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A Review of Research on Pre-Service Teachers' Technological Pedagogical Content Knowledge for Teaching English Language

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Abstract

In this modern era, the knowledge of technology, pedagogy, and content knowledge (TPACK) is very crucial in preparing the pre-service teachers to become quality teachers in order for them to face the challenge of 21st century. This paper reviews literature of TPACK mastery among pre-service teachers. The objective of this study is to find out the level of TPACK mastery of pre-service teacher and at the same time identify the challenges faced by student teachers during their practicum especially challenges that are related to the use of technology tools. The researcher will use triangulation method which are classroom observations, semi-structured interviews, and document analysis. The samples are four pre-service teachers who enroll in the Teaching English as Second Language (TESL) course from Faculty of Language and Communication (FBK), Sultan Idris Education University (UPSI). The pre-service teachers are in their final year (7th semester). They are mostly well verse with technology. However, there are reasons that they cannot implement the use of technology in their classroom such as time constraint and also inadequate space. Therefore, the result that the researcher expect is the pre-service teacher will be using very little technology tools and would be sticking to the traditional method which is 'chalk and talk'. Unless, the pre-service teachers take the initiative to use the computer lab or ICT room in the school to conduct their lesson, then only they can implement the 21st century learning. Another option for the pre-service teachers is by bringing their own tools into the classroom which not many of them can afford it. In conclusion, the teachers in Malaysia are equipped with the soft skills in using technology tool but there are challenges for them to carry out activities using technologies and many schools also are not equipped with sufficient tools for all teachers in school.

Keywords: TPACK, Quality Teacher, Pedagogy, Technology.

Introduction

The importance of technology implementation in teaching and learning and also in education system now has become a policy choice in educational development because the conventional teaching and learning strategies and approaches are no longer applicable with this current situation of 21st century learning. The educators should equip themselves with the knowledge and technological skills and apply technologies in producing more effective teaching and learning process (Chai et. al., 2010).

Technology affords the opportunities for the teachers to come out with or to create variety of contexts and learning environment in teaching and learning process. With all the opportunities provided by the usage of technology, there are also unsolved challenges that in a way prevent the teachers from embedding the use of technology and rather stick to conventional ways or teaching methods. Therefore, it is very important for those student teachers to acquire the skills of using technology tools in classroom because of the necessity from the 21st century learning environment. Becoming a teacher in the future is a challenge for them that they must be able to cope with the learning styles of Gen-Z who are exposed a lot to the variety of technology tools.

Shulman in 1987 initiated the concept of pedagogical content knowledge (PCK) that integrated the two types of knowledge which are pedagogical knowledge and content knowledge for teachers. As it is necessary for the ESL teachers to apply technology in the classroom, Koehler and Mishra in 2008 introduced the concept of Technological Pedagogical Content Knowledge (TPACK). They explained the three knowledge area, (technology, pedagogy and content) should be instilled into the teacher's professional knowledge to develop TPACK that is necessary to provide proper learning environment to digitally savvy students.

Malaysian Government has spent millions on ICT for education as it a part of "Eleven Shifts to Transform the System" which is "Leverage ICT to Scale up Quality Learning across Malaysia" (Ministry of Education Malaysia, 2003). The enormous expenditure was made to ensure proper and effective roll out of ICT usage in classrooms. This includes students performing in their study at a greater advancement in forms of better results in examinations and real life situations. Nowadays, children are well versed in using computers and computer gadgets such as smart phones, chrome books and tablets. These "techno-savvy" children have a deep "relationship" with technology and as such, they always prefer modern technologies to do their daily activities such as messaging, watching videos, listening to music and reading magazines and comics (Cimermanova, 2013).

