values, selecting attributes, reducing attributes, and discretizing data as data preprocessing and then classified the prepared data with the 3 mentioned algorithms. The classification results showed that all algorithms performed at the same high level of accuracy for every cases of discretization. But only Naïve Bayes gave all 3 predicted classes, while the other two gave 1 and 2 classes in some cases. Therefore, the preferred algorithm for our dataset is Naïve Bayes.

Keywords – Classification Algorithms, O-NET Score, Decision Tree, Naïve Bayes, k-Nearest Neighbour.

I. INTRODUCTION

In Thailand, there is one kind of National Education Test called "O-NET", which stands for Ordinary National Education Test. O-NET is a basic national education examination for assessing knowledge and ideas of grade 6, grade 9, and grade 12 students in accordance with 67 learning standards stated in Basic Education Core Curriculum B.E. 2551 covering 8 major subject areas - Thai, Mathematics, Science, Social Science, English, Health and Physical Education, Art, and Career and Technology. All students of grade 6, 9, and 12 have to take this examination in order to use the result as a compulsory part of their graduation and to evaluate their academic proficiency at the national level [1].

Classification is a data mining technique that maps data into predefined groups or classes. It is a supervised learning method which requires labelled training data to generate rules for classifying test data into predetermined groups or classes. It is a two-phase process. The first phase is the learning phase, where the training data is analysed and classification rules are generated. The next phase is the classification, where test data is classified into classes according to the generated rules [2].

In this study, we compared 3 classification algorithms – Decision Tree, Naïve Bayes, and k-Nearest Neighbor (k-NN) - on 318,094 records of the O-NET Scores. Our dataset is composed of 10 Attributes, i.e. Thai1, Mathematics1, Science1, Social Science1, English1,

Thai2, Mathematics2, Science2, Social Science2, and English2 (when the number "1" in the last position of subject name identifies that the subject was in the examination for grade 9 students and the number "2" was the one for grade 12 students). Of these 10 attributes, we divided into 2 groups – input attributes, which are Thai1, Mathematics1, Science1, Social Science1, and English1, and class attributes, which are Thai2, Mathematics2, Science2, Social Science2, and English2. We used all 5 input attributes to build the classification model for each class attribute, using the 3 algorithms as mentioned above, and compare their performances.

II. LITERATURE REVIEW

A. Data Preprocessing

The purpose of Data Preprocessing is to transform the raw input data into an appropriate format for subsequent analysis. The steps involved in Data Preprocessing include fusing data from multiple sources, cleaning data to remove noise and duplicate observations, and selecting records and features that are relevant to the data mining task at hand [3].

B. Classification

Classification is one type of predicting modelling task, which is used for discrete target variables, in data mining. This task performs to assigning objects to one of several predefined categories/class. There are many algorithms used for classification, e.g. Decision Tree, Naïve Bayes, k-Nearest Neighbour, Neural Network, etc. [3]. However, in this paper, we will mention only the 3 algorithms that we chose for our work, i.e. Decision Tree, Naïve Bayes, and k-Nearest Neighbour.

A Decision Tree is a tree-like graph or model. It is more like an inverted tree because it has its root at the top and it grows downwards. This representation of the data has the advantage compared with other approaches of being meaningful and easy to interpret. The goal is to create a classification model that predicts the value of a target attribute (often called class or label) based on several input attributes of the dataset [4].

A Naïve Bayes classifier is a simple probabilistic classifier based on applying Bayes' theorem (from





Bayesian statistics) with strong (naive) independence assumptions. A more descriptive term for the underlying probability model would be 'independent feature model'. In simple terms, a Naïve Bayes classifier assumes that the presence (or absence) of a particular feature of a class (i.e. attribute) is unrelated to the presence (or absence) of any other feature [4].

The k-Nearest Neighbour algorithm is based on learning by analogy, that is, by comparing a given testing data with training data that are similar to it. The training data are described by n attributes. Each data represents a point in an n-dimensional space. In this way, all of the training data are stored in an n-dimensional pattern space. When given an unknown data, a k-nearest neighbour algorithm searches the pattern space for the k training data that are closest to the unknown data. These k training data are the k "nearest neighbours" of the unknown data. "Closeness" is defined in terms of a distance metric, such as the Euclidean distance [4].

C. Performance Evaluation

Evaluation of the performance of a classification model is based on the counts of test records correctly and incorrectly predicted by the model. These counts can be tabulated in a table known as a Confusion Matrix and can be summarized with a single number, i.e. Accuracy or Error Rate, that would make it more convenient to compare the performance of different models [3]. In this study, we used the accuracy to compare the performance of 3 algorithms so we will mention only the definition of the accuracy, as follows;

$$Accuracy = \frac{Number of Correct Predictions}{Total Number of Predictions}$$

D. Related Work

Nitaya et al. [5] reviewed the techniques for dealing with missing attribute values in data mining. Four approaches of handling missing values were introduced to the numeric and nominal datasets. The experimental results revealed the superior suggestive choice of ignoring numerical data instances with missing values, whereas replacing the unknown values with the symbol "?" produces a better classification results for the nominal dataset.

Dougherty et al. [6] reviewed previous work on continuous feature discretization identify defining characteristics of the methods and conducted an empirical evaluation of several methods. They compared binning, an unsupervised discretization method, to entropy-based and purity-based methods, which are supervised algorithms, and found that the performance of the Naïve Bayes algorithm significantly improved when features were discretized using an entropy-based method. In fact, over their tested datasets, the discretized version of Naïve Bayes slightly outperformed C4.5 on average. They also showed that in some cases the performance of the C4.5 induction algorithm significantly improved if features were discretized in advance.

Goyal [7] analyzed the five major classification algorithms: k-Nearest Neighbor (k-NN), Naïve Bayes (NB), Decision Tree (DT), Decision Stump (DS), and Rule Induction (RI) and compared the performances of these major algorithms. The results are tested on five datasets namely Weighting, Golf, Iris, Deals, and Labor, using Rapid Miner Studio. The k-NN and Rule Induction were performing well among the all algorithms, but the k-NN could be considered as the best among these algorithms for these datasets.

III. RESEARCH METHODOLOGY

A. Data Preprocessing

Data Pre-processing represents a prerequisite phase for data mining in the process of knowledge discovery in databases (KDD). Data pre-processing tasks are distinguished in data reduction, aiming at decreasing the size of the dataset by means of instance selection and/or feature selection, and data projection, altering the representation of the data, e.g. mapping continuous variables to categories or encoding nominal attributes [8].

