

## Exploration of Understanding of Secondary School Students in Science and

### Technology Concept in Proposed ICT Learning Model

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#### ระดับมัธยมศึกษาเพื่อเสนอรูปแบบการเรียนรู้ ICT

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#### ABSTRACT

This research aimed to explore the teachers' and students' understanding of science concepts in secondary schools in Thailand and to suggest to proposed ICT learning model to make students aware of current science issues impacting on the society. A total of 165 (15 teachers and 150 Students) participated in the study. Students were from years 10, 11 and 12 who studied information and communication technology subject in year 2012 and teachers who taught the same course. Research instruments consisted of a questionnaire, interview form for teachers, classroom observations and video recordings. The study was based on a widespread popular and influential conceptual modeling representation theory. In the model, ICT supports internal learning processes of representation (creating and self-organizing knowledge) and promotes collaboration and interaction (social processes and making meaning).

#### บทคัดย่อ

การศึกษาในครั้งนี้ มีวัตถุประสงค์เพื่อสำรวจความเข้าใจด้านวิทยาศาสตร์และเทคโนโลยีของครูและ นักเรียน ในโรงเรียนระดับมัธยมศึกษาของประเทศไทย เพื่อเสนอรูปแบบการเรียนรู้ ICT ให้นักเรียนมีความตระหนักถึงประเด็น วิทยาศาสตร์ที่มีผลต่อสังคม กลุ่มเป้าหมาย เป็นครูผู้สอน จำนวน 15 คน และเป็นนักเรียนชั้นมัธยมศึกษาปีที่ 4-6 จำนวน 150 คน ซึ่งเรียนในวิชาเทคโนโลยีสารสนเทศและการสื่อสาร ปีการศึกษา 2555 สำนักงานเขตพื้นที่การศึกษา มัธยมศึกษาเขต 25 เครื่องมือที่ใช้ในการศึกษา ประกอบด้วย 1) แบบสอบถามความรู้ความเข้าใจในด้านวิทยาศาสตร์ และเทคโนโลยี 2) แบบสัมภาษณ์ครูผู้สอน 3) แบบสังเกตชั้นเรียน 4) วิดีโอบันทึกภาพและเสียง โดยศึกษาอยู่บน พื้นฐานของทฤษฎีตัวแทนความคิดในการสร้างรูปแบบการเรียนรู้ ICT เพื่อสนับสนุนการสร้างตัวแทนความคิดภายใน (การสร้างองค์ความรู้ด้วยตนเอง) และการมีปฏิสัมพันธ์กับภายนอก (กระบวนการทางสังคมและการสร้างความหมาย ของการเรียนรู้)

**Key Words:** Understanding, Learning Model

**คำสำคัญ:** ความเข้าใจ รูปแบบการเรียนรู้

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## INTRODUCTION

The educational reform in Thailand as determined by The National Education Act which are the Act 1999 and amended Act 2002 aims to provide high quality education in Thailand. The education reform of four specific areas, to wit: the reform of schools and education institutions; the reform for teachers and educational personnel; (Operation Centre of the Education Reform, 2003). The heart of the reform of learning is the teacher. The teacher is a key role in promoting the learning of the students. Teachers are responsible in transferring knowledge to their client. However, the students only wait for the knowledge the teacher is transferring to them. As a result, students do not think critically and can hardly solve problems they encounter in everyday life. When the education reforms are implemented which most their obtained knowledge in solving problems. Opportunity for students to use their potential fully is important. Therefore, teaching and training processes must be thought out focusing on the application of knowledge in solving practical problems. This is because Thai social needs people with knowledge and integrity.

### Conceptual understanding and representation

Conceptual understanding (CU) is based on the belief that students construct their own understanding of concepts by expanding or modifying their existing views. The procedure also reinforces the value of cooperative learning and the individual student active role in learning. However, the majority of past studies have focused on the development of new approaches to conceptual understanding rather than on the critical evaluation and improvement of existing approaches.

A representation can function as a thinking tool or scaffold during its construction, and then becomes an artefact of this thinking, shifting from a "live" representation during the process of constructing. Giere and Moffatt (2003) recommended that students should learn how to use representations in science as thinking tools for predicting, understanding and making claims, rather than memorizing "correct" representations for knowledge display. In terms of theoretical foundations, we look at the emergence of a promising candidate for conceptual modeling theories, namely *models of representation* (Wand and Weber, 1995) that are referred to as representation theory.