TPACK

The TPACK framework consist of seven components namely Technological Knowledge, Content Knowledge, Pedagogical Knowledge, Pedagogical Content Knowledge, Technological Pedagogical Knowledge, Technological Content Knowledge, and Technological Pedagogical and Content Knowledge

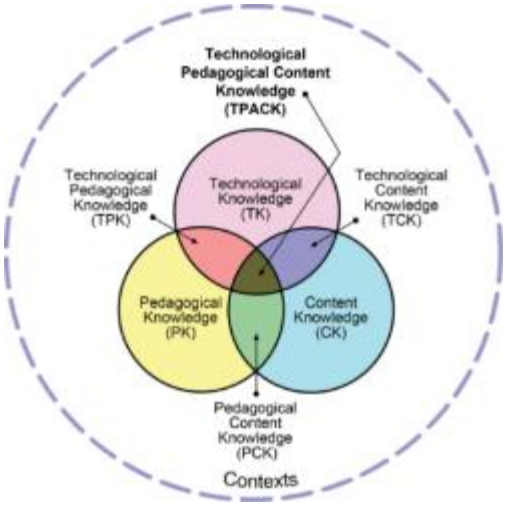

Figure 1.1 TPACK Frameworks by Mishra & Koehler (2006)

There are five stages of Teachers TPACK development. The first stage is *recognizing* (knowledge). This stage is where a teacher is able to use technology. The second stage is *accepting (persuasion*). This is the stage where teachers chose certain parts in their teaching and learning to integrate with technology while some other part to be kept with other traditional or other approaches that considered more effective without the assistance from technology devices.

The third stage is *adapting* (decision) where teacher started to engage the activities in the classroom with the topic that they choose and thought would be more meaningful with the integration of technology while the rest remain with the other suitable approaches. The fourth stage is *exploring* (implementation). In this stage, teacher considered as more advanced in the implementation of technology because this is the stage where teachers are actively integrating appropriate technology in their teaching and learning. The final stage is advancing (confirmation). This is when the teachers look back into their teaching and learning process what they have carried out with the integration of technology tools and evaluate the result of their decision of bringing in the environment of 21st century in their classroom (Niess et al, 2009).

Discussion

The study about TPACK was carried out worldwide and from a lot of different perception. However, in this part, the focus is only on the perception of pre-service teachers towards TPACK. It reveals that the pre-service teachers are generally not equipped with the TPACK due to the lack of experience in school. List of study related to TPACK is included in this paper as show in the table below.

References	Research Title	Methodology	Findings
Hasniza, Niki, & Tengku Faekah(2013)	*A Case Study of Secondary Pre-Service Teachers' Technological Pedagogical and*	Mixed method (survey and interview)	- Pre-service teachers perceived that they had the necessary technology knowledge, sufficient enough for them to apply TK during their practicum.

	Content Knowledge Mastery Leve		
Duygu Cetin-Berber (2015)	*An Investigation of Turkish Pre-service Teachers' Technological, Pedagogical and Content Knowledge*	Experiment	-There is a significant different of TPACK perceptions between pre-service teachers who went for practicum and who do not undergo practicum yet.
Ghaida (2012)	*Developing Technological Pedagogical Content Knowledge in pre-service science teachers: Support from Blended Learning.*	Survey	- Significant increase for 'ICT as a tool for instruction and productivity' and 'enjoyment'
Julie & Tina (2015)	*Pre-service Teachers' Perceptions of Technology and Multiliteracy Within the Inclusive Classroom.*	Course	-Slightly more than half of the respondents (51%) believed that understanding technology would improve their teaching.
Thuthukile (2016)	*Pre-service Teachers' Competence to Teach Science Through Information and Communication Technologies in South Africa.*	Mixed method (questionnaire and focus group interview)	- Result from interview reveal that the pre-service teachers do not bring ICT into the classroom due to some constraint such as school culture who does not allow the use of cell phone in classroom and also the cost of data bundle used will be bulky.
Sahin,Tugra & Agah (2016)	*Pre-service Teachers' Level of Web Pedagogical Content Knowledge: Assessment by Individual Innovativeness.*	Relational Screening Model	-Not only W-PCK scores are meaningful for the classification of pre-service teachers according to their individual innovative profile but also classification rate has a high accuracy
Julien & Ming (2015)	*Putting TPACK on The Radar : A Visual Qualitative Model for Tracking Growth of Essential Teacher Knowledge*	Course	-The qualitative evidence from the reflections supports the need for a better model of the TPACK framework.
Petrea &Yehuda (2015	*An International investigation of TPACK*	Survey	- Pre-service teachers have low confidence in TK and TPK.

