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Digital Literacy and TPACK Levels of Pre-service EFL Teachers

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ABSTRACT	ARTICLE INFO
Digitalization in education has gained much importance in the 21st century. Digital skills and technological knowledge of both teachers and learners have become a necessity to be able to transfer traditional methods and techniques to technology-enhanced learning environments smoothly. According to Gilster (1997), digital literacy is a cognitive rather than a technical concept that involves being critical and skeptical as it encompasses the internet as a new medium. There is a requirement to introduce digital literacy to students to be able to make them digital citizens and use technology appropriately not just in formal education but outside the school in their personal lives. Likewise, L2 education makes use of affordances of digital technologies to develop learners' communicative competence. Moreover, with the sudden integration