In this study, we did 4 stages of data preprocessing, i.e. deleting missing values, selecting attributes, reducing attributes, and discretizing data, as the details shown below;

Deleting Missing Values

At first, we got 329,474 records of O-NET Scores with missing value. Then after deleting all records that have missing values, 318,094 records remained.

Selecting Attributes

Because the initial dataset had 15 attributes including unwanted attributes, i.e. Student ID, and 3 subjects considered not necessary for this study - Health and Physical Education, Art, and Career and Technology, then we ignored these attributes. Finally there are 10 remaining attributes, i.e. Thai1, Mathematics1, Science1, Social Science1, English1, Thai2, Mathematics2, Science2, Social Science2, and English2 (when the number "1" in the last position of subject name identifies that the subject was in the examination for grade 9 students and the number "2" was the one for grade 12 students).

Reducing attributes

Data reduction is performed by means of feature selection and/or instance selection. Feature selection aims at identifying the most relevant, explanatory input variables within a dataset. In addition to improving the performance of the predictors, feature selection facilitates a better understanding of the underlying process that generated the data. Also, reducing the feature-vector





condenses the size of the dataset, accelerating the task of training a classifier and thereby increasing computational efficiency [8].

In this study, we reduced attributes by analysing the relevant of 5 input attributes (Thai1, Mathematics1, Science1, Social Science1, and English1) with each of 5 class attributes (Thai2, Mathematics2, Science2, Social Science2, and English2) then we got the relevant class-input attributes as shown in Table I.

TABLE I: The relevant class-input attributes

Class Attribute	Relevant Input Attributes		
Math2	English1, Mathematics1, Science1		
Science2	Thai1, Mathematics1, Science1, Social Science1,		
	English1 (All input Attributes)		
Thai2	Thai1, Science1, Social Science1, English1		
English2	Thai1, Mathematics1, English1		
Social Science2	Thai1, Science1, Social Science1, English1		

Discretizing Data

Firstly, in this study, we discretized data using equal width interval binning approach. But this type of discretization is vulnerable to outliers that may drastically skew the range. Moreover, this approach do not utilize instance labels in setting partition boundaries, it is likely that classification information will be lost by binning as a result of combining values that are strongly associated with different classes into the same bin. In some cases this could make effective classification much more difficult [6]. Therefore, with respect to the mentioned drawback, we tried to discretize the data with our specification, in order to compare the classification accuracy of this discretization approach to the first one. We assigned 3 sets of discretization range as shown in Table II.

TABLE II: Assigned Discretization Range

C-4 N-	Upper-Limit Score assigned to Class				
Set No.	Low Medium		High		
1	27	73	100		
2	30	70	100		
3	33	66	100		

B. Classification

After preprocessing the data, we classified it with 3 algorithms, i.e. Decision Tree, Naïve Bayes, and k-Nearest Neighbor, using Rapid Miner Studio 6 as a tool. In addition, we compared the 3 algorithms on our dataset in 2 dimensions. The first dimension is comparing classification performances between using all input attributes and using only relevant input attributes of each class, as mentioned above. The second one is comparing classification performances among 4 discretization range.

The results of all these works were shown in the next section.

IV. RESULTS

In this study, we compared the performance of the selected classification algorithms using accuracy and number of predicted classes. Moreover, in order to compare the performance of Decision Tree with various discretization ranges, we also recorded the size of tree, which including Leaf Nodes.

The results of the classification were shown in Table 3 to Table 6 below.

TABLE III: Classification Performances when Discretizing Attributes

 by Binning

Algorithms Class Attributes		(Not i	All Attributes educed attribute	s)	Reduced Attribut		
		Accuracy	No. of Predicted Class	Size of Tree	Accuracy	No. of Predicted Class	Size of Tree
	Math2	88.81	3	10	88.81	3	10
	Science2	75.01	2	4	Canno	ot reduce attribut	es
Decision	Thai2	79.97	3	7	79.97	3	7
Tree	English2	91.17	2	4	91.17	2	4
	Social Science2	76.47	1	1	76.47	1	1
	Math2	86.62	3	N/A	88.71	3	N/A
	Science2	76.16	3	N/A	Cannot reduce attributes		es
Naïve	Thai2	79.33	3	N/A	79.28	3	N/A
Byes	English2	89.36	3	N/A	90.39	3	N/A
	Social Science2	71.50	3	N/A	74.48	3	N/A
	Math2	87.94	3	N/A	87.46	3	N/A
	Science2	74.06 3 N/A		Cannot reduce attributes		es	
k-Nearest	Thai2	79.70	3	N/A	79.85	3	N/A
Neighbour	English2	89.33	3	N/A	89.88	3	N/A
	Social Science2	75.31	3	N/A	75.05	3	N/A

From Table III, we can transform the data graphically, as shown in Fig. 1 and Fig. 2.



Figure 1. Classification Performances when Discretizing Attributes by Binning and Using All Attributes.



Figure 2. Classification Performances when Discretizing Attributes by Binning and Reducing Attributes.





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TABLE IV: Classification Performances when Discretizing Attributes

 by Range 27-73-100

From Table 4, we can transform the data graphically, as shown in Fig. 3 and Fig. 4.

Algorithms Class Attributes		(No	All Attributes t reduced attribut	es)	R	s		
		Accuracy	No. of Predicted Class	Size of Tree	Accuracy	No. of Predicted Class	Size of Tree	
	Math2	78.08	3	7	78.08	3	7	
	Science2	54.13	1	1	Cannot reduce attribute			
Decision	Thai2	89.51	1	1	89.51	1	1	
Tree	English2	86.25	2	10	84.23	2	4	
	Social Science2	81.02	1	1	81.02	1	1	
	Math2	78.23	3	N/A	78.23	3	N/A	
	Science2	65.09	3	N/A	Cann	nnot reduce attributes		
Naïve	Thai2	88.42	3	N/A	88.69	3	N/A	
Byes	English2	86.33	3	N/A	85.09	3	N/A	
	Social Science2	79.54	3	N/A	80.25	3	N/A	
	Math2	65.41	3	N/A	64.22	3	N/A	
	Science2	60.19	3	N/A	Cann	ot reduce attrib	outes	
k-Nearest	Thai2	88.34	3	N/A	88.89	3	N/A	
Neighbour	English2	60.57	3	N/A	57.58	3	N/A	
	Social Science2	80.00	2	N/A	71.37	2	N/A	