Ping , Seng & Doris (2011)	*Self Reflection and pre-service teachers' Technological Pedagogical Knowledge: Promoting Earlier adoption of…*	Mixed method	- Most pre-service teachers indicated their readiness in using ICT in their field placement.
Hasniza & Tengku Faekah (2016)	*Validation of A Technological Pedagogical Content Knowledge Instrument In A Malaysian Secondary School Context.*	Case study	- Malaysia pre-service teachers did not clearly distinguish their PCK, TPK TCK and TPACK, suggesting that the pre-service teachers could not differentiate between the technology-related domains and the PCK.
Lee & Tsai (2010)	*Exploring teachers' perceived self efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web*	Survey	-This study reveals that the teachers with more years of teaching have lower of confidence not only in term of the using Web but also on how to integrate the Web into instructions.
Tantrarungroj & Suwannatthachote (2012)	*Enhancing Pre-service Teacher's Self-efficacy and Technological Pedagogical Content Knowledge in Designing Digital Media with Self-Regulated Learning Instructional Support in Online Project-Based Learning*	Experiment	-Pre-service teachers who experienced online project-based learning with different types of self-regulated learning strategies had significantly higher score in the post-test for self-efficacy in designing digital media and TPACK compared to their pre-test scores.
Shively & Yerrick (2014)	*A case for examining pre-service teacher preparation for inquiry teaching science with technology*	Case study	-Pre-service teachers do not get enough exposure of technology tools
Chai, Koh & Tsai (2010)	*Facilitating Pre-service Teachers' Development of Technological, Pedagogical, and Content Knowledge (TPACK)*	Survey	there are significant different in the pre-service teachers TPACK components after attending the ICT course designed

Meng, Sam, Yew & Lian (2012)	*Effect of Lesson Study on Pre-Service Secondary Teachers' Technological Pedagogical Content Knowledge*	Survey	-There is significant effect on the pre-service secondary teachers' TPACK for teaching mathematics with GPS in term of gender before and after engaging in LS.
Raman (2014)	*TPACK Confidence of Pre-service Teachers in Universiti Utara Malaysia*	Survey	-Pre-service teachers have a high level of competency, confidence and TPACK.
Lau (2013)	*Opportunities and Challenges Faced by Private Higher Education Institution Using the TPACK Model in Malaysia*	Survey	-There are still rooms for improvement in private higher educational institution on ICT based educational system.
Muniandy (2011)	*Views of Pre service Teachers in Utilizing Online Video Clips for Teaching English Language*	Survey	-Pre-service teachers highly accept the applicability of online video clips and they show very strong attitude and readiness to use the video clips in the future teaching.
Ozturk (2012)	*Wikipedia as a teaching tool for technological pedagogical content knowledge (TPCK) development in pre-service history teacher education*	Project-based learning (PBL)	Effective TPACK development in pre-service teacher education requires systematic engagement of student-teachers in rich teaching experiences within the real teaching contexts.

Hasniza, Niki & Tengku Faekah(2013) conducted a study is to examine the pre-service teachers' use of ICT during field experience and their development of Technological, Pedagogical and Content Knowledge (TPACK) mastery before and after completing the field experience in New Zealand and in Malaysia. In this study, the method used is mixed method. This study used survey with large sample (107 respondents) and interview with three students before and after completing their field experience. There are four major findings in this study. Firstly is the mean of all quantitative score for the entire TPACK domain indicated overall positive response. Then, Technology knowledge was the lowest mean score among the seven domains of perceptions of TPACK. They also found out that pre-service teachers perceived that they had the necessary technology knowledge, sufficient enough for them to apply TK

during their practicum. In summary, they suggested that all the three domains of knowledge were important and they are equally important.