### Technological Pedagogical and Content

#### Knowledge

To date, many of the explanations have been a part of the knowledge base developed by cognitive scientists. It naturally follows that mental models would become a part of the vocabulary that ICT practitioners use to explain a very complex world. ICT is defined by UNESCO as forms of technology used for creating, displaying, storing, manipulating, and exchanging information (Meleisea, 2007). ICT, in general, consists of computers, network, e-mail, internet, telephone, television, radio and sound forth. ICT has a broad meaning. This section will present a narrower scope of ICT which is utilized in the development of the model.

Technological Pedagogical and Content Knowledge (TPACK) builds upon Lee Shulman's concept of pedagogical content knowledge (PCK). Identifying ways in which specific concepts can be addressed through technology may offer one of the more promising methods of enhancing learning outcomes.

Mishra & Koehler (2005) describe TPACK as a complex, situated form of professional understanding; the nexus of teachers' content, pedagogical, and technological knowledge.

### THE PURPOSE

This research aimed to explore the teachers' and students' understanding of science concepts in secondary schools in Thailand and to suggest to proposed ICT learning model to make students aware of current science issues impacting on the society.

### METHODOLOGY

The research made use of quantitative and qualitative type regarding an interpretive paradigm. Interpretive research seeks to describe and interpret human behavior. (Mariam,1998; Cohen *et al*, 2000). As the process of interpretation, this research aims to explore the teachers' and students' understanding of science concepts in secondary schools in Thailand and to develop an ICT learning model to make students aware of current science issues impacting on the society.

### THE TARGET

The target was a total of 165 (15 teachers and 150 Students) participated in the study. Students were from years 10, 11 and 12 who studied information and communication technology subject in year 2012 and teachers who taught the same course.

### DATA COLLECTION AND ANALYSIS

Data collected included: questionnaire, interview form for teachers, classroom observations, video

recordings of classroom sessions and teacher interviews.

### INSTRUMENTS USED

The instruments were the following : questionnaire, interview form for teachers, classroom observations and video recordings. The study was based on a widespread popular and influential conceptual modeling representation theory.

The focus of ICT in this study is the use of internet, software, multimedia resources, course management systems and computer-based testing systems in education. The applications of ICT in learning resources include educational software, distributed resources via the WWW and video resources. Educational software is not only learning resources for students but also tools for instructional organisation of learning. (Revised from Collis and Moonen, 2001).

Researchers interpreted data from questionnaire and interview so that the technology teacher and students were give more useful responses. The following is the interpretation used

$\bar{X}$	Description
4.21 - 5.00	maximum agree
3.41 - 4.20	much agree
2.61 - 3.40	middle agree
1.81 - 2.60	low agree
1.01 - 1.80	lowest agree

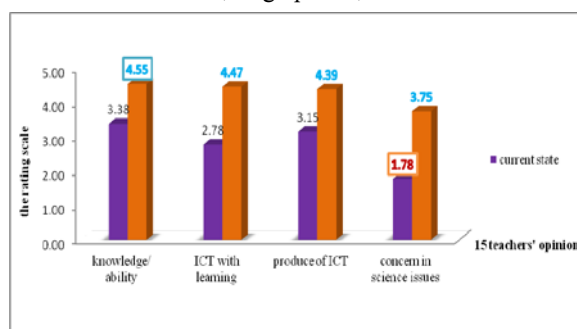
From table, explanation the option from 1.01 to 5.00 for describe opinion. There is device by Likert's rating scale of range at 0.8 in respectively. Start from the lowest agree to the maximum

## FINDINGS AND DISCUSSION

### 1. Students with ICT learning

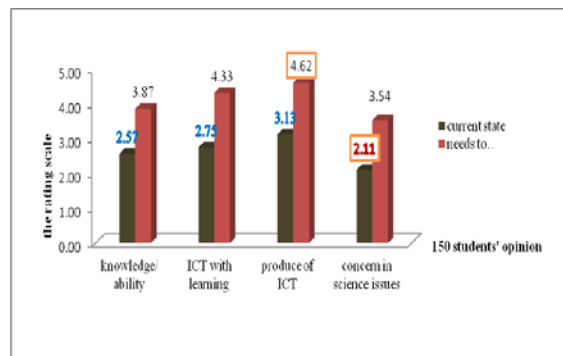
Based on the class observation, it was found that teacher is trying to enhance students gain science and technology knowledge and experience through explanations such as letting students find out more information from websites that teacher recommended or letting students study from the knowledge sheet. Moreover, teacher also discussion on issues related to social, teacher pointed out that science has been influenced by values, social and opinions of human beings.

Graph about relations of opinion of teachers and students toward ICT (see graph 1-2)



**Graph 1:** Relations of opinion of teachers toward ICT

The graph 1 shows understanding of knowledge / ability to use ICT and the level on the current state of ICT to improve learning and needs to development of teachers in schools. As seen from the graph, the mean average to knowledge/ability of ICT in current state is 3.38 and needs to development in the future is 4.55 at the highest agreement level which are described as maximum agree while the current state of concerning in science issues has a mean of 1.78 which is described as lowest agree but they want to development in the future is 3.75 which is described as much agree.