TABLE V: Classification Performances when Discretizing Attributes

 by Range 30-70-100

	Class	(Not reduced attributes)			Rec	s		
Algorithms A	Attributes	Accuracy	No. of Predicted Class	Size of Tree	Accuracy	No. of Predicted Class		
	Math2	86.64	3	7	86.64	3	7	
	Science2	74.74	2	4	Cannot reduce attribute			
Decision	Thai2	84.51	2	4	84.51	2	4	
Tree	English2	89.69	2	7	88.55	2	4	
	Social Science2	63.79	1	1	63.79	1	1	
	Math2	86.91	3	N/A	86.91	3	N/A	
	Science2	70.78	3	N/A	Cannot reduce attributes			
Naïve	Thai2	83.90	3	N/A	84.48	3	N/A	
Byes	English2	89.60	3	N/A	89.24	3	N/A	
	Social Science2	67.00	3	N/A	68.89	3	N/A	
	Math2	71.53	3	N/A	70.88	3	N/A	
,	Science2	74.12	3	N/A	Cannot reduce attribu		utes	
k- Nearest	Thai2	83.17	3	N/A	84.73	3	N/A	
Neighbour	English2	69.50	3	N/A	66.53	3	N/A	
-	Social Science2	60.85	2	N/A	62.66	2	N/A	

TABLE VI: Classification Performances when Discretizing Attributes

 by Range 33-66-100

Class		All Attributes (Not reduced attributes)			Reduced Attributes			
Algorithms	Attributes	Accuracy	No. of Predicted Class	Size of Tree	Accuracy No. o Predict Class	No. of Predicted Class	Size of Tree	
	Math2	88.63	3	7	88.63	3	7	
	Science2	85.22	2	4	Cannot	t reduce attr	ibutes	
Decision	Thai2	79.00	2	4	79.00	2	4	
Tree	English2	91.43	2	4	91.43	2	4	
	Social Science2	61.36	2	4	61.36	2	4	
	Math2	88.74	3	N/A	88.74	3	N/A	
	Science2	84.82	3	N/A	A Cannot reduce		attributes	
Naïve	Thai2	76.54	3	N/A	77.87	3	N/A	
Byes	English2	90.20	3	N/A	91.85	3	N/A	
	Social Science2	66.75	3	N/A	66.31	3	N/A	
	Math2	87.61	3	N/A	87.99	3	N/A	
	Science2	83.10	3	N/A	Cannot	t reduce attr	ibutes	
k-Nearest	Thai2	78.32	3	N/A	76.70	3	N/A	
Neighbour	English2	91.02	3	N/A	90.76	3	N/A	
	Social Science2	62.03	3	N/A	56.55	3	N/A	







Figure 4. Classification Performances when Discretizing Attributes by Range 27-73-100 and Reducing Attributes

From Table 5, we can transform the data graphically, as shown in Fig. 5 and Fig. 6.



Figure 5. Classification Performances when Discretizing Attributes by Range 30-70-100 and Using All Attributes



Figure 6. Classification Performances when Discretizing Attributes by Range 30-70-100 and Reducing Attributes





From Table 6, we can transform the data graphically, as shown in Fig. 7 and Fig. 8.



Figure 7. Classification Performances when Discretizing Attributes by Range 33-66-100 and Using All Attributes



Figure 8. Classification Performances when Discretizing Attributes by Range 33-66-100 and Reducing Attributes

V. CONCLUSION

From the classification performances shown above, we can make the conclusions as follows;

When discretizing data by Binning and by Range 33-66-100, all algorithms performed well, i.e. gave high level of accuracy for all class attributes and for both cases of input attributes using, i.e. using all input attributes and using only relevant input attributes of each class.

When discretizing data by Range 27-73-100 and Range 30-70-100, Decision Tree and Naïve Bayes performed at the same high level of accuracy in both cases of input attributes using, while k-NN gave significant lower accuracy than the others in both cases.

When we considered the suitable discretization range of each class, we found that the "Science2" class got the low accuracy whilst discretized by 27-73-100 Range, and "Social Science2" class got the low accuracy whilst discretized by 30-70-100 Range and 33-66-100 Range.

But other than accuracy, we also considered the number of classes that each algorithm can predict, due to its important for our future work. With this concern, only Naïve Bayes gave all 3 predicted classes in every case, while the other two gave 1 and 2 classes in some cases. Therefore, the preferred algorithm for our future work is Naïve Bayes.

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A Simulation of Inductive Iris Characteristics in Microwave Engineering Course

Pinit Nuangpirom and Somsak Akatimagool

Department of Teacher Training in Electrical Engineering, King Mongkut's University of Technology North Bangkok, 1518, Pracharat 1 Road, Wongsawang, Bangsue, Bangkok 10800

Abstract- Wave Iterative Method (WIM) is a numerical modeling for electromagnetic field analysis on various microwave circuits. Principles of transmission line, four terminal network parameter and boundary condition were applied to WIM simulation. In this research, the physical of inductive iris was illustrated to a mathematical model using GUI function and m-file of MATLAB. After using developed WIM simulation, the inductive iris characteristics, electric field, magnetic field can be analyzed correctly. The frequency response comparison agrees well with the theories and the classical simulation.

Keyword: Wave Iterative Method, Simulation tool, Inductive Iris

I. INTRODUCTION

Nowadays, numerical methods are important for scientists, engineers and researchers. The development and application are necessary for technical solutions [1-4]. Wave Iterative Method (WIM) is a numerical method that has been developed since 2001, and it's suitable to analyze various microwave circuits. [5-6]. Evolution of the WIM is developed to support microwave circuits, such as waveguides [7-8], filter [9] and communication engineering education [10-11]. The WIM advantage is easy to learn and to realize because the principle of transmission line, network parameters and boundary conditions are included in computation algorithm.

In this paper, we study and introduce an efficient WIM simulation based on iterative method and wave propagation for analysis of waveguide inductive obstacles. This method has been combined with mode matching technique to characterize the symmetrical and asymmetrical obstacles in a rectangular waveguide.

II. WAVE ITERATIVE METHOD

The computation algorithm for the electromagnetic wave propagation in a waveguide is based on the Wave Iterative Method (WIM) [5-11]. The WIM operating process, as shown in Figure 1, shows the amplitude and direction of the incident, reflected, and transmitted waves that propagate within a rectangular waveguide. On the obstacle, the waves are calculated in the real domain (pixels) and the waves in the free space are calculated in the spectrum domain (modes). For alternating between both domains, we use the Fast Fourier Transform (FFT)

and Inverse Fast Fourier Transform (IFFT) to reduce the computation time and to illustrate directly the electromagnetic field in the real domain.