A study by *Duygu* Cetin-Berber (2015) was carried out to investigate pre-service teachers' technological, pedagogical and content knowledge (TPACK) in Turkey. They used experiment as their method of research. The experiment was done in a form of a survey carried out with the sample of 491 elementary pre-service teachers who attended the summer semester at Pamukkale University in southwestern Turkey. In the end, they found out that there was a significant different for the TK between male and female. There was also no significant difference between perceptions of female and male students in terms of CK,PK, PCK, TCK, TPK, or TPACK. They also suggested that age group was not a significant factor for the TPACK perceptions of pre-service teachers. Lastly, there is a significant different of TPACK perceptions between pre-service teachers who went for practicum and who do not undergo practicum yet.

Alayyar (2012) conducted a study to explore the potential of blended support for leaning as an efficient way to support the Design Team. The method used is a survey with 78 participants (pre-service science teachers) who attended an 'Educational Seminar'. The findings are ICT skill test result show significant increase in students' scores. There is significant increase for 'ICT as a tool for instruction and productivity' and 'enjoyment'. Finally, anxiety and frustration had reduced significantly at the end of the intervention. This results show that technological tools helps the teaching to provide better teaching and learning process.

Julie and Benevides (2015) conducted a study to Examine whether pre-service teachers who develop a multiliteracy lesson plan that integrates technology reports changes in their perceptions of technology, self-efficacy for technology and understanding of multiliteracy. A total of 143 pre-service teachers were gathered in a program and they have to complete an assignment for the course that incorporated one or more special education App with one or more curriculum-based. More than half of the participants believed that technology is not important to either student learning (56%) or student motivation(58%) during the pre-test. The percentage decreased to 48% after the post-test for student leaning and 54% for student motivation. Slightly more than half of the respondents (51%) believed that understanding technology would improve their teaching. Small percentage of pre-service teachers (17%) feeling confident about using technology to address the need of each student. The post –test result increase the percentage to 24%.

Thuthukile Jita (2016) conducted a study with the main objective to identify the pre-service teachers' perceived competencies with respect to the technological pedagogical content knowledge (TPACK). The study used mixed method used involving 103 final year pre-service teachers completing a questionnaire on their competence to use ICT for teaching and 21 of them participated in focus group interview concerning their experience with ICTs during teaching practice. The study's findings are, participants regard content knowledge and pedagogical knowledge as more important than technology-related knowledge. Pre-service teachers applied technology in preparation and presentation of the lesson but do not include in detail how the student were engaged with the ICT during the teaching and learning. Result from interview reveal that the pre-service teachers do not bring ICT into the classroom due to some constraint such as school culture who does not allow the use of cell phone in classroom and also the cost of data bundle used will be bulky. In summary, the data collected suggested that the pre-service teachers were not skilled in technology-related knowledge domain.

Another study conducted by Gokcearslan, Karademir and Korucu (2016) was carried out to determine whether a profile of pre-service teachers based on their "individual innovativeness" can be used as a significant predictor in also categorizing them according to their knowledge of web technology, pedagogy and content. This study used The Relational Screening Model which involved 170 pre-service teachers. The study found that not only W-PCK scores are meaningful for the classification of pre-service teachers according to their individual innovative profile but also classification rate has a high accuracy and " General Web" , "Communicative Web" and "Pedagogical Web " sub factors have the highest prediction percentage.

