European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available online at: www.oapub.org/edu

DOI: 10.46827/ejes.v11i11.5667 Volume 11 | Issue 11 | 2024

PERCEPTIONS OF VIETNAMESE EFL TEACHERS ON THEIR TECHNOLOGICAL, PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK)

Luu Huu Tho[i]
Nam Can Tho University,
Vietnam

Abstract:
A quantitative study was conducted in a Vietnamese city to survey EFL teachers' perceptions. It investigated the perceptions of 100 EFL teachers on their TPACK. The research instrument, the questionnaire, is the intersection of many sources which had been collected and adapted to the research context before it was piloted and administered for the reliability of the scale calculated as α= 0.809. Quantitatively, using descriptive statistics (mean score, standard deviation) to examine their perceptions of TPACK showed that TK and CK were the most positively perceived. In contrast, TCK and TPACK were the least perceived. Limitations, implications and recommendations for further study are put forward.

Keywords: technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), pedagogical content knowledge (PCK)

1. Introduction

TPACK has gained popularity worldwide, particularly in Western nations. The TPACK framework serves as a model for the effective integration of technology in teaching, emphasizing the competencies required by educators. This framework is constructed around the interplay of three critical domains: content knowledge, pedagogical knowledge, and technological knowledge, which together form a complex structure. Consequently, defining and evaluating TPACK is a multifaceted endeavor. While Mishra and Koehler (2006) initially conceptualized TPACK through the lenses of content, pedagogy, and technology, their approach was not fully reflected in the assessment tools they created. This indicates that the TPACK components encompass a broader and more profound significance. In this context, TPACK can be understood as the amalgamation of knowledge that educators must possess to effectively integrate pedagogical and

[i] Correspondence: email luuhuutho2027@gmail.com

technological strategies within specific content areas, thereby enhancing the use of educational technology (Schmidt et al., 2009; Koehler & Mishra, 2005, 2008). Furthermore, the TPACK component highlights the importance of technological knowledge in coordinating and merging subject-specific and topic-specific activities through emerging technologies to support student learning (Cox & Graham, 2009). So and Kim (2009) characterized the TPACK component as the pedagogical representation of subject matter and technology. Numerous studies have corroborated the existence of seven components within TPACK (Koh et al., 2010; Jamieson-Proctor et al., 2013; Archambault & Barnett, 2010), asserting that technological pedagogical knowledge (TPK) cannot be examined in isolation. Thus, the framework encompasses content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK), which must be interconnected with the TPACK framework, alongside the other components: pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK), all of which interact dynamically (Koehler & Mishra, 2005; Koehler & Mishra, 2008, 2009; Mishra & Koehler, 2006).

The current investigation was carried out in a Vietnamese city where English is widely spoken. The present study aims to find out **t**he perceptions of Vietnamese EFL teachers about their TPACK in the Mekong Delta. The current study closes the gap left by the previous literature review. Stated differently, the results of this study will offer valuable and practical information that will add to the body of literature and improve the overall development of TPACK in training programs and EFL teachers' English language instruction. Additionally, the current study will provide solid proof of EFL teachers' opinions regarding TPACK. Lastly, the study's conclusions can shed light on the variables that affect teachers' TPACK.

1.1. Technology knowledge (TK)

Technological Knowledge (TK) encompasses the understanding and abilities related to various forms of technology, including books, boards, and digital tools (Mishra & Koehler, 2006). Similarly, Schmidt et al. (2009) posited that TK comprises the competencies necessary for utilizing diverse digital technologies within educational settings, such as computers, the internet, interactive whiteboards, mobile devices, and software applications. Within the TPACK framework, the TK domain is essential for the effective operation of digital devices, certain software, and for addressing technical issues related to both hardware and software. Schmidt et al. (2009) noted that while technology should encompass both traditional and digital forms, most TK components in their instrument predominantly reflect digital technologies. This observation highlights the ambiguity of the term "technology," which fails to specify activities such as creating audio or video recordings, computer publishing, utilizing blogs, engaging with social networks, and designing web-based sites. In the research conducted by Koh et al. (2010), the definition of TK was overly broad, leading to varied interpretations among participants, such as the statement, "*I have the technical skills I need to use technology*." Although TK items were associated with multiple dimensions, Lux et al. (2011) crafted these items without

adequately considering the technological affordances of the technologies in question, which influences the determination of where technology can be advantageous or detrimental in achieving specific goals. Some investigations have focused on particular TK items. For instance, Archambault and Barnett (2010) identified only three TK items, all related to troubleshooting technology issues. Another study by Koh and colleagues found merely two specific TK items. Nevertheless, researchers such as Archambault & Barnett, Lee & Tsai, and Hsu & others have emphasized the significance of TK, despite not examining all seven components of the TPACK framework. Questions remain regarding the number of specific TK items included in many of these studies. However, a survey conducted by Chai and colleagues in 2011 identified six valid TK items.

1.2. Content knowledge (CK)

CK is the type of knowledge that teachers have about the subject matter. In other words, CK is the knowledge of what is taught. It is composed of theories, terms, ideas and constructs (Shulman, 1986). In other words, CK is referred to as the knowledge about the learning of students, methods of instruction, a number of theories in pedagogy, and assessment of students' learning in a subject matter teaching with no references to the content. Therefore, this kind of knowledge is a so-called knowledge of strategies of teaching and practices together with supportive knowledge, the knowledge from numerous disciplines that can enhance teachers' approach that is applied to their teaching and learning of subject matter.

1.3. Pedagogical knowledge (PK)

The framework consists of the knowledge that educators possess about the practices, processes, and methods required for teaching (Koehler *et al.,* 2007). It also addresses an understanding of how students learn, classroom management strategies, lesson planning, and assessment techniques. Therefore, teachers must be well-versed in cognitive, social, and developmental learning theories to acquire the essential skills needed for effective classroom management.

1.4. Technological content knowledge (TCK)

Mishra and Koehler (2006) conceptualized Technological Content Knowledge (TCK) as the interplay between technology and content, emphasizing how technology influences teachers' representation of subject matter. Koehler, Mishra, and Yahya (2007) further articulated that this domain necessitates a solid foundation in Content Knowledge (CK) alongside the capability to teach content through technological means. Consequently, educators must possess a deep understanding of their subject areas and the technological tools that can enhance student learning. TCK is particularly relevant in the context of teaching geometry, as it alters the learning experience and provides diverse forms of representation. Additionally, Cox (2008) described TCK as the comprehension of technologies utilized within specific disciplines and how these technologies reshape the content of those disciplines by creating and representing new knowledge. While this

definition offers clarity, it lacks specificity compared to the earlier one. In various TPACK surveys, items related to TCK were often not distinctly separated from pedagogical elements, which has contributed to TCK not being recognized as an independent factor. Archambault and Barnett (2010) incorporated pedagogical terminology within TCK items, resulting in a conceptual overlap with Technological Pedagogical Knowledge (TPK) and TPACK. Chai et al. (2011) included four TCK items in their survey; however, two of these were associated with the first subject matter, while the other two were similarly phrased in relation to a second subject matter. Similarly, Shahn (2011) validated four TCK items, three of which pertained to pedagogical concepts such as lesson planning, instructional technologies, and classroom activities.

