Factors Influencing the Technological Pedagogical Content Knowledge (TPACK) of English Teachers in Primary Schools, Chiang Mai Primary Educational Service Area 1

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Abstract: The purposes of this study were to measure the Technological Pedagogical Content Knowledge (TPACK) and to investigate the factors influencing the TPACK of English teachers in primary schools, Chiang Mai Primary Educational Service Area 1. A sample of 81 English teachers in primary schools of Chiang Mai Primary Educational Service Area 1 were selected through two-stage cluster sampling. The research instruments were a likert 5 point scale questionnaire and a semi-structured interview. Data collected by questionnaires were analyzed by frequency, percentage, mean, standard deviation, Pearson Product Moment Correlation Coefficient, and Multiple Regression Analysis. Data from the interview were analyzed through Content Analysis. The results showed that 1) the TPACK of English teachers in primary schools of Chiang Mai Primary Educational Service Area 1 was at a high level (M=3.62 SD=0.55) and 2) the factors influencing the TPACK of English teachers in primary schools, Chiang Mai Primary Educational Service Area 1 at 0.05 level of significant were frequency of technology use in classroom (β = -0.414) and technology literacy (β = 0-.280)

Keywords: Technological Pedagogical Content Knowledge, technology literacy

1. Introduction

In 21st century, technology has evolved at a rapid pace and become necessities an all aspects of life. In area of education, technology has become an expected requirement rather than additional benefits to the classroom because it apparently increases the effectiveness and productivity of teaching. Technology, therefore, becomes integral in teaching and learning. The changes in teaching and learning, due to technology, teachers in this digital era are challenged with developing technological knowledge and connecting it to their teaching. To put it simply, technological knowledge is essential.

Technological pedagogical content knowledge (TPACK or TPCK) is the framework proposed by [1]. It was developed based on Pedagogical content knowledge (PCK) framework of [2]. It consists of two main components: Content knowledge (CK) or knowledge about a subject being taught or learnt both inside and outside class, and pedagogical knowledge (PK) means knowledge of the practices, processes, and methods in relation to teaching and learning.

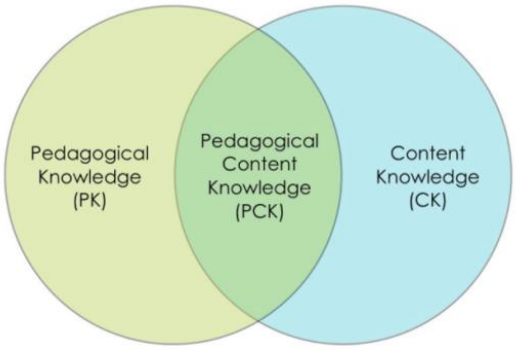

Fig. 1 PCK framework by [2]

In addition to CK and PK, [2] stated that teachers needed pedagogical content knowledge (PCK) for relating their PK to their CK. PCK indicates teachers' capacity to transform content knowledge to suit different learners' ability and background. As such, students can relate their prior knowledge to their new knowledge and, consequently, have comprehension of that subject [2], [3].

Nonetheless, after technology was initiated in educational context, PCK gained a large number of critiques since it excludes the role of technology in education. TPACK is the framework that adds technological knowledge (TK),

or knowledge and skills in operating all types of technology, into PCK. The interconnection among CK, PK, and TK exhibits three more components: 1) Technological pedagogical knowledge (TPK) is knowledge of tools suitable for a specific teaching and learning settings. It portrays that technology and pedagogy influence each other.

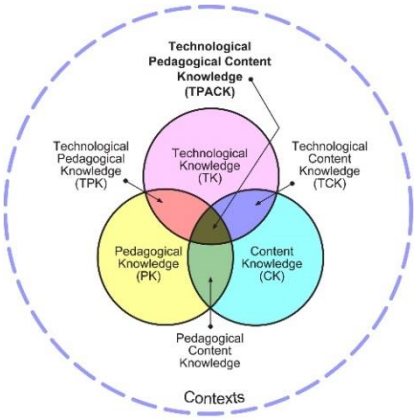

Fig.2 TPACK Model by [1]

By implementing technology to teaching and learning, changes in teaching will take place; 2) TCK or knowledge about how technology and content is related. Teachers know which technology to be used and how to implement it with which kinds of subject content. The implementation of technology to subject content would assist students' learning, making them to achieve learning goals or learning outcome. TCK also involves the use of technology by teachers to enhance their knowledge in that subject content; and 3) Technological Pedagogical Content Knowledge (TPACK) is a set of knowledge that emerges from interaction among CK, PK, and TK. It is the basis of effective teaching subject content through technology; teachers have knowledge in technology and can use it for teaching content in a teaching learning context aiming to develop students' knowledge. It is explained that the success in teaching and learning is not a result from teachers' knowledge and skills in using technology, but the integration of CK, PK, and TK [4], [5]. (see Figure 1).