Figure 1. The principle of Wave Iterative Method.

In Figure 1, the first step, the excited source $\binom{A_{(x,y)}^0}{(x,y)}$, propagate into the obstacle as iris circuit, and then the higher-mode waves caused by the scatter on the conductor surface will be incident and will reflect within the waveguide. An infinite numbers of reflected and transmitted waves are produced at the obstacle interface. Finally the calculation of waves will use the principle of mode matching at the input and output ports of the waveguide.

The excited wave $(A^0_{(x,y)})$ in the real domain of waveguide source can be done as follows:

$$A_x^{(0)} = \sqrt{\frac{2}{ab}} \cos \frac{\pi x}{a}, \ A_y^{(0)} = \sqrt{\frac{2}{ab}} \sin \frac{\pi y}{b}$$
(1)

where a is the width and b is the height of the waveguide. That is the matrix of x and y are obtained as

$$x = \left(\frac{a}{2m} : \frac{a}{m} : a\right), \quad y = \left(\frac{b}{2n} : \frac{b}{n} : b\right)$$
(2)

and m, n are number of $m \times n$ pixel





The reflected waves $(B_{x,y})$ in n^{th} iteration on the obstacle are

$$B_{x,y}^{(n)} = S_{x,y} A_{x,y}^{(n-1)} . \tag{3}$$

Where the scattering parameter $(S_{x,y})$ of waves in the real domain for a two-port network is defined as

$$\begin{bmatrix} S_{x,y} \end{bmatrix} = \begin{bmatrix} -S_{C(x,y)} & S_{D(x,y)} \\ S_{D(x,y)} - S_{C(x,y)} \end{bmatrix},$$
(4)

when S_C is equal to 1 in the conductor area and S_D is equal to 1 for the free space. To transform the wave from the real domain to the spectrum domain, we use the Fast Fourier Transform (FFT) of the TE/TM modes as equation following,

$$B_{i(m,n)}^{(n)} = \left[FFT\right] \left(B_{i(x,y)}^{(n)}\right).$$
(5)



Considering the edge of waveguide input area, the electric wall can be presented. The basic functions of TE field components in the electric wall, as shown in Figure 2 for an inductive obstacle, are

$$\vec{E}_{x(x,y)}^{\alpha} = \mathbf{K}_{x}^{\alpha} \cos\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right),\tag{6}$$

$$\vec{E}_{y(x,y)}^{\alpha} = -\mathbf{K}_{y}^{\alpha} sin\left(\frac{m\pi x}{a}\right) cos\left(\frac{n\pi y}{b}\right) , \qquad (7)$$

where α refers to the TE mode and K is the constant value with respect to the x and y directions. The equations are defined as

$$K_{x}^{TE} = \frac{n\sqrt{\frac{2\tau}{ab}}}{b\sqrt{\frac{m^{2}}{a^{2}} + \frac{n^{2}}{b^{2}}}}, \quad K_{y}^{TE} = \frac{-m\sqrt{\frac{2\tau}{ab}}}{a\sqrt{\frac{m^{2}}{a^{2}} + \frac{n^{2}}{b^{2}}}}, \quad (8)$$

where $\tau = 1$ if m, n = 0 and $\tau = 2$ if $m, n \neq 0$

At the input port of the waveguide, the incident waves $\begin{pmatrix} A_{x,y} \end{pmatrix}$ of higher-order modes will feedback into the obstacle of the waveguide. The equation for incident waves $\begin{pmatrix} A_{m,n} \end{pmatrix}$ is

$$A_{m,n}^{(n)} = \left[\Gamma_{m,n}\right] B_{m,n}^{(n)}.$$
(9)

The reflection coefficient $\binom{l^{n}m,n}{l}$ of waves in the spectrum domain at the input and the output ports of the waveguide can be written as

$$\Gamma_{m,n} = \Gamma_{m,n}^{TE} = \frac{1 - Z_0 Y_{m,n}^{TE}}{1 + Z_0 Y_{m,n}^{TE}}$$
(10)

where $Z_{0,is}^{0}$ the intrinsic impedance of the dominant mode and $Y_{m,n}^{TR}$ is the TE modes admittance with the orders of m and n which can be expressed as

$$Y_{m,n}^{TE} = \frac{\left(\frac{m\pi}{a}\right)^2 + \left(\frac{n\pi}{b}\right)^2 - \omega^2 \mu\varepsilon}{j\omega\mu}.$$
 (11)

Therefore, considering the waves on the obstacle, the waves $(A_{m,n})$ will be transformed by using the Inverse Fast Fourier Transform (IFFT) to analyze the basic functions of TE field components by using Eq.(6)-(7), to come back to the real domain as

$$A_{x,y}^{(n)} = Pixel_IFFT\left(A_{m,n}^{(n)}\right).$$
(12)

The implementation of the Wave Iterative method consists of a recurrence relationship of wave between the propagation in both sides of the waveguide and the propagation on the obstacle. From Eq.(3) and Eq.(9), the total waves at n^{th} iteration are

$$A_{m,n}^{(n)} = \Gamma_{m,n} \hat{S} A_{m,n}^{(n-1)} + A_{1,0}^{\text{TE}/_{TM}}, \qquad (13)$$

where ^S is the spectrum operator of scattering coefficient.

At the convergence condition, the reflected wave on the obstacle at n^m iteration, is tend toward zero, the total waves will be the steady state field. So, we can obtain the input reflection coefficient of obstacle circuit of dominant mode, $\Gamma_{in(1,0)}^{coefficient}$ as,

$$\Gamma_{in(1,0)} = \frac{B_{1,0}^{TE/TM}}{A_{1,0}^{TE/TM}} = \frac{\sum_{n=1}^{N} B(n)_{1,0}^{TE/TM}}{A_{1,0}^{TE/TM}}.$$
(14)

The input impedance, $Z_{in(1,0)}$ of zero thickness obstacles in the rectangular waveguide can be written as

$$Z_{in(1,0)} = Z_0 \left(\frac{\Gamma_{in(1,0)} - 1}{2\Gamma_{in(1,0)}} \right).$$
(15)

Then, the input reactance will be a positive value for an inductive element. If the input impedance is equal to zero or infinity, the obtained element will be a LC series or parallel resonant circuit respectively. The net 2.5D electric field distribution on the obstacle by summing the amplitude of the incident and the reflected waves of N iterations can be expressed as

$$E_{x,y} = \sqrt{Z_0} \sum_{n=1}^{N} \left(A_{x,y}^{(n)} + B_{x,y}^{(n)} \right).$$
(16)