1.5. Technological pedagogical knowledge (TPK)

There exists a variety of definitions regarding Technological Pedagogical Knowledge (TPK). Margerum-Leys and Marx (2002) describe this knowledge as an understanding of the applicability of pedagogical strategies across different technologies and the adaptability of these technologies in teacher instruction within classroom settings (Schmidt et al., 2009). Similarly, Mishra and Koehler (2006) offer a comprehensive definition of TPK, characterizing it as the existing knowledge of technologies relevant to educational activities, as well as the understanding of how teaching can be technologically adaptable. Furthermore, TPK is recognized as having the capability to select appropriate tools for pedagogical strategies. Technological Knowledge (TK) encompasses knowledge about strategies for utilizing the features of technologies, assessing the ability to employ current technologies for educational purposes, and implementing strategies for technological tools. The definition of TPK is arguably the most precise within the TPACK framework. Cox (2008) articulated it as an understanding of the technologies applicable in specific pedagogical contexts, including their advantages and limitations, and how these technologies influence or are influenced by the teacher's pedagogical strategies. Jimoyiannis (2010) defined TPK as the knowledge of how supportive technology can enhance specific pedagogical strategies utilized in the classroom. Additionally, TPK is identified as a specific components for science education, including ICT-based learning strategies, promoting scientific inquiry through ICT, supporting information skills, scaffolding for students, and addressing students' technical challenges. While Lux et al. (2011) and Hsu et al. (2013) validated TPK items, the other six components of TPACK were not successfully validated. In contrast, all components were effectively explored in the surveys conducted by Schmidt et al. (2009), Chai et al. (2011), Akman and Guven (2015), and Chai, Chin, Koh, and Tan (2013b).

1.6. Pedagogical content knowledge (PCK)

Schulman (1987) referred to content knowledge as what is applied in teaching some subject matter, whereas PCK differs in various subject areas since it requires the combination of subject and instruction (Schmidt et al., 2009). A teacher who is equipped with PCK is asked to be skillful at designing and practicing the content matter that will

be taught (Mishra & Koehler, 2006). In other words, this kind of knowledge includes content knowledge and strategies in pedagogy, which is used to help learners understand about the particular content. In English language teaching, PCK is a so-called specialized knowledge that is applied in language teaching and learning. It is also a tool to represent EFL in the classroom where learners of English can understand English in the practical teaching context. PCK is useful in exploring problems facing the students and ways that assist learners in tackling such problems in consideration of many variables that are relevant to their language learning issues, like assessment procedures and teaching materials.

2. Literature Review

Various scholars in non-Vietnamese settings have undertaken a multitude of research projects related to TPACK, as briefly illustrated below, which presents the sources, methodologies, and key outcomes of these studies. Following this, a summary is provided, pinpointing the gaps the current research seeks to fill.

The study by So and Kim (2009) utilized a mixed-methods approach to investigate the challenges perceived by student-teachers in their application of content, technology, and pedagogy knowledge for integrating lesson design with technology. Data were collected from questionnaires and lesson design artifacts from ninety-seven pre-service teachers who participated in a collaborative lesson design project. The findings revealed that, despite a theoretical comprehension of pedagogical knowledge (PK) regarding problem-based learning (PBL), the lesson designs produced by these teachers did not effectively align the technological tools, content, and pedagogical strategies. Consequently, while the pre-service teachers exhibited a strong understanding of PK in PBL, they lacked the necessary skills to apply this knowledge in technology-integrated lesson planning.

In their 2010 study, Lee and Tsai developed a TPACK-W framework that enhances the understanding of teachers' experiences when integrating digital technology into their teaching methodologies. This research focused on examining the self-efficacy of teachers concerning TPACK-W by designing a new questionnaire, which also evaluated their perspectives on Web-based instruction. The study gathered data from 558 educators across various elementary, middle, and high schools in Taiwan through a survey approach. The analysis utilized Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), confirming that the reliability and validity of the findings were deemed acceptable. Notably, the results suggested that teachers with extensive teaching experience tended to have diminished confidence in using computers and technological tools. Additionally, these teachers were found to be less confident in their ability to incorporate the Web into their instructional strategies.

Chai, Koh, and Tsai (2010) undertook a study focused on Technological Pedagogical Content Knowledge (TPACK) to investigate pre-service teachers' perceptions regarding their development in this area. The researchers utilized a survey

method, employing a questionnaire that was adapted from the work of Schmidt, Baran, Thompson, Mishra, Koehler, and Shin (2009) to align with the specific context of their research. This questionnaire underwent factor analysis, which was validated by experts in the United States, and was subsequently administered to 124 teacher candidates for a pilot study, yielding Cronbach's alpha reliability coefficients of .80 across all TPACK domains. The study involved a sample of 889 pre-service teachers from secondary schools in Singapore who were assigned to teach two subjects pertinent to their majors as part of the Postgraduate Diploma in Education program. The findings indicated a significant enhancement in the participants' TPACK components following their completion of an ICT course. This outcome corroborates the conclusions drawn by Brown and Warschauer (2006), which suggested that ICT courses can effectively enhance teachers' perceptions of their competencies in integrating ICT into teaching and learning. Gao, Chee, Wang, Wong, and Choy (2011) conducted qualitative research involving interviews with fourteen pre-service teachers who were intentionally selected for their extensive knowledge of technological knowledge (TK) and skills. The study aimed to explore their perceptions regarding the integration of pedagogy and information and communication technology (ICT) in their learning and teaching experiences. The findings highlighted the development of these pre-service teachers and their ability to translate technological pedagogical knowledge (TPK) into practical teaching methods. The qualitative approach emphasized the developmental journey of the pre-service teachers and their application of TPK through self-reflection on the entire teacher preparation program. Data collection involved observing and video-recording each participant during their teaching assistantship, revealing significant success in both TPK and a positive shift in their beliefs about using ICT. However, a notable transformation was observed when comparing their initial ICT practices at the start of their placements. The results indicated that a majority expressed a willingness to incorporate ICT into their professional practice, while also suggesting that the process of learning to teach with ICT does not follow a straightforward path of translating beliefs, knowledge, and skills into effective practice.

A recent investigation conducted by Graham, Borup, and Smith (2011) aimed to utilize the TPACK framework to explore how pre-service teachers made decisions regarding the integration of ICT in their instructional practices. Out of 137 elementary teacher candidates enrolled in four sections at Brigham Young University, 133 consented to participate in the study. These participants engaged in both pre- and post-course assessments and completed three design tasks, which were administered online during the initial week of an educational technology course. Prior to these tasks, they were asked to articulate their approaches to teaching key curriculum standards with the support of technology. The researchers analyzed the students' rationales, categorizing them into themes that corresponded to various knowledge domains, specifically Content Knowledge (CK), Pedagogical Knowledge (PK), and the intersections of TPACK constructs. The results revealed that while the participants' Technological Knowledge (TK) remained stable, there was a notable increase in both CK and PK levels.