In language teaching, English to be specific, teachers have implemented a variety of technology as tools for different purposes such as for exposing learners to authentic language use [6], [7], for motivating students to participate in activities [8], for assessment [9], and for creating learning community [10].

Despite the fact that most teaching and learning uses technology nowadays, problems relevant to implementing technology in teaching and learning have been addressed. For example, teachers do not use technology in class because they lack time and technology facilities [11], teachers cannot integrate technology corresponding to learning objectives [6] nor employ it to the whole learning process [12]. Some teachers refuse to implement technology in class because they view it as unnecessary tools and are unwilling to learn about it [6]. According to [7], it is explained that, for a teacher to introduce technology into his or her classroom, factors such as teacher's present knowledge, students' need, societal expectation, and monetary and human resources were contributory factors.

Therefore, it can be said that, to integrate technology into teaching effectively, teachers need to acquire technological knowledge and relevant factors should be examined closely.

Past studies show that there are factors contributing to technological pedagogical content knowledge. Many authors have stressed the importance of gender on TPACK. Following the study of [13]**,** gender affected level of technological pedagogical content knowledge. He concluded that male had higher level of TPACK than female. Similarly, [14] found that male teachers were able to implement technology into teaching and learning more effectively than female teachers. In addition, male teachers' knowledge of all TPACK components was higher than female teachers.

Teaching experience is another factor several researchers agreed to influence TPACK. [14]-[15] pointed out that with more teaching experience, teachers had more confident in integrating technology into their teaching subject content. This is congruent with the study of [12]. Other factors influencing TPACK being investigated included basic knowledge of computers, the support from school, and the availability of computers in school [16]; and intrapersonal factors such as self-efficacy, outcome expectation, and interest [17], for example.

Although some researchers conducted their studies on TPACK, there was limited number of studies on factors affecting TPACK of English teachers in primary schools in Thailand's context. This study was, therefore, conducted with two objectives:

1) To measure TPACK of English teachers in primary schools

2) To investigate the factors influencing TPACK of English teachers in primary schools

2. Research Methods

2.1 Research Design

This study employed the mixed method design which include both qualitative and quantitative approach to collect and analyze data. The basic premise of the mixed method design is that the combination of quantitative data and qualitative data brings to the more complete and compelling utilization of data sets than the separated data collection and analysis [18]. On one hand that quantitative method involves collecting numerical data that can be subjected to statistical analysis, qualitative method is used for exploring quantitative findings and reflecting participants' points of view. In this study, the quantifiable information was drawn from the questionnaire while the qualitative e data, obtained from the interview, provided extended details that help interpretating of data gain from the questionnaire.

2.2 Participants

The participants of this study were 81 English teachers in primary schools of Chiang Mai Primary Educational Service Area 1. They were selected through two-stage cluster sampling. For the first sampling stage, schools of Chiang Mai Primary Educational Service Area 1that had more number of primary English teachers were purposively selected. The second sampling stage was the selection of primary English teachers through simple random sampling.

2.3 Research Instruments

Two instruments were used in this study: a questionnaire and interview.

1. Questionnaire.

The questionnaire consisted of two parts. The first part was informant's background information including age, gender, education background, working position, teaching experience, school size, frequency of use of technology in classroom, technology literacy, and training experience. This information related to factors that might have an effect on TPACK. The second part measured TPACK. It consisted of 39 questions with all questions requiring on a five point Likert scale. A Cronbach's alpha value of 995.0confirmed the reliability of the questionnaire.

2. Semi-structured interview.

A semi-structure interview consisting of 5 predetermined questions was used in this study. The semi-structure interview allows the researcher to control the interview by means of predetermined questions constructed as a reflection of the research topic and used as guidelines during the interview. [19] states that in semi-structured interviews allows depth to be achieved by providing the opportunity on the part of the interviewer to expand on the interviewee's responses. Additionally, the followed-up questions, the other type of questions in the semi-interview that emerge spontaneously, yield additional insights to the predetermined questions and help an interviewer expand interviewees' opinions [20].

2.4 Procedure

The questionnaire was distributed after obtaining the informed consent letters from the participants. The participants were ascertained the data they provided in both questionnaires and the interview were confidential and used in this study only. After the participants filled out the questionnaire, they were scheduled for the interview which lasted approximately 15 minutes at their convenience. With the consent from the participants, each interview was audio-recorded and transcribed for further analysis.