Similarly, the net 2.5D magnetic fields can be expressed by subtracting the amplitude of the incident and the reflected waves of N iterations series as can be expressed as

$$H_{x,y} = \frac{1}{\sqrt{Z_0}} \sum_{n=1}^{N} \left(A_{x,y}^{(n)} - B_{x,y}^{(n)} \right).$$
(17)

November 6, 2014 www.icteched.org Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand





Thus, the admittance parameters of two ports network are obtained as

$$Y = \sum_{x,y} \left(\frac{J_{(x,y)}}{E_{(x,y)}} \right),$$
 (18)

also, the impedance parameters can be written as

$$Z = \sum_{x,y} \left(\frac{E_{(x,y)}}{J_{(x,y)}} \right).$$
 (19)

Finally, the scattering parameters of planar circuit are given by

$$S = [1 - Z][1 - Z]^{-1}.$$
 (20)

III. WIM SIMULATION DESIGN

The WIM simulation program created through a graphical user interface (GUI) function and m file of MATLAB ®program, shown in the Figure 3.



Figure 3. Flowchart of WIM simulation.

Scheme works in the following sequence.

1. Start the simulation program using the main menu.

2. Design the dimension of waveguide iris structure.

3. Set the initial values; such as frequency operating, dielectric constant, characteristics impedance, etc.

4. Calculate the reflected wave of pixel mode.

5. Convert the pixel mode to spectrum mode of reflected wave using the Fast Fourier Transform.

6. Calculate the incident wave from reflected wave with reflection coefficient.

7. Convert the spectrum mode to pixel mode of incident wave using the Inverse Fast Fourier Transform.

8. Check the convergence status of result, If no;

return to execute the calculation again, If yes; present the simulated results; such as the electric and magnetic field distribution, the scattering and admittance parameters, as shown in Figure 4



Figure 4. WIM Simulation program

III. SIMULATED RESULTS

In this topic, examples of iris circuit are presented by using the developed simulation base on the proposed Wave Iterative Method (WIM) algorithm. We will show results of inductive iris characteristic analysis and compare the performance of computation among the WIM simulation, CST software and theoretical results.

A. Inductive Obstacle [9].

The vertical obstacle section transforms the inductive equivalent circuit, shown in Figure 5. The dimensions of rectangular waveguide consists of a width (a) equal to 42 mm, a height (b) equal to 28 mm a length (c) equal to 96 mm and the usable obstacle width (d) equal to 21 mm. The cutoff frequency of the waveguide is 3.571 GHz.



(a) Overall perspective (b) Cross sectional view (c) Equivalent circuit Figure 5. Symmetry inductive iris structure.

Figure 6 presents the comparison of dB(S11) and dB(S21) of the inductive obstacle structure with the WIM, the CST simulation and theory [12]. In this case, we can obtain the -3 dB cutoff frequency at 4.75 GHz. We observed that this comparison revealed good agreement and the shunt inductive circuit is presented as a high pass filter.





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Figure 6. Comparison of dB(S11,S21) with WIM, CST and Theory



Figure 7 presents the input reactance of the inductive iris in frequency range from 3.6-8 GHz following the width of obstacle. We observed that the width increased, the inductance of the inductive iris will increase. The analyzed result is consistent with the properties of the inductive iris.

B. Asymmetrical Window [12].

The asymmetrical window section transforms the inductive equivalent circuit, as shown in Figure 8. The dimensions of rectangular waveguide consists of a width (a) equal to 42 mm, a height (b) equal to 28 mm a length (c) equal to 96 mm and the usable obstacle width (d) equal to 28 mm. The cutoff frequency of the waveguide is 3.571 GHz.



(a) Overall perspective (b) Cross sectional view (c) Equivalent circuit Figure 8. Asymmetrical inductive iris structure.

Figure 9, the compared results of dB(S11) and dB(S21) among the WIM, the CST, and the theory [12] are in good agreement. We have seen that the cutoff frequency is 4.15 GHz at -3 dB. Moreover, we observed that the shunt inductive circuit is presented as a high pass filter.



Figure 9. Comparison of dB(S11,S21) with WIM, CST and Theory



Figure 10. The inductance of inductive iris.

Figure 10 presents the input reactance of the inductive obstacle in frequency range from 3.6-6.3 GHz following the width of obstacle. We observed that the width increased, the inductance of the inductive obstacle will increase. The analyzed result is consistent with the properties of the inductor.

C. Symmetrical Obstacle [12].

The symmetrical obstacle section transforms the inductive equivalent circuit, shown in Figure 11. The dimensions of rectangular waveguide consists of a width (a) equal to 42mm, a height (b) equal to 28 mm a length (c) equal to 96 mm and the usable metal width (m) equal to 3 mm respectively. The cutoff frequency of the waveguide is 3.571 GHz.



(a) Overall perspective (b) Cross sectional view (c) Equivalent circuit Figure 11. Symmetry inductive iris structure.

Figure 12 presents the dB(S11) and dB(S21) at the operating frequency of 3.8-8 GHz, we have seen that the -3 dB cutoff frequency is 5 GHz of a high pass filter. The good agreement among the WIM, CST, and theory is presented [12]. However, the error caused by the difference of pixel number definition appears a small.







Figure 12. Comparison of dB(S11,S21) with WIM, CST and Theory



Figure 13. The inductance of inductive obstacle.

Figure 13 presents the input reactance of the inductive obstacle in frequency range from 3.8-8 GHz following the width of obstacle. We observed that the width increased, the inductance of the inductive iris will increase.

V. CONCLUSION

The capability of WIM simulation has been presented to analyze the characteristics of symmetrical and asymmetrical inductive iris structures. The WIM algorithm based on electromagnetic wave propagation and iterative method can provide a reasonably good approximation to the correct values of circuit parameters, its accuracy is dependent on usable pixel size and mode number. Additionally, The WIM simulation can be used effectively as a teaching media in the teaching of telecommunication engineering.