Tantrarungroj and Suwannatthachote (2012) conducted a research study aimed at assessing the confidence levels of prospective educators regarding the development of digital projects, as well as their comprehension of the requisite tools for such tasks. The study involved a sample of 242 future teachers from Chulalongkorn University in Thailand. Initially, the participants completed a pre-test to evaluate their prior knowledge before engaging in a seven-week instructional program. Upon completion of the course, the same test was administered again. The findings indicated that those who had engaged in online project work and employed various self-directed learning strategies demonstrated significantly improved scores on the post-test in comparison to their pre-test results.

A research investigation by Hasniza, Niki, and Faekah (2013) focused on the integration of Information and Communication Technology (ICT) by pre-service teachers during their field experiences, as well as the evolution of their Technological Pedagogical Content Knowledge (TPACK) both prior to and following these experiences in New Zealand and Malaysia. Employing a mixed-methods approach, the study involved a survey of 107 participants and interviews with three students conducted before and after their field experiences. The analysis yielded four principal findings. Firstly, the overall mean quantitative score for the TPACK domain reflected a predominantly positive response. Secondly, the Technological Knowledge (TK) component recorded the lowest mean score among the seven TPACK clusters. Furthermore, pre-service teachers recognized TK as both necessary and adequate for application during their practicum. In conclusion, the study highlighted that three knowledge domains were significantly and equally influential in the development of TPACK.

Lau's (2013) research aimed to explore the opportunities and challenges faced by students, involving a pilot test with 10 participants from different Malaysian states, selected through convenience sampling methods. For the final phase, the study expanded to include 60 respondents who completed a questionnaire survey. The research was situated within a private higher education institution in Malaysia, focusing on how modern technologies have been integrated into educational practices, as framed by the TPACK model. The results indicated that there remains significant potential for improvement in the implementation of ICT-based educational systems within private higher education institutions.

Nordin, Davis, and Ariffin (2013) conducted a study aimed at exploring the perceptions of pre-service teachers regarding their Technological Pedagogical Content Knowledge (TPACK) levels both prior to and following their field experiences in educational settings. The research sought to determine whether there was a statistically significant change in TPACK levels after these practical experiences. Utilizing a TPACK scale adapted from the works of Schmidt et al. (2009) and Archambault and Crippen (2009), the study involved 107 student-teachers enrolled in a university program in New Zealand, who completed the scale before and after their field placements. Additionally, three participants were selected for in-depth interviews conducted at both time points. The findings revealed that the participants exhibited the highest scores in Content

Knowledge (CK) while their Technological Knowledge (TK) scores were the lowest at both stages. Paired-sample t-tests demonstrated significant improvements in TK, Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and overall TPACK. Analysis of the interview data and observations indicated that the participants experienced substantial changes in their TPACK levels, closely linked to their school experiences. The authors recommended further research involving comparative surveys to better prepare teachers for their roles in Malaysian middle schools.

The integration of Information and Communication Technology (ICT) in educational practices has emerged as a significant focus within modern teaching methodologies. A study conducted by Lin, Tsai, Chai, and Lee (2013) explored teachers' perceptions regarding the application of technology in their instructional approaches, specifically examining their Technological Pedagogical Content Knowledge (TPACK). The research involved a sample of 222 teacher candidates and in-service educators within the context of Singapore, employing structural equation modeling to analyze the seven components of TPACK, which include Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and the overall TPACK. The results indicated a positive relationship between Technological Pedagogical Content (TPC) and various TPACK dimensions. Notably, the findings revealed that female educators exhibited greater self-confidence in their Pedagogical Knowledge (PK) compared to their male counterparts, while demonstrating lower self-confidence in their Technological Knowledge (TK). Additionally, a significant negative correlation was identified among the TK, TPK, TCK, and TPC perceptions of female in-service teachers, particularly in relation to their age.

The research conducted by Maeng, Mulvey, Smetana, and Bell (2013) explored the implementation of technology-enhanced inquiry instruction and the development of Technological Pedagogical Content Knowledge (TPACK) among secondary school science teacher candidates. Prior to their teaching experiences, twenty-seven pre-service teachers received comprehensive guidelines aimed at integrating technology into science instruction, as part of a two-year Master of Arts teaching program focused on educational reform. During their student teaching, twenty-six of these participants actively engaged in utilizing technology for inquiry-based instruction. Data were collected from various sources, including observations, lesson plans, interviews, and reflective writings, which illustrated how the participants integrated technology to support inquiry instruction and informed their decision-making regarding the technological tools employed. The findings revealed that the participants' use of technology was well-aligned with both the content and context, effectively facilitating both non-experimental and experimental inquiry experiences. Their technology use was characterized by selectivity and appropriateness, encompassing engaging introductions, support for data collection and analysis, as well as enhancing communication and negotiation of results, all of which contributed to their TPACK development. Additionally, the use of digital images in

facilitating whole-class inquiry was identified as a particularly promising approach for teachers engaged in inquiry instruction. The results underscored the importance of science teacher educators' development of Content Knowledge (CK) and Technological Knowledge (TK) in equipping teacher candidates for technology-supported inquiry instruction, thereby facilitating a transition towards student-centered teaching and enhancing TPACK development.

A research investigation conducted by Shively and Yerrick (2014) focused on the experiences of student-teachers enrolled in two educational technology courses. The study employed a variety of methodologies, including interviews, field notes, surveys, reflective digital narratives, and student-generated exhibits, to explore how pre-service teachers approach the instruction of science through inquiry and technology. The results indicated a significant lack of exposure to technological tools among the pre-service teachers. Consequently, it is imperative that these individuals participate in additional courses to enhance their familiarity with technology tools, thereby better preparing them for implementation in educational settings.

Banas and Yerk (2014) conducted a survey study that examined the impact of authentic learning exercises, specifically strategy instruction, on the self-efficacy of student-teachers regarding technology integration and their intentions to incorporate technology into their teaching practices. The findings revealed a predictive relationship between the shifts in self-efficacy related to technology integration among teacher candidates and their corresponding changes in intentions to integrate technology. The study involved a sample of 104 teacher candidates enrolled in a professional preparation methods course. The perceived self-efficacy in Technological Knowledge (TK), Pedagogical Knowledge (PK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Content Knowledge (TPACK) emerged as significant factors influencing technology integration. A paired samples t-test demonstrated notably high scores, with PCK being the most prominent among all TPACK self-efficacy measures and intentions for technology integration. Furthermore, multiple regression analysis indicated that changes in self-efficacy regarding technology integration were predictive of shifts in intentions, particularly concerning Technological Knowledge.