Colvin & Tomayko (2015) aimed to find a way to present visually a particular teacher's knowledge profile within the TPACK model after quantifying the teacher's knowledge level in each of its seven domains. There are 25 undergraduate students in mathematics and science were gathered in a program and been asked to watch a video explaining the framework of TPACK. After that, they write a short reflection to express what they understand about TPACK after watching the video. Then the data was analyzed by looking for specific evidence of understanding the TPACK framework and able to improve knowledge and skills within the TPACK framework's knowledge domains. In conclusion, the qualitative evidence from the reflections supports the need for a better model of the TPACK framework. There are also evidence supports that TPACK radar diagram may fit the need of pre-service teachers.

A study conducted by Redmond & Peled (2015) to identify the similarities and differences of TPACK across two international universities. Therefore, a survey carried out from two pre-service teacher programs in Australia and Israel involving 99 pre-service teachers. The study concluded that pre-service teachers are provided with a wealth of experiences of using technology in their learning and in designing learning experiences in their course work. Pre-service teacher need to have opportunities to apply the theory of TPACK in the design of their lesson and learning tasks in their professional experience. Pre-service teachers have low confidence in TK and TPK. There is limited difference in the experience and confidence of pre-service teachers in TPACK irrespective of location.

There is a study by Gao, Tan, Choy (2011). The purpose is to present the qualitative findings relating 14 pre-service teachers' development and translation of their technological pedagogical knowledge (TPK) into their classroom practices. Mixed methods which focused more on qualitative by examining the process of pre-service teachers developing and applying TPK through self-reflection throughout their teacher preparation program. The study finds that most pre-service teachers indicated their readiness in using ICT in their field placement. The study also finds that learning to teach with ICT is not a linear translation of the support beliefs, knowledge and skills into practice, but multi-dimensional, and developmental process involving confirmation and adjustments to many aspect of changes simultaneously. Finally, the study shows that it is important to engage the pre-service teachers in reflecting student learning.

Hasniza Nordin& Tengku Faekah Tengku Ariffin (2016) conducted a study to validate the Technological Pedagogical Content Knowledge (TPACK) instrument for using ICT in teaching and learning effectively in a Malaysian secondary school setting. The study used a case study situated within a particular context in Malaysia and also a survey administered to 150 pre-service teachers enrolled in a university in Malaysia. The result shows that measurement model adequately fit with the data collected within a Malaysian secondary school context that also leading to validity of adapted TPACK instrument used tin this study. Secondly, Malaysian pre-service teachers did not clearly distinguish their PCK, TPK TCK and

TPACK, suggesting that the pre-service teachers could not differentiate between the technology-related domains and the PCK.

Lee and Tsai in 2010 conducted a study to provide a framework for understanding teachers' TPACK-W. The method used for this study is survey method that the senior teachers tend to have lower confidence in all aspect of the TPACK-W survey. The result is parallel with some other studies such as study by Yaghi (2001) who suggested that teachers with more years of teaching experience had lower confidence level in term of the usage of computers or technology tools. This study reveals that the teachers with more years of teaching have lower of confidence not only in term of the using Web but also on how to integrate the Web into instructions.

A study by Tantrarungroj & Suwannatthachote (2012) was conducted to investigate pre-service teachers' self efficacy in designing digital media and their technological pedagogical content knowledge (TPACK) for designing digital media using different form of self-regulated learning instructional support for online project-based learning. They used experiment whereby they have pre and post-test. They run seven weeks of lesson plan after the pre-test. This study involved 242 pre-service teachers at Chulalongkorn University in Thailand. The finding shows that pre-service teachers who experienced online project-based learning with different types of self-regulated learning strategies had significantly higher score in the post-test for self-efficacy in designing digital media and TPACK compared to their pre-test scores.

Shively and Yerrick in 2014 conducted a case study to examine a collection of pre-service teachers who enroll in two educational technology courses. They used a bounded, case study approach which includes interviews, field notes, surveys, reflective digital narratives and students-generated exhibits in exploring the pre-service teachers of how to teach science using inquiry and technology. The finding of this study is that the pre-service teachers do not get enough exposure of technology tools. Therefore, with the expectation for the higher institutions to produce teachers with the ICT skill, more courses is needed for them to get sufficient exposure for them to implement in schools. The interview reveals that they experience a lot of traditional lectures at most of the courses.