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An Interesting Statistic of Skill in ICT Career

Patsakorn Singto Faculty of Information Technology King Mongkut's University of Technology North Bangkok Bangkok, Thailand patsakorn.s@rmutr.ac.th

Abstract—The ICT Careers Information has become a hot topic to many interested people, students, educational institutions, job seekers or applicants who looking career information or to get their occupation opportunities or changing the jobs. Gathering career information, finding, collecting, analyzing, doing professional summary and announcing will more useful. Moreover, using Semantic Relation analysis and Semantic Relation demonstration will make use for information and meet individual needs in order to Career Path, Career Development, Career Trend, Career properties. Skill in ICT career is an important component of 4 topics. Statistical information of Skill in ICT Career much more interesting and helpful in order to indicate the way of career development, student education, educational management of institutions. In this paper, researchers propose statistical skill analysis in ICT career by gathering career information from the popular job posting websites, in part of analysis we established semantic relation ontology by using weight calculation in term of frequency and relevance and demonstrated in term of Text Cloud visualization. The third highest skills found in all careers database are MS-SQL, Windows Server and HTML.

Keywords— Text Clouds; ICT Career Ontology; Semantic Information

I. INTRODUCTION

The Job Markets are source of employment services which provide and match the knowledge and skill needed for government and companies which provide jobs to people who wish to find a job. ICT careers are popular careers in job markets both national and international job market. The job markets services will provide services via Job Portal websites, well-known as Online Careers Center Service (OCCS) which places for announcing the job qualifications from many job careers with many companies. The example of job portal websites such as CareerBuilder, HotJobs, Monster, JobsDB. A large number of careers in OCCS and various sources and organizations cause a problem which is an inconsistency of competent description among organizations. Some competence or skills are required by project activities [1]. Growth factors of job market are 1) The rapid growth of the organization 2) The development of information technology including hardware infrastructure and software. Both factors are influence to students, educational institutions, job seekers or applicants who

Anirach Mingkhwan Faculty of Industrial and Technology Management King Mongkut's University of Technology North Bangkok Prachinburi, Thailand anirach@ieee.org

looking career. They should know the state of career information and requirement of qualification about ICT knowledge and skills. Then jobs data analysis and presentation by using Semantic Relation analysis and Semantic Relation demonstration will make useful information and meet individual needs in order to Career Path, Career Development, Career Trend, Career properties.

In previous research, we have proposed and demonstrated ICT analysis by using Semantic Relations and ontology [2] which can be described the relationship of ICT career to users as needs and to become more effective searching than common searching. We found the key element which help to combine in various opinions. ICT Skills are important in determining the appropriateness of applicants and the same as important for applicants in selecting jobs or improving themselves to get opportunities in their careers. Moreover, for students and educational institution ICT skills information will be specified their qualifications and what should be given to graduates to leave the workforce. The similar skills found in a various job postings can be indicator of labour market trend to people who use the data.

Therefore, in this paper propose established ontology in order to calculate the statistical information of ICT Skill from all careers and each career group. To demonstrate information in term of Text Clouds Visualization in order to highlight the most skills found in all careers and each career group by using weight of the semantic relationship. The order of the contents are describing the ontology of ICT career then describing how to gather data and calculate weight and frequency. And last propose the results of statistical format in term of Text Clouds visualization.

We organize this paper as follows; Section 2 shows information on ICT career in ISCO-08 for classified and classified knowledge in ICT career. Section 3 illustrates propose strategy to ICT career ontology and semantic search component . Section 4 illustrates ICT career analysis process. Section 5 experimental and result to shows an example on ICT career Section 6 gives the conclusion and future work.





II. BACKGROUND

Several studies have been presented in literature to add more information to ICT career and text visualization in order to the use of text clouds visualization.

A. ICT careers

ICT careers information are also used in a wide range of research topic such as matching job seekers with job vacancies, educational planning, and so on. The rapid changes that have taken place in information and communications technologies, and the influence of these changes on the occupation structure of the labour market. Therefore, International Standard Classification of Ocupations 2008 (ISCO-08) was adopted bv International Labour Organization (ILO) which are to promote rights at work, encourage decent employment opportunities, enhance social protection and strengthen dialogue on work-related issues [3,4].

Careers are classified into the following 11 unit groups: ICT service manager, System Analysts, Software Developers, Web and Multimedia Developers, Applications Programmers, Database Designers and Administrators, Systems Administrators, Computer Network Professionals, ICT Operations Technicians, ICT User Support Technicians and Web Technicians.

B. Classified Knowledge in ICT Career

According to ACM/IEEE-CS has been the set of knowledge areas in curriculum [5]. The perspective of the computer scientist, there are implications for the knowledge areas that address programming, software engineering, data management, mobility, human computer interaction, security and intelligent systems correspond with the requirement of the job market. This paper is that IT skills group obtains knowledge areas in Computer Science curriculum.

C. Term Frequency and weight

The main function of a term frequency is counts how many times the term occurs in a document[6]. The more times a term t occurs in document d the more likely it is that t is relevant to document. Term frequency gives more credit to words that appears more frequently. For instance, a word that appears ten times in a document is not usually ten times more important than a word that only appears one. Term frequency weights is typically used for query weighing, where terms appear only once or twice.

D. Text Clouds

A Text clouds or word cloud or weighted list in visual design is a visual representation for text data, or to visualize free from text of word frequency in a given as a weighted list. The importance of each text is shown with font size or color[6].

Text clouds are meant to facilitate rapid understanding and comprehension of a body of words, links, phrases, etc. Any block of information composed of text is open to analysis as a text cloud, as these screen captures of text clouds for restaurant menus, magazine covers.

Several approaches have been proposed to measure tag similarity using statistics [8,9]. An interesting approach to construct semantic networks on the basis of cooccurrences with the goal of comparing the network structure of is in.

In our paper we propose statistical and semantic information for show text clouds based on ICT career ontology.

III. THE PROPOSE STRATEGY

In this section we describe our approach and the used techniques.

A. ICT Career Ontology

Ontology is theory of conceptualization in artificial intelligent [10,11]. ICT career ontology developing process is explained as follows:

1) List all possible related word, ICT careers related technical skill is collected from web job portals such as JOBSDB, CareerBuilder.

2) Group similar meaning words into concept, Group of ICT career uses of International Standard Classification of Occupations 2008 (ISCO-08) and Group of technical skill uses of knowledge group into ACM/IEEE curriculum.

3) Define relation among concepts on the relations, isa, part-of and attribute-of relation. Is-a and part-of relation are the relation which connecting between classes, attribute-of relation is defined by the primitive data type, such as string, integer, boolean and so on. For example technical skill, personal skill, education are partof ICT careers. The database system is technical skill.

4) Define weight for each attributed-of relation, Weight will enable to know the number of skill in each component. For example, weight of MS-SQL database in Application Programmer is 0.4 that shown in Figure 1.