Hsu's (2014) qualitative study investigated the impact of educational technology courses on the development of technology integration knowledge among teacher-candidates within a teacher preparation program in the United States. The research involved eight pre-service teachers enrolled in a primary education program at a prominent university located in the Midwest. Data collection encompassed a range of sources, including interviews, documents, and observations, which were subsequently analyzed. The findings indicated that the technology knowledge (TK) acquired and shaped by the pre-service teachers played a crucial role in their technology integration courses. The study recommended the incorporation of diverse activities into educational technology courses to enhance the readiness of teacher-candidates in effectively integrating technology into their teaching practices.

Lee and Kim (2014) conducted a survey research project focused on creating a model for instructional design aimed at enhancing the TPACK (Technological Pedagogical Content Knowledge) learning of student-teachers within a course dedicated to the integration of multidisciplinary technology. This model was subsequently applied to assess its impact in a teacher-candidate education environment, involving the participation of fifteen pre-service teachers from diverse disciplines. The researchers gathered data through various means, including written materials, TPACK questionnaires, collaboratively developed lesson plans, and field notes. The results indicated that the pre-service teachers faced challenges in comprehending pedagogical knowledge (PK), revealing that their TPACK learning was characterized by a combination of knowledge types rather than a cohesive integration of PK, technological knowledge (TK), and content knowledge (CK).

Koh, Chai, Hong, and Tsai (2014) conducted a study examining the perceptions of Technological Pedagogical Content Knowledge (TPACK), lesson design practices, and design dispositions among 201 teachers in Singapore. Utilizing a survey instrument that had undergone validation and reliability testing through Confirmatory Factor Analysis (CFA), the researchers found that significant factors influencing teachers' perceptions of TPACK remained unidentified. The structural equation modeling indicated a direct relationship between teachers' perceptions of their design dispositions and lesson design practices and their understanding of TPACK. The results suggested that to enhance teachers' perceptions, it is essential for teacher educators to provide support that fosters lesson design practices conducive to ideation and iteration. Additionally, assistance from teacher trainers in addressing design dispositions, which can help clarify and resolve conflicting ideas in lesson design, was deemed necessary. The insights gained regarding teachers' lesson design practices and design dispositions were crucial for promoting professional development aimed at integrating information and communication technology, particularly when TPACK was overlooked.

Julie and Benevides (2015) conducted a study to investigate the extent to which pre-service teachers altered their views on technology, their self-efficacy regarding its use, and their comprehension of multiliteracy concepts. The participants, comprising 143 pre-service teachers enrolled in a specific program, were tasked with developing a multiliteracy lesson plan that incorporated technology reports as part of a course assignment. Initial assessments revealed that a significant majority of the participants did not regard technology as crucial for enhancing student learning (56%) or motivation (58%). However, subsequent evaluations indicated a reduction in these percentages, with only 48% now considering technology important for student learning and 54% for motivation. Notably, just over half of the respondents acknowledged that a better understanding of technology could enhance their teaching practices. Furthermore, the proportion of pre-service teachers who felt confident in their ability to utilize technology to meet individual student needs was relatively low at 17%, although this figure rose to 24% following the post-test.

Redmond and Peled (2015) conducted a study examining the similarities and differences in Technological Pedagogical Content Knowledge (TPACK) among pre-service teachers from two international universities in Australia and Israel. The study involved a sample of 99 pre-service teachers and revealed that these individuals had considerable experience with technology through their coursework. The findings underscored the importance of providing pre-service teachers with opportunities to implement TPACK theory in their lesson planning. However, it was noted that these teachers exhibited lower levels of confidence in their Technological Knowledge (TK) and Technological Pedagogical Knowledge (TPK). Despite the geographical differences, the variations in their experience and confidence regarding TPACK were relatively minor.

Oz (2015) carried out a mixed-methods investigation aimed at evaluating the Technological Pedagogical Content Knowledge (TPCK) of English as a Foreign Language (EFL) teacher candidates, involving 76 university students enrolled in an English Language Teaching (ELT) program at a Turkish state university. Participants were recruited and asked to complete the TPCK Scale anonymously, in addition to responding to several open-ended questions. The findings indicated a significantly high level of TPACK among the candidates. Notably, a gender-based analysis revealed that female participants scored higher in the Technological Knowledge (TK) and Pedagogical Knowledge (PK) dimensions of TPACK. Furthermore, qualitative analysis suggested that faculty members demonstrated a greater utilization of TPACK compared to cooperating teachers. The study concluded that integrating Content Knowledge (CK), PK, and TK within a contemporary teacher education framework, particularly in a technology-rich environment for language learners, substantially enhances the quality of instruction.

Lin, Yu, Wang, and Ho (2015) conducted a study examining the perceived integration of Technological Pedagogical Knowledge (TPK) in educational settings. The research aimed to elucidate the relationship between learning theories and technology, as these theories underpin the principles and processes that inform educational practices. The study involved 313 nursing educators, both full-time and part-time, from a nursing institution during the 2012-2013 academic year in Taiwan. Findings indicated that faculty members viewed learning theories as essential for the selective application of technology in their teaching; however, a significant number of educators felt inadequately equipped to align their technological choices with these theories. Additionally, while some instructors employed emerging technologies in their teaching, they often overlooked fundamental pedagogical principles, such as assessment, activity design, and the pacing of learners. The research highlighted the necessity for a cohesive integration of technology and pedagogy, suggesting that the outcomes could provide valuable insights for technology specialists and trainers. This information could enhance the development of training materials that address the professional needs of educators, thereby fostering a stronger connection between pedagogical knowledge and the use of emerging technologies in instructional practices.

Akman and Guven (2015) conducted a study on the monitoring methods of 113 social studies teachers and 919 pre-service teachers, focusing on their self-efficacy

regarding TPACK, utilizing a scale developed by the researchers. The analysis employed structural equation modeling to determine consistency index values, while data classification and analysis were performed using the SPSS and AMOS software programs, respectively. The findings indicated that the relationships between various components and teachers' technological knowledge (TK) as well as student-teachers were generally low to moderate, whereas the correlation between content knowledge (CK) and pedagogical knowledge (PK) was notably stronger. Consequently, the integration of PK and CK among social studies teacher candidates and practicing teachers were found to be significantly established.

Ersoy, Yurdakul, and Ceylan (2016) aimed to explore the TPACK competencies of student-teachers in relation to their levels of ICT proficiency, the phases of ICT usage, and gender differences. The research involved 61 pre-service teachers from a state university's school of education, employing a quasi-experimental design with pretest and posttest measures during the 2011-2012 academic year, without a control group. The study utilized instruments such as the TPACK-deep Scale, ICT Usage Phase, and ICT Usage Level to gather data. Findings indicated that the TPACK competencies of the participants improved from a medium to a higher level following engagement in TPACK-based activities. Additionally, advancements were noted in areas such as proficiency, ethics, exertion, and design, which are components of the TPACK framework. By the conclusion of the intervention, there was a notable increase in the ICT usage phase among the teacher candidates. Ultimately, while the enhancement in ICT levels among student-teachers influenced their TPACK competencies, no significant differences were observed in TPACK competence based on gender.