2.5 Data Analysis

Quantitative data collected by questionnaires were analyzed by frequency, percentage, mean, standard deviation, Pearson Product Moment Correlation Coefficient, and Multiple Regression Analysis. On the other hand, qualitative data from the interview were analyzed through content analysis.

3. Results

The results were discussed based on the research objectives as follows:

Research Objective 1

To measure TPACK of English teachers in primary Schools

The findings show that, among the seven components in the TPACK framework, the participants expressed their knowledge in 7 components—content knowledge, pedagogy knowledge, pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge—at a high level. Nonetheless, technology knowledge (TK) was the only component with average level as can be seen in Table I.

Table I TPACK of English Teachers in Primary Schools

TPACK Components	M	SD
TK	3.46	0.59
CK	3.78	0.54
PK	3.86	0.44
PCK	3.87	0.47
TCK	3.66	0.51
TPK	3.63	0.53
TPACK	3.62	0.55

Research Objective 2

To investigate the factors influencing the TPACK of

English teachers in primary schools

Results from multiple regression analysis indicate that there is a significant relationship between the two factors— frequency of use of technology in classroom and technology literacy—and TPACK. Frequency of use of technology in classroom gained the highest relationship with TPACK (β = -.414; p = .163) followed by technology literacy (β = -.280; p = .163) (Table 2).

Table 2 Results of Multiple Regression Analysis for the Factors on TPACK of English Teachers in Primary Schools

Variables	**B**	**SE**	β	**t**	**p**
Constant	5.26	0.58			
Gender					
- Male	-0.15	0.16	-.106	-0.89	.375
- Female	(reference group)				
Age					
- 21 - 30	-0.53	0.38	-.409	-1.42	.162
- 31 - 40	-0.21	0.30	-.183	-0.72	.477
- 50 - 41	-0.12	0.21	-.080	-0.57	.570
- 51 - 60	(reference group)				
Level of Education					
- Bachelor's degree	-0.06	0.15	-.054	-0.41	.686
- Master's degree or higher	(reference group)				
Academic position					
- Contract teacher	0.02	0.26	.016	0.09	.931
- Assistant teacher and Practitioner level	0.13	0.20	.107	0.66	.513

Variables	**B**	**SE**	β	**t**	**p**
- Professional level	-0.22	0.30	-.191	-0.73	.465
- Senior professional level	(reference group)				
Years of experience teaching English to primary students					
- 1-5	-0.03	0.33	-.022	-0.08	.936
- 6 - 15	0.07	0.31	.061	0.22	.824
- more than 15	(reference group)				
Years of teaching experience					
- 1-5	0.31	0.42	.241	0.74	.461
- 6 - 15	0.14	0.32	.124	0.43	.669
- more than 15	(reference group)				
School size					
- small and medium	-0.02	0.15	-.018	-0.14	.886
- special-large and large	(reference group)				
Frequency of technology use in classroom	-0.32	0.10	-.414	-3.36	.001
Technology literacy	-0.21	0.09	-.280	-2.30	.024
Technology training experiences	-0.07	0.09	-.099	-0.73	.468

(R^2 = .261, Adj R^2= .077, F = .142, p = .163)

4. Discussions

A. The mean score of the components related to technology were in rank order from the lowest (TK=3.46, TPACK=3.62, TPC=3.63, TCK=3.66).

To explain this point, because the participants had knowledge in technology (TK) with the lowest mean score, other factors related technology implementation was influenced and low accordingly. According to [21], as cited in [17], technology knowledge nowadays is very different from the past because it changes constantly and becomes increasingly complicated. Also, since technology becomes a part of life in this digital era, technology knowledge, thus, involves knowledge in data processing, forms of communication models, and solving problems with technology. Because technology knowledge is progressing constantly, many teachers are not able to keep their pace in developing their technology knowledge with the pace of technology development. Undoubtedly, when they integrate technology with content in their teaching, they do not know how to do it effectively. Their TPC, TCK, and TPACK, therefore, are low accordingly.

Data from the interview reflected this point. Ying stated that "I am not good at technology. Likewise, Kai said that, "The major problem of teachers about technology is that, at the moment, we neither know what kinds of technology or application is available and suitable for our class, nor how to integrate it in our teaching." Oil asserted that, "There are many forms of technology that can be integrated to my teaching, but, unfortunately, I don't know them."

B. Technology literacy or abilities to use technology, to be more specific, is the factor with significant relationship with the majority of TPACK components which are TK (t=6.02, p<0.001), CK (t=3.91, p<0.001), TCK (t=2.01, p=0.048), and TPACK (t=2.05, p=0.044) .