B. Semantic Search Component

This component is designed to extend the possibility to improve the quality of search. There are two major advantages on using semantic in search process. Firstly, semantic search enables us to find the most appropriate. Synonym set can be applied to detect other keywords with the same meaning and get more alternatives. For example, ICT career has title name, formal name and informal name such as "Software Developer" and "Java Application Developer". We apply synonym set to combine all names with the same meaning. Secondly, if we cannot find the appropriate results from keywords, hierarchical representation enables the most connected alternatives, such as parent-child relation, sibling's relation.







Fig 1. Application Programmer Ontology mapping with RDF Graph

IV. ICT CAREER ANALYSIS

Conventional ICT career's representations don't provide any semantics about the career title and specification. The complexity appears at different levels

and it is expressed by concepts such as synonyms, hyponyms (is-a) and meronyms (part-of) [11]. A. Weighing Terms

The weight of specification determine their representative for ICT careers. This paper adapt weights calculate of "Tf-IDF' algorithm [12], which we consider the number of occurrence of a specification in the ICT career. The equation (1) is:

$$W_{i,j} = \frac{freq_{i,j}}{\max_{a} freq_{a,j}} \tag{1}$$

 $W_{i,j}$ is weight of specification "j" in the ICT career "i" freq_{i,i} is number of occurrences of "j" in "i"

 $\max_{a} freq_{a,j}$ is frequency of most repeated specification in ICT career

B. Similarity measures

This paper uses the domain ontology at this step to compute the semantic distance (similarity), between concept in adjacent word. Table 1 shows the levels of relevance between ontology member. We define three relevance levels such as direct, strong and normal which these have value 1.0, 0.9 and 0.6 respectively.

Table 1. Relevance between ontology levels .

Relevance Level	Concept/Individual	Relevance Quantification
Direct	Synonyms	1
Strong	Hyponyms, Hypernyms (is-a)	0.9
Normal	Meronyms, holonym (part-of)	0.6

The purpose of this paper to combine statistical information and semantic properties of specifications in the ICT careers ontology. We define our weighted terms formula (1) also considering statistical information which they should favor specification of the ICT career. We propose a specification weighting based on compound with terms frequency and semantic weight. The formula is (2). Weight of specification carried order list.

$$W = \{w_{ij}\} = \{w_{ij}' + R_{ij}\} \quad (2)$$

 $\{W_{i,j}\}$ is set weight of specification "j" in the ICT career "i"

 R_{ij} is weight of specification "j" relevance in the ICT Career "i"

C. Text clouds visualization.

A Text clouds in visual design is a visual representation for text data, or to visualize free from text of word frequency in a given as a weighted list. For smaller frequencies one can specify small sizes. For larger frequencies one can specify large sizes. Weight is mapped to a fontsize scale of 1 through 100. The rang of available weights are shown in Table 2.





Table 2 Weight range to fontsize scale

<u> </u>	
W_{ij}	S_{ij}
>0.0	20
>0.2	40
>0.4	60
>0.6	80
>0.8	100

 S_{ij} is display fontsize

 W_{ii} is weight of specification "j" in the ICT career "i"

V. EXPERIMENTAL RESULT

We collected demand for ICT Professionals from various Online Career Center Services such as JobDB, Monster, HotJob and etc. Table 3 shows 550 careers are classified into career group complied by international standard ISCO-08 and there are 50 careers in each group. Table 4 shows group of ICT Skill of 550 careers complied by Computer Curricula ACM/IEEE 2013.

Text Clouds Visualization has been established regarding to calculating results between ICT weight and used Word Application to generate Text Clouds which shown in figure 2. In the figure regarding to each career, the most skills required for Software Developer are MS-SQL, MySQL. According to demand for Software Developer require the person with competence and experienced in database management and simplicity of MS-SQL and MySQL are considered in order to use for managing database within an organization. Group of Network Computer Professional, the most skills required are Windows Server, TCP/IP and Network Security and demand for this career require the person with competence and knowledge Windows Operating system management and computer network and communication protocal TCP/IP.

The text clouds visualization generated from compound weight semantic and statistical information are show in text clouds visualization. An example of generated text cloud is shown in Figure 2. We use public tools for generating text clouds locally on the desktop. This paper we use Wordle Application for generating "text clouds" from specification in the ICT career.

ICT Career Group	Amount
ICT Services Managers	50
System Analysts	50
Software Developers	50
Web and Multimedia Developers	50
Applications Programmers	50
Database Designers and Administrators	50
Systems Administrators	50
Computer Network Professionals	50
ICT Operations Technicians	50
ICT User Support Technician	50
Web Technician	50
Total	550

Table 3. ICT Career Group Data

Fable 4. An example group I	ICT	skill	of	ICT	Career
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ICT Skill Group	Technical Skill
Database System	DB2, IBM Db, Informix,MS Access, MS SQL,MS SQL Report,MS-DB,MySQL,Oracle,Oracle Report, Sybase, Spring, SQLite, Hibernate, PL/SQL
Web Programming	.Net, Ajax, ASP.Net, DHTML, HTML, HTML5, CSS, JavaScript, Jquery, JSON, JSP, PHP, XHTML, XML, XML/JSON, Servlets, WSDL
Programming Language	Java, C#.Net, SQL Language, EJB, VB.Net, C#, OOP, C++, Shell script, C, ADO.NET, Perl, VB, Visual Studio .Net, COBOL, Delphi, Ruby, Programming, LinQ, MS Excel VBA, Python, .NET frameworks, DLL, J2EE, Visual C++, COBOL/400
Software Engineering	UML, Software Design, OOAD OOM SDLC, ER- diagrams, OOD, Screen Design, CMMI, DFD, System Analysis, business/workflow, OOA, Agile, CMM, Design Pattern
Operating System	Windows Server, Linux, Windows, Unix, Sun Solaris, iOS, Active Directory, Android, VMWare, Install/Configuration, Windows 8, Window Infrastructure, Windows Security, Window Mobile
Computer Networking	SSL,HTTP,Network Monitoring,TomCat Server,VOIP,Config Network,LAN,ISA Server,SAN Storage,SOAP,UDDI

VI. CONCLUSIONS

In this paper, we propose statistical calculation of ICT Skill. Data from ICT ontology of ICT career will be calculated as Weight calculated by term of frequency and relevance then generated Text Clouds visualization to demonstrate statistical results.