Jita (2016) conducted a research investigation aimed at exploring the perceptions of pre-service teachers regarding Technological Pedagogical Content Knowledge (TPACK). The study employed a mixed-methods approach, engaging 103 final-year pre-service teachers who completed questionnaires assessing their competencies in integrating Information and Communication Technology (ICT) into their teaching practices. A subset of 21 participants was subsequently selected for interviews to gain deeper insights into their use of ICT in educational settings. The results indicated that Content Knowledge (CK) and Pedagogical Knowledge (PK) were prioritized over Technological Knowledge (TK). While the participants utilized technology for lesson preparation and presentation, they did not provide insights into the interactive engagement of students with ICT during the learning process. The interviews revealed that the pre-service teachers faced challenges in implementing ICT in the classroom, primarily due to restrictions on cell phone usage and the financial burden associated with data costs. This suggests a deficiency in their skills related to Technological Knowledge.

Nordin and Ariffin's (2016) study provided empirical support for the TPACK framework as a tool for enhancing ICT integration in teaching and learning within a Malaysian secondary school context. Utilizing a case study approach, the researchers gathered data from a survey involving 150 student-teachers enrolled at a Malaysian university. The findings indicated that the measurement model aligned well with the

data collected from the secondary school, affirming the validity of the adapted TPACK instrument used in the study. However, it was noted that participants exhibited confusion regarding the distinctions among PCK, TPK, TCK, and TPACK, suggesting that pre-service teachers struggled to differentiate between technological knowledge (TK) and pedagogical content knowledge (PCK).

According to the research conducted by Luik, Taimalu, and Suviste (2017), it is essential to recognize the significant role that quality teacher preparation plays in equipping educators for the needs of twenty-first-century students within teacher training institutions across various countries. In addition to pedagogical skills, it is imperative that teachers are proficient in integrating technology into their instructional methods to enhance the effectiveness of their teaching. Numerous studies have been conducted concerning the TPACK framework. In Estonia, a TPACK measurement instrument was developed to assess pre-service teachers' perceptions of TPACK. The results revealed that while pre-service teachers demonstrated competence in integrating technology into their teaching, they exhibited a deficiency in pedagogical knowledge (PK) within their instructional practices.

Research on TPACK has notably increased in recent years; however, there has been a scarcity of quantitative studies examining EFL teachers' perceptions in Vietnam, which is the primary focus of this research.

3. Material and Methods

This study aims to answer these research questions: "What are EFL teachers' perceptions of their TPACK?" To achieve this goal, the current study employed a questionnaire. A total of 100 EFL teachers were given a background questionnaire, which included four parts, namely gender, age, work experience and major. Many of them were early career teachers, whereas some of them have been in the profession for over 10 years by the time of research.

Quantitatively, the present study used a questionnaire which comprised 7 sections with 83 items that were measured on a 5-point scale ranging from (1) strongly agree, (2) agree, (3) neutral, (4) disagree, and (5) strongly disagree. Contextualized TPACK model was employed in the present research. The survey instrument was adapted to my research context by the following method. The seven sections include TK (14 items), CK (13 items), PK (15 items), PCK (10 items), TCK (5 items), TPK (11 items) and TPACK (15 items).

The questionnaires designed to collect information on demographic information and personal teaching experiences regarding TPACK were administered to a total of 100 EFL teachers in a Mekong Delta province. The English version was pilot-tested for coefficient reliability of the scale, which was calculated as α= 0.809 by SPSS. It was greater than α= 0.7, indicating that it was in good enough internal reliability for the survey. In response to the research question, quantitative data were analyzed by calculating descriptive statistics (mean score, standard deviation) about their perceptions of TPACK.

4. Results and Discussion

In order to address the research question entitled "What are EFL teachers' perceptions on their TPACK?", the research attempted to make comparisons as follows:

Table 1: Findings

Clusters	N	Mean	SD
TK	100	2.870714	1.53693
CK	100	2.7776	1.45945
PK	100	2.744667	1.49817
PCK	100	2.764	1.53463
TCK	100	2.61	1.49273
TPK	100	2.679782	1.48662
TPACK	100	2.636	1.50834

Mean scores show the perceptions of teachers in TPACK. Their perceptions of TPACK were all "agree" in different levels which revealed that seven clusters were very important to teachers. Accordingly, teachers perceived that their TK (Mean = 2.870714; SD = 1.53693), CK (Mean = 2.7776; SD = 1.45945) were the two most essential factors for teachers, whereas TPK, PK and PCK (Mean ranged from 2.679782; SD ranged from 1.48662 to 1.53463) were rated as next influential elements. Out of the seven clusters, TCK (Mean = 2.61; SD = 1.49273), TPACK (Mean = 2.636; SD = 1.50834) appeared to catch their attention the least. It is concluded that TK and CK were the most positively perceived, whereas TCK and TPACK were the least perceived.

Regarding TK, both groups of teachers were not confident in handling technological issues (Mean = 3.5700; SD = 1.53909), followed by overcoming technical problems that may be experienced in the instructional environment on their own (Mean = 3.5100; SD = 1.62366). They did not have any clear ideas about their adaptation of new essential technology (Mean = 3.0000; SD = 1.48392) as well as solutions to hardware problems of technological devices in their instructional environment (Mean = 2.8700; SD = 1.56770). On the contrary, the participants expressed their high self-confidence in software use that was already installed in technological devices in the instructional environment, followed by using new developing technologies for instructional purposes, choosing appropriate technologies for instructional purposes as well as having adequate opportunity to study various technologies. Furthermore, the items with gradually low mean scores for TK were about their ability to necessary software installation into technological devices in their teaching environment, using the technology they need, and their ability to help learners with problems with computers as well. Moreover, they were generally confident in learning about innovative technology as they were frequently interested in technology. Thus, they were knowledgeable about various technologies (Mean ranged from 2.45 to 2.47; SD ranged from 1.40974 to 1.67646). Overall, all participants showed their confidence in over 70% of technology knowledge as well as their ability to apply technology to their teaching practices. It is concluded that almost

71% of TK items was positively perceived by all participants, whereas just 14% was given negative self-perceptions.