Another TPACK-related study was conducted by Chai, Koh and Tsai in 2010. The objective of the study was to examine the perceived development of pre-service teachers in term of their technological, pedagogical, and content knowledge (TPACK). They used survey method where they adapted a questionnaire from Schmidt, Baran, Thompson, Mishra, Koehler, and Shin (2009). The participant is 889 of pre-service teachers in the Postgraduate Diploma in Education in Singapore. The shows that there are significant different in the pre-service teachers TPACK components after attending the ICT course designed. This result comes to agreement with previous study by Brown &Warschauer in 2006 saying that ICT courses can enhance the teachers' perceptions of the competencies in using ICT in teaching and learning.

A study conducted by Meng, Sam, Yew and Lian in 2012 was meant to examine the effect of Lesson study (LS) on pre-service secondary teachers' TPACK for teaching mathematics with The Geometer's Sketchpad (GPS). This study used survey where they employed a group consisted of 46 pre-service secondary teachers who enrolled in the mathematics teaching methods course in the first semester of the academic session 2011/2012 in a Malaysian Public University. The result of this study shows that LS there is significant effect on the pre-service secondary teachers' TPACK for teaching mathematics with GPS in term of gender before and after engaging in LS.

Raman (2014) conducted a study to measure TPACK level of confidence of pre-service teachers in Universiti Utara Malaysia. This study involved 154 pre-service teachers from various program. The participants answer questionnaire via 'Google Form'. The result shows that the pre-service teachers have a high level of competency, confidence and TPACK.

Lau Teng Lye conducted a research study in 2013 with the objective to examine the opportunities and challenges encountered by the students in one of the private higher education institution in Malaysia. Another objective is to find out to what extent that the modern technologies have been utilized by the education group based on the TPACK model. This study used questionnaire survey involving 10 respondents (convenient sampling) from various states of Malaysia for the pilot test and used 60 participants for the final test. The finding of this research is that there are still room for improvement in private higher educational institution on ICT based educational system. Most of the academic staff scored average level which is 3.9 out of 7 of integrating ICT in their teaching and learning process. Another evidence that academic staff was not utilize the ICT in their teaching and learning environment was only 80% of the staff were undertaken the online training modules.

A study conducted by Muniandy (2011) provides the utility knowledge of how and widely and freely available online video clips can be collected and utilized to teach English Language. This study used a questionnaire that has been distributed to 33 TESOL pre-service teachers at a public university. The result shows that the pre-service teachers highly accept the applicability of online video clips and they show very strong attitude and readiness to use the video clips in the future teaching.

A study by Ozturk (2012) meant to explore a web-based teaching activity designed for technological pedagogical content knowledge (TPACK) development in pre-service history teacher education in Turkey. This research conducted using project-based learning (PBL) approach. The participants are the student teachers who receive both disciplinary education in history and pedagogical formation and there are 27 of them (14 females and 13 males). The result shows that it support the idea that effective TPACK development in pre-service teacher education requires systematic engagement of student-teachers in rich teaching experiences within the real teaching contexts.

Conclusion

Technology implementation is very important in teaching and learning. Teachers can be the leaders of the educational reform that is needed to fully integrated technology into the classroom (Teo, 2009; Lambert & Gong, 2010).In order for the teachers to teach more effectively, they need to develop their TPACK. The TPACK framework which has been revised by Mishra and Koehler (2006) has been discussed widely and debated and most scholars agree that the attainment of TPACK is worthy a goal for teachers (Colvin, Tomayko, 2015). Determining the pre-service teachers' mastery level of TPACK is one of the important steps towards the effective planning of activities in teaching and learning that related to the use of technology in education.

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