When analyzing and demonstrating overall of statistical information of each ICT careers that the most common skill is MS-SQL. Analyzing by career group with 3 samples showed that group of Software Developer had top 3 highest skills are MS-SQL, My-SQL and ASP.Net. Group of Network Computer Professional had top 3 highest skills are Windows Server, TCP/IP and Network Security. Group of ICT Career User Support Operation had top 3 highest skills are Network System, Windows Server and SQL Language. Statistical results of ICT can be analyzed the importance of qualifications and skills needs to labour market and useful for career development in all ICT career groups.

In this paper, researchers used data from collection and classified to 11 career groups which were divided equally 50 announcements that indicate overall of the statistical information, but cannot be clearly for Career Trend Analysis. For further research, to study and discover about work experience in ICT careers and to compare among ICT career for career development.

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ICT Skill for Software Developer

ICT Skill for Network Computer Professional



ICT Skill for ICT Career

Fig. 2 Technical skill of ICT career text clouds visualization





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The 2nd International Conference on Technical Education "Engineering and Technical Education"

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About ICTechEd 2014 :

According to the changing of global economy, Thailand's economic highly depends on manufacture and service industries whereas the expansion in agricultural sector decreases in numerous areas and agriculturists. The movement of some agriculturists to the industrial and service sectors causes the problem of higher low quality labors. The vocational education reform is a way to solve the problem as stated by emphasizing on production and developing teachers and students to be quality. For this reason, the instructional model and curriculum development should be designed considering the academic and vocation increasingly.

The Faculty of Technical Education (FTE), King Mongkut's University of Technology North Bangkok (KMUTNB) has continuously concentrated on producing and developing qualified technical teachers in Bachelor's, Master's and Doctoral levels while conducting and publicizing research in both technical education and engineering over 46 years. That is a consequence of the academic cooperation between the Thai Government and Federal Republic of Germany especially in the knowledge transfer regarding the "Engineering Teacher". Until now, the FTE has always encouraged instructors, students, and researchers to conduct the research in vocational development in order to upgrade the career development and the sustainably learning developments. Moreover, knowledge networking on technical education especially with the Office of Vocational Education Commission (VEC) is aimed at increasing the number of academic staffs with graduate level that will be emphasized on the potential of knowledge transfer corresponding to the industrial demand. That is the concept of creating the master of learning models, which reflects on the research potential continuously.

The 7th National Conference on Technical Education and the 2nd International Conference on Technical Education will be organized under the theme of "Engineering and Technical Education". The objective of The 2nd ICTechEd is to provide an international forum for researchers, academicians as well as engineers to initiate, distribute, and exchange knowledge, new ideas, and application experiences about engineering and technical education that will contribute to the academic sustainable development.

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- Assoc. Prof. Dr. Poom Kumam King Mongkut's University of Technology Thonburi, Thailand

- Miss. Pornsawan Chantakhad
- Miss. Walaiporn Yodkammee
- Miss. Siriporn Yangsuay
- Miss. Kanita Konnam





- Asst. Prof. Dr. Santi Tantrakoon King Mongkut's Institute of Technology Ladkrabang, Thailand
- Assoc. Prof. Dr. Chuwong Phongcharoenpanich King Mongkut's Institute of Technology Ladkrabang, Thailand
- Dr. Phongthanat Sae-Joo KhonKaen University, Thailand
- Assoc. Prof. Dr. Mitchai Chongcheawchamnan Prince of Songkla University, Thailand
- Prof. Dr. Suksun Horpibulsuk Suranaree University of Technology, Thailand
- Asst. Prof. Dr. Thara Angsakul Suranaree University of Technology, Thailand
- Asst. Prof. Dr. Somkid Amornsamankul Mahidol University
- Dr. Kriengkrai Rajchakit Maejo University

Faculty of Technical Education, King Mongkut's University of Technology North Bangkok

1518 Pracharat 1 Road, Wongsawang, Bangsue, Bangkok Thailand 10800 Tel. +66 2 555 2000 ext 3221 Fax. +66 2 586 9015 http://www.fte.kmutnb.ac.th E-mail Address: teched@fte.kmutnb.ac.th

Philosophy Commitments Vision Aission

Philosophy : To encourage innovation in Science and Technology through the development of people
Commitments : Produce high quality graduates with good academic record excellence in the fields of Science, Engineering and Technology for Teaching who can demonstrate, manage, utilize, innovate and develop efficient technology. Altogether, focus on up-grading the study of science, engineering and advanced technology to serve the need of the economy
Vision : The Learning Organization and master of engineer teacher through balance of morality who creative research and invention the technology towards international
Mission : To produce and develop qualified technical teachers in Bachelor's, Master's and Doctoral levels, To conduct and publicize research in both technical education and engineering, To provide academic services .i.e. consultancy, testing, survey and training, and Activities related to the country's art and culture should be the preservation of tradition.

Uniqueness : A master of Engineering Teacher and Creative innovation

Indentity : Graduates with Creativity, Workability and knowledge transferable

Curriculum and Programs

Faculty of Technical Education

- Doctor of Philosophy Program in Information and Communication Technology for Education
- Doctor of Philosophy Program in Technical Pedagogic Research and Development

Department of Teacher Training in Mechanical Engineering

- Bachelor of Science in Technical Education Program in Mechanical Engineering
- Bachelor of Science in Technical Education Program in Production and Industrial Engineering
- Bachelor of Science in Technical Education Program in Mechatronics Engineering
- Master of Science in Technical Education Program in Mechanical Engineering

- Master of Science in Technical Education Program in Mechatronics Engineering Department of Teacher Training in Electrical Engineering

- Bachelor of Science in Technical Education Program in Electrical Engineering
- Master of Science in Technical Education Program in Electrical Engineering
- Doctor of Philosophy Program in Electrical Engineering Education

Department of Teacher Training in Civil Engineering

- Bachelor of Science in Technical Education Program in Civil Engineering
- Bachelor of Engineering Program in Civil Engineering and Education
- Master of Engineering Program in Civil Engineering and Education
- Doctor of Philosophy Program in Civil Engineering and Education
 Department of Computer Education
 - Bachelor of Science in Technical Education Program in Computer Technology
 - Master of Science in Technical Education Program in Computer Technology
 - Specializing in two fields of study
 - Computer Education
 - Multimedia Technology
 - Doctor of Philosophy Program in Computer Education

Department of Technology Education

- Master of Science in Technical Education Program in Technical Education Technology
- Doctor of Philosophy Program in Technical Education Technology
- Department of Technical Education Management
 - Master of Science in Technical Education Program in Vocational and Technical Education Management
 - Doctor of Philosophy Program in Vocational and Technical Education Management