The results regarding CK revealed that most of them became neutral in their ability to improvise examples and problems different from those presented in sources (Mean = 3.1400; SD = 1.71164), followed by their hesitance on thinking in English (Mean = 3.1100; SD = 1.46952), having sufficient knowledge of English (Mean = 3.0700; SD = 1.43727), applying available knowledge about English subjects (Mean = 3.0500; SD = 1.57233), making a decision on the order of English subjects and concepts to be covered. Neutrally, they were hesitant in their skills of explaining objectives of English subjects in accordance with grade level, linking English subjects with similar courses (Mean = 2.9500; SD = 1.55294), and giving examples on how to use English daily life (Mean = 2.9200; SD = 1.24462). Nevertheless, pre-service teachers and in-service teachers were between 1.91 and 2.90, indicating that they had favorable attitudes towards having solutions to incurred everyday problems with English thinking (Mean = 2.6400; SD = 1.48065), ability to make a good decision on covering the scope of English subjects (Mean = 2.5400; SD = 1.45241), use diverse strategies to tackle English problems (Mean = 2.5000; SD = 1.48732); and have a better understanding on social sciences (Mean = 2.2300; SD = 1.42740), as well as English. Finally, they agreed that subject matter knowledge was important to their work even though they felt unsure of some items. It is concluded that nearly 38% of CK items received negative perceptions. On the contrary, positive perceptions accounted for 62% of all.

The descriptive statistics for PK demonstrated that all attendants had higher confidence in their knowledge of pedagogical methods. On the one hand, they disagreed with the use of various teaching approaches in the classroom environment, such as cooperative learning and direct learning. On the other hand, three of all items were rated neutrally (Mean ranged between 2.91 and 3.2), indicating that there was high suspicion of their perceptions of pedagogical knowledge in displaying their effective classroom management during classes, using instructional techniques based on student performance; taking into account any potential individual differences in the instructional process. However, the highest positive mean score was ascribed to the participants' knowledge of assessing students' learning in a variety of ways (Mean = 2.8900; SD = 1.61992), followed by their adaptation to widely misunderstood problems and misconceptions of student learning. Besides, they were able to use the best instructional strategy and method for teaching a particular concept, make classes attractive to stimulate student learning and keep up-to-date with instructional strategies, methods and techniques. Moreover, they also perceived that they can detect misconceptions students might experience and take measures against potential problems that might be experienced in the classroom. In the same vein, the average score (Mean = 2.5700; SD = 1.50591; Mean = 2.5400; SD = 1.58541) were respectively received for their perceptions of assessment in-class student performance, preparations of expedient measurement tools for examinations, while the lowest mean score (Mean = 2.3400; SD = 1.24089) was ascribed to their knowledge about the ability to change teaching activities according to what the

students understand or do not understand in the current situation. It is concluded that there was significantly positive self-perceptions of all PK items, accounting for over 73%, whereas more than 6% belonged to their negative perceptions.

From the questionnaire, likewise, PCK indicates "agree" (Mean ranged from 2.90 to 2.33; SD ranged from 1.56024 to 1.58945) for most of the items in the intersection of knowledge on pedagogy and content. All participants rated most items related to this cluster positively, that most PCK items were significant factors in their perceptions, suggesting that they thought critically about supporting students associate a particular English subject or concept with other subjects or concepts (Mean = 1.24089; SD = 1.56024), determining what obstacles may face students in a particular English subject (Mean = 2.8800; SD = 1.55881), and choosing effective teaching approaches to guide students in English and enable them to think scientifically (Mean = 2.8500; SD = 1.45904). Furthermore, other items with lower scores were about identifying instructional strategies, methods and techniques suitable for English subjects, explaining the contents of English subjects in the curriculum, choosing effective teaching approaches to guide student learning in English and enabling them to think English (Mean ranged from 2.8100 to 2.7000). Last but not least, they also perceived that choosing effective teaching approaches to guide student learning literacy and to enable them to think appropriately (Mean=2.5100; SD=1.50081), having students study English subjects (Mean = 2.5000; SD = 1.33712), and teaching English classes in accordance with the theoretical foundations of the curriculum (Mean = 2.3300; SD = 1.58945) were significantly important in their working environment. On the contrary, all participants showed negative attitudes towards overcoming any misconceptions that students might encounter in a particular English subject (Mean = 3.4500; SD = 1.59782). It is concluded that participants' positive perceptions accounted for 90%, while the rest, 10%, was for their negatively perceived items.

Based on the quantitative data, the participants perceived TCK as an important element in their English language practice, helping them opt for teaching knowledge of content with appropriate technology to facilitate student learning. A great majority of TCK items deeply influenced their perceptions of how to surf the Web for those English classes-related subjects and concepts (Mean = 2.9000; SD = 1.60492); and how to use software like Microsoft Office already installed in computers for English (Mean = 2.7600; SD = 1.53162). Other elements were ascribed to participants' knowledge of which technology is used in studying and understanding English. Additionally, the participants also showed their self-perception in overall knowledge on applying multimedia or making presentations in teaching English subjects, as well as using flash animations and graphical drawings to enrich English classes (Mean ranged from 2.6900 to 2.3300; SD ranged from 1.44036 to 1.51127). It is incredibly concluded that 100% of TCK items were positively perceived by a total number of teachers.

There were statistically significant differences in the sixth cluster as TPK. Although all respondents rated themselves negatively in evaluating their students about a class in which technology is effectively used (Mean = 3.2300; SD = 1.49649), there was a big

suspicion on their perceptions four of all TPK items which were received for their knowledge on predicting how influential technology can be on the process of the learning and instruction (Mean = 3.0800; SD = 1.77343); motivating online learning among learners; using diverse methods and approaches during online instruction; and planning how to use technology for instructional purposes as well. In contrast, akin to rated positive items towards teachers' attitudes, 60% of TPK items were highly developed. The initial third higher scores of three items which were attacked to their knowledge about the selection of technologies that will increase student learning from a lesson (Mean = 2.6600; SD = 1.59684); customizing various activities in teaching and technology use that they are learning (Mean = 2.3776; SD = 1.32007); and enabling learners to approach with online environments that contribute to their knowledge and skills (Mean = 2.3700; SD = 1.24442). The rest three items with relatively positively low scores for TPK belonged to the respondents' perceptions of thinking critically about how to use technology in my classroom, choosing the technologies that will intensify the effect of teaching approaches for a lesson, and they finally confirmed that the teacher training they received enabled them in thinking in detail about how influential technology use is on teaching approaches (Mean ranged from 2.3600 to 2.0800; SD ranged from 1.50098 to 1.42616). It is concluded that their negative perceptions were measured as 9%, followed by almost 36% of neutrality, whereas 55% belonged to positively perceived items.