[22] explains that, because abilities in implementing technology manifests technology knowledge (TK), teachers who are competent in using technology will be confident to use technology. They would use technology as a tool for exploring more about the subject content they are teaching. This causes effect to content knowledge (CK) and technological content knowledge (TCK). Additionally, by being skillful in using technology, they are likely to facilitate their teaching through integrating technology with their methods of teaching (TPACK). In [16], abilities to use technology is the influential factor in TPACK as it determines teachers' decision in integrating technology to their teaching and learning. That is, a teacher who are not good at using technology would avoid using technology because they feel that using technology is too complicated.

One interesting finding is that the avoidance of implementing technology to teaching is not solely due to technology literacy and TK. During the interview, Nuch said, "Technology is not always suitable for teaching primary schools. My students are young learners. I would rather develop their communication interaction with

people around them by myself than implementing technology. This agrees with an opinion of Am, another interviewee. She said that,

" Generally, my selection of technology depends of the level of students. I teach very young students at this school. Thus, technology may not be the best answer for my class. I prefer teaching them through coloring activities and activities physical movement activities."

C. Frequency of technology use in classroom has significant relationship with TCK (t=2.96, p=0.004), TPK (t=2.26, p=0.026) and TPACK (t=2.93, p=0.004).

The frequent use of technology in classroom provides opportunities for teachers to know more about hardware and software. This helps teachers improve their knowledge and skills in implementing technology, become more proficient, have more confident in using technology, and results it TCK,

TPK, and TPACK.

Past researchers showed that frequent use of technology represents teachers' interest in integrating technology to their teaching. For instance, in the study of [23], they pointed out that interest in using technology is a personal factor affecting teacher's decision in integrating technology into their teaching. [24] explained that if teachers had negative attitudes towards the use of technology, they would see it as unnecessary tool and heavy burden on teachers. Subsequently, they would reject technology.

Nuch, an interviewer, stated that, "At school, there is no encouragement from anyone to use technology because we all think our way of teaching is good enough—we don't have to spend time on searching information from online resources, connecting to the Internet, or preparing new lesson plans in which technology is integrated." This affirms that, if teachers lack interest in using technology, the implementation of technology in classroom is unlikely to take place. Level of TCK, TPK, and TPACK would remain low also. The study of [12], [16], and [25]and support this point.

5. Recommendations

5.1 Recommendations for Practice

1. Since the ability in using technology, or digital literacy, is a factor that influences most of the components of TPACK, school administrators should promote their staff's development of technology knowledge and skills. This can be done by inviting speakers to give knowledge about new technologies, organizing technology training that suits with the skill level and interest of their teachers, and organizing workshops for teachers to have hands-on experience in implementing technology, and exchange knowledge and experience with other teachers, for instance.

2. Teachers should continuously seek knowledge related to main components of TPACK either by self-direct learning, or attending a training or workshop, so that they will be able to integrate technology when they teach the subject content effectively. The emphasis should be placed more on technology knowledge (TK) since the rapid development of technology brings about new knowledge and skills. The acquisition of TK allows teachers to manage their teaching with technology promptly.

3. School administrators are obliged to have insights into the components of TPACK and know their workforce's TPACK level. As such they can prepare guidelines to develop the knowledge of components in relation to TPACK and their workforce will eventually be able to maximize their technology knowledge and skills. Besides, they can integrate technology to their teaching effectively leading to learners' successful learning. This concurs with the study of [26] suggesting that an important thing that should be taken into account about technology implementation is enhancing teachers' knowledge, skills, and abilities in using technology. As such, they can integrate technology into their teaching, develop their teaching learning process, and make utmost use of technology available at their institutions

4. It is necessary for school administrators to place the emphasis on the importance of the availability of various technological equipments in the classroom. A teacher in a classroom without technology readiness will lack opportunities to integrate technology into his or her teaching. As a consequence, he or she would view technology as an unnecessary tool and have no motivation in seeking technology knowledge.

5.2 Recommendations for Further Research

1. Future studies are needed to look at wider range of factors affecting level of TPACK. They include gender, teachers' belief, teachers' attitudes towards technology, teachers' self-efficacy, outcome expectation, teachers' interest, schools' policy on integrating technology into teaching and learning, the readiness of different aspects related to technology such as the Internet, computers, and software, for instance.

2. The relationship among the six components of TPACK should be investigated to explain how teachers connect them in classroom and how all components affect TPACK.

3. There is a need to examine TPACK of teachers who teacher other subjects, and those who teach at different educational levels such as high school teachers and university lecturers. Thereby, educational practitioners and school administrators will obtain useful data for planning guidelines to develop their technology knowledge and skills corresponding to TPACK framework.

4. The relationships between TPACK and English language learning achievement should be explored. This would reveal how TPACK results in English language learning management as well as learning achievement of English language learners.

5. The results from this study can be used as a basis for developing TPACK model for English language teaching context.

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