**Graph 2:** Relations of opinion of students toward ICT

The graph 2 shows understanding of knowledge / ability to use ICT and the level in the current state of ICT for communication and needs to development of students in schools, students were from years 10,11 and 12 who studied information and communication technology subject in year 2012. As seen from the table, the mean average of knowledge /ability of ICT in current state is 2.57 which is described as low agree and needs to development in the future is 3.87 which are described as much agree. In the aspect of concerning in science issues, it has a mean of 2.11 which is described as low agree but needs to development in the future, it has a mean of 3.54 which is described as much agree while production and development of ICT needs to development in the future at the highest agreement level at 4.62 in average.

### 2. From the interview teachers

Data from study, after class observation for enhancing learning through technology based on technological Pedagogical and Content Knowledge (TPACK), the responses of the teacher-respondents towards question knowledge / ability to use ICT. The main query have 2 question which were “Do you think that ICT is helpful in learning? How?” and “What are you responsible subject for teaching?”

As manifested from that, the teachers-answered accordly. As to Nutthakorn and Amornrut, It is useful to learn more in everyday. Support teachers in delivering content to teaching, Demonstration and examples, the students can clearly and more understandable. And They used for teaching Programming, Information and communication technology.

In addition, during the learning activities, teachers suggested the related websites to the student to allow them to search for more information in consistence with the interests of the student. They can review their own expressing concepts to resolve the problems. The main query was on "Have you ever been to use ICT to teach in any part of your subject?" As manifested from the teachers answered differently. As to Penpimol, Kaewtar and Nutthakorn, it can be showed that, Penpimol sometimes used to search information and activities of learning. but Kaewtar sometimes used to views and examples from the internet. However, Nutthakorn always used to students learning from the social media, internet and working by themselves.

#### **A PROPOSED ICT LEARNING MODEL**

Dealing with design properly in ICT learning model based on a widespread popular and influential conceptual modeling representation theory are the following.

First stage, learning preparation is learners are provided with a wide range of learning resources, including traditional resources (e.g. textbook, library resources) and ICT resources (e.g. educational software, rich resources on internet and video

resources). The flexibility in learning resources connects with three dimensions: topics, key learning materials and learning resources.

Second stage, Instructional organization is compile of learning becomes more flexible since face-to-face lectures, a course management system and a computer-based testing system are integrated. This integration permits them deciding on the pace of study, choosing instructional organization of learning (i.e. face-to-face and online), time and place to contact teachers and other learners.

Third stage, implementation is instruments of ICT offers different methods of communication such as face-to-face, e-mail, chat, forum and social networking websites. It enhances flexibility of social organization of learning and time, location and methods of interacting.

Forth stage, student exploration is students explore various alternatives of social organizations of learning and languages. ICT actively promotes communication; therefore, it effectively fosters different kinds of social organizations of learning (e.g. working in groups, working individually and in combination).

Fifth stage, expression is an indication of how fast they would complete set tasks and teachers more time for alternative teaching methods (such as project, work group) and more opportunities to invite students to speak out with the teacher, including the articulation of learning goals and the design of learning activities.

Last stage, communication which students were asked to indicate how often they have opportunities to discuss, explain and talk about their learning with other students.

## CONCLUSIONS

In general, school sub-curricula different types of teaching and learning methods, and so no single method or type of tool used can be the choice for all occasions. Moreover, within any learning domain, students' and teachers' needs evolve during the activities in which they are involved and tools have to support this evolution, namely the aspect of the school curriculum and the social structure to the development of science and technology are sustainable.

ICT offers flexible learning environment usually means distance learning in common ways of thinking, yet flexible learning relates to many different choices for students such as time, topics and learning materials. The use of ICT in this aspect, consisting of e-mail systems and websites offers different communication options and software systems for text-based chat and other forms of communication. And to educate the public about science and technology, it is necessary to instill the belief that science And technology will play a role in life, all life on this planet.

In summary, we should help pupils to integrate knowledge (scientific and technology, but also other forms of knowledge) into their design processes for understanding and making claims, rather than memorizing to correct. We should not try to force them to use generalist strategies that may not fit their personality. Finally, we should not only teach

students to use scientific knowledge, but also knowledge about social phenomena. Thus they learn to recognize the complexity of real design processes, even though they do not yet need to cope with this full complexity themselves. Prospective technology teachers should learn how to guide that process and how to deal with the dilemma between a directive versus a more laissez-faire approach.

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