Last but not least, the statistical result of TPACK indicated that a total number of teachers had more favorable attitudes towards the intersection among TCK, TPK and PCK. To begin with, the highest positive average score was ascribed to their perceptions of taking into account English contents, strategies of learning and teaching and relevant new technologies during lesson planning (Mean = 2.8400; SD = 1.55518); followed by their knowledge of satisfying learners' requirements during online English instruction (Mean = 2.7900; SD = 1.55242); strategy use that they learned through the integration of content, technology and teaching approaches (Mean = 2.7500; SD = 1.55294). Moreover, their gradually lower mean scores were obtained for the participants' knowledge on technology-assisted evaluation tool use during their the learning-teaching process of assessment (Mean = 2.7300; SD = 1.42740); taking advantage of technological equipment in determining students' misconceptions about English subjects (Mean = 2.7100; SD = 1.54590); as well as their knowledge on having their colleagues help them coordinate the content, technology and teaching approaches (Mean = 2.6900; SD = 1.75058); whereas other items with lower mean scores which were given to their knowledge about how they can use technology to reinforce students' skills in, comprehension of and predictions about a particular English subject (Mean = 2.5900; SD = 1.57695); as well as integrate technology with English classes effectively and adequately in order to make them more accessible and more comprehensible (Mean = 2.6200; SD = 1.60668). Furthermore, they revealed their positive self-perceptions of TPACK, which were presented in their self-confidence in technology use in the classroom based on learner needs and their ability to support various learners at school for coordinated English use, as well as strategies of technology and instruction. Lastly, quantitative data results also revealed their lowlier

ranked perceptions of TPACK cluster, which was received for their intersected knowledge of content, technological tools and pedagogical skills, like appropriate harmonization of technology and teaching approaches, as well as technology use in giving efficient examples in parallel with the English textbook. In contrast, the last two relatively low scores were assigned to all respondents' knowledge about their competence to apply technology in measuring students' background knowledge about English subjects (Mean ranged from 2.5300 to 2.2500; SD ranged from 1.56641 to 1.28216). On the contrary, choosing the technologies to enrich the lesson content was given to the participants' negative score (Mean = 3.4700; SD = 1.51394). It is concluded that more than 93% of all TPACK items were given for positive perceptions, whereas the rest were negatively perceived, accounting for 7%.

5. Recommendations

Future research should take into account the limitations of the current study. First, it did not seem to be generalizable because of the small sample size and limited research environment. Second, respondents with varying educational backgrounds and work contexts found the English version of the questionnaire to be sufficiently psychologically friendly. Along with recommendations, the study's research implications are presented. Future studies should be carried out in a broader setting, including the STEAM environment. Additionally, future research should take into account instructors' perspectives on a variety of topics, including majors, workplaces, educational attainment, and interests. Additionally, TPACK advocates should use CFA and EFA to create a new scale with more elements in a wider Vietnamese study environment. Future research could also examine elementary, secondary, and high school teachers' perspectives of TPACK in light of their diverse work situations. Comparative data analysis on TPACK between high school teachers and English language center teachers, whose environments appear to be more adaptable, is another suggestion. To avoid the respondents' uneasiness, the prospective researcher in this field should, if at all possible, speak with the respondents face-to-face rather than sending the survey via Google Forms or email. Additionally, it is advised that convenience sampling methods be used in future studies. Finally, before a research questionnaire is used for an official survey, it should be bilingually translated and given to three specialists.

6. Conclusion

This study was conducted to investigate EFL teachers' perceptions among 100 participants. A questionnaire was used to collect data in the Vietnamese context and the data was analyzed using SPSS. The current study was conducted in a Vietnamese city where English is highly prevalent. The study aimed to explore EFL teachers' perceptions of TPACK in the Mekong Delta. The current study has made a significant contribution to the analysis of existing literature and motivated the overall development of TPACK in

English language teaching and training programs. The current study was conducted with the aim of studying foreign language teachers' perceptions of secondary school English. Quantitative data showed higher perceptions of TK and CK, whereas less positive perceptions of TCK and TPACK were given lower level of positive perceptions.

It is concluded that TK, whose finding was in line with Ersoy, Yurdakul and Ceylan's (2016) research, which level of ICT increase of student-teachers fluctuated their competencies of TPACK, but there was not a significant difference between sex and competence of TPACK), but it was contrary with Jita (2016)'s finding, which was indicated that there is a limited use of ICT due to the prohibition of cell phone use by interview, and CK, whose finding supported Maeng, Mulvey, Smetana & Bell's (2013) finding which indicated that science teacher educators' CK and TK development contributed to preparing teacher-candidates for inquiry instruction supported by technology, facilitation in transiting to the instruction of student-centeredness, and TPACK development, were the most positively perceived. On the contrary, TCK and TPACK were the least perceived. This was consistent with Koh, Chai, Hong & Tsai's (2014) finding, which indicated that what was understood about lesson design practices and design dispositions of teachers was pivotal to promoting professional development for integrated information as well as communications technology when their TPACK was ignored. However, the present research finding was contrary to the findings of Oz (2015), who reported that TPACK was found to be significantly high. Regarding sex, there was a difference in females' TK and PK dimensions that had higher scores in TPACK. Qualitative results found that faculty members used TPACK more than cooperating teachers). The present study also confirmed the findings about the relationship between other components and teachers' TK and student-teachers were low and middle, whereas the relation level between CK and PK was higher, which was conducted by Akman & Guven (2015).

When comparing this result to those of older studies, it must be pointed out that even though I did not replicate the previously reported study by Nordin, Davis & Ariffin (2013), who found that CK level got the highest scores, while their TK was rated lowest before and after field experience, there was also a significant growth in TK, PK, PCK, TCK and TPACK. Contrary to the current research result that TK was ranked first, Banas & Yerk (2014), who demonstrated that TK, PK, TPK, PCK, and TPACK self-efficacy of pre-service teachers became a measurable factor in technological integration, used a paired samples t-test to compare items indicating a significantly high score, while PCK was greatest of all TPACK self-efficacy. A similar conclusion was reached by Lin, Yu, Wang and Ho's (2015) research, which showed that specialists and trainers of technology were provided with data on material enhancement for suitable professional training and resolve the needs of teachers within their training on technology profession in such a way that link PK and emerging technology utilization in instruction.

Acknowledgements
The author is grateful for my supervisor's sincere supervision, who willingly gave constructive feedback to this research.

Conflict of Interest Statement
The author declares no conflicts of interest.

About the Author(s)
Luu Huu Tho's MA degree is in Principles and Methods in English Language Education at Can Tho University. His research interests are EFL, ELF, and Multilingualism.

References

Angeli, C. & Valanides, N. (2005). ICT-related pedagogical content knowledge: a model for teacher preparation. In C. Crawford, R. Carlsen, I. Gibson, K. McFerrin, J. Price, R. Weber & D. Willis (Eds.), *Proceedings of SITE 2005--Society for Information Technology & Teacher Education International Conference* (pp. 3030-3037). Phoenix, AZ, USA: Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.learntechlib.org/primary/p/19585/

Archambault, L. M., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: exploring the TPACK framework. *Computers & Education*, *55* (4), 1656 1662. http://dx.doi.org/10.1016/j.compedu.2010.07.009

Beaudin, L. & Hadden, C. (2004). Developing techno-pedagogical skills in pre-service teachers. In J. Nall & R. Robson (Eds.), *Proceedings of E-Learn 2004--World Conference on eLearning in Corporate, Government, Healthcare, and Higher Education* (pp. 492-498). Washington, DC, USA: Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.researchgate.net/publication/284776078_Developing_technopedagogical_skills_in_preservice_teachers

Chai, C. S., Hwee, J., Koh, L., & Tsai, C. (2010). Facilitating pre-service teacher's developmentof technological, pedagogical, and content knowledge (TPACK). *Educational Technology & Society, 13*(4), 63–73. Retrieved from https://www.jstor.org/stable/jeductechsoci.13.4.63

Cox, S., & Graham, C. R. (2009). Diagramming TPACK in practice: Using an elaborated modelof the TPACK framework to analyze and depict teacher knowledge. *Tech Trends*, *53(*5), pp. 60-69. Retrieved from https://www.proquest.com/docview/223116532?sourcetype=Scholarly%20Journals

Doering, A., & Veletsianos, G. (2006). A review of the research: geospatial technologies in K12education. Unpublished manuscript.

Doering, A., Veletsianos, G., Scharber, C., & Miller, C. (2009). Using the technological, pedagogical, and content knowledge framework to design online learning environments and professional development. *Journal of Educational Computing Research, 41*(3), 319-346. http://dx.doi.org/10.2190/EC.41.3.d

Erdogan, A., & Sahin, I. (2010). Relationship between math teacher candidates' technological pedagogical and content knowledge (TPACK) and achievement levels. *Procedia Social and Behavioral Sciences, 2*(2), 2707-2711. http://dx.doi.org/10.1016/j.sbspro.2010.03.400

Gess-Newsome, J. (1999). Pedagogical content knowledge: An introduction and orientation. In. Gess-Newsome, & N. G. Lederman (Eds.), *Examining Pedagogical Content Knowledge* (pp. 3 17). Dordrecht, Netherlands: Kluwer Academic Publishers. Retrieved from https://www.researchgate.net/profile/Julie-Gess-newsome/publication/227212507_Pedagogical_Content_Knowledge_An_Introduction_and_Orientation/links/00b7d52bc76f142f50000000/Pedagogical-Content-Knowledge-An-Introduction-and-Orientation.pdf

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41* (4), 393-416. Retrieved from https://doi.org/10.1080/15391523.2009.10782536

Jang, S. J., Tsai, M. F. (2013). Exploring the TPACK of Taiwanese secondary school science teachers using a new contextualized TPACK model. *Australasian Journal of Educational Technology, 29*(4), 566-580. Retrieved from https://doi.org/10.14742/ajet.282

Julie K. & Benevides, T. (2015). Pre-service teachers' perceptions of technology and multiliteracy within the inclusive classroom. *International Journal of Psychology and Educational Studies, 2 (2),* 35-46. http://dx.doi.org/10.17220/ijpes.2015.02.004

Kabakçı-Yurdakul, I. (2011). An evaluative case study on professional competency of preservice information technology teachers. *Turkish Online Journal of Educational Technology, 10* (3), 33-53. Retrieved from https://www.researchgate.net/publication/287835477_An_evaluative_case_study_on_professional_competency_of_preservice_information_technology_teachers

Keating, T. & Evans, E. (2001). Three computers in the back of the classroom: pre-service teachers' conceptions of technology integration. In J. Price, D. Willis, N. Davis & J. Willis (Eds.), *Proceedings of SITE 2001--Society for Information Technology & Teacher Education International Conference* (pp. 1671-1676). Norfolk, VA: Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.semanticscholar.org/paper/THREE-COMPUTERS-IN-THE-BACK-OF-THE-CLASSROOM%3A-OF-Keating-Evans/71521e4030e0fc1a0770fcb53d93e67b9230d58b

Koehler, M. J., & Michra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge.

Educational Computing Research, 32(2), 131-152. Retrieved from http://dx.doi.org/10.2190/0EW7-01WB-BKHL-QDYV

Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers and Education, 49*(3), 740-762. http://dx.doi.org/10.1016/j.compedu.2005.11.012

Kurt, S. D. (2012). Pre-recovery and post-recovery emotions in the service context: a preliminary study. *Managing Service Quality: An International Journal*, 226(*6*), pp. 592-605. http://dx.doi.org/10.1108/09604521211287561

Lee, M. H., & Tsai, C. C. (2008). Exploring teacher's perceived self-efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web. *Instructional Science, 38* (1), 1-21. Retrieved from http://dx.doi.org/10.1007/s11251-008-9075-4

Margerum-Leys, J., Marx, R. W. (2012). Teacher knowledge of educational technology: a case study of student/mentor teacher pairs. *Journal of Educational Computing Research*, *26*(4), p. 427-462. http://dx.doi.org/10.2190/JXBR-2G0G-1E4T-7T4M

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: a framework for teacher knowledge. *The Teachers College Record*, *108*(6), 1017-1054. Retrieved from https://one2oneheights.pbworks.com/f/MISHRA_PUNYA.pdf

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology: developing a technology pedagogical content knowledge. *Teaching and Teacher Education, 21*(5), 509–523. https://doi.org/10.1016/j.tate.2005.03.006

Nordin, H., & Ariffin, T. F. T. (2016). Validation of a technological pedagogical content knowledge instrument in a Malaysian secondary school context. *Malaysian Journal of Learning and Instruction, 13* (2016*),* 1-24. http://dx.doi.org/10.32890/mjli2016.13.1.1

Nordin, H., Davis, N., & Ariffin, T. F. T. (2013). A case study of secondary pre-service teachers' technological pedagogical and content knowledge mastery level. *Procedia Social and Behavioral Sciences, 103* (2013), 1-9. http://dx.doi.org/10.1016/j.sbspro.2013.10.300

Pierson, C. (2001). Globalization and the end of social democracy. *Australian Journal of Politics and History*, *47* (4), 459-474. https://doi.org/10.1111/1467-8497.00238

Redmond, P., & Peled, Y. (2015, March). An international investigation of TPACK. In *Proceedings of the 26th Society for Information Technology & Teacher Education International Conference* (SITE 2015) (Vol. 1, pp. 3384-3389). Association for the Advancement of Computing in Education (AACE).

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). Technological pedagogical content knowledge (TPACK): the development and validation of an assessment instrument for pre-service teachers. *Journal of Research on Technology in Education, 42* (2), 123–149. https://doi.org/10.1080/15391523.2009.10782544

Shively, C. T., & Yerrick, R. (2014). A case for examining pre-service teacher preparation for inquiry teaching science with technology. *Research in Learning Technology*, *22*(1), 1-13.

Shulman, L. S. (1986). Those who understand: knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14. Retrieved from https://www.wcu.edu/webfiles/pdfs/shulman.pdf

Shulman, L. S. (1987). Knowledge and teaching: foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22. Retrieved from https://people.ucsc.edu/~ktellez/shulman.pdf

So, H., & Kim, B. (2009). Learning about problem-based learning: student teachers integrating technology, pedagogy and content knowledge. Australasian Journal of Educational Technology, 25 (1), 101–116. https://doi.org/10.14742/ajet.1183

Tantrarungroj, P., & Suwannatthachote, P. (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. *Creative Education*, *3*, 77–81. http://dx.doi.org/10.4236/ce.2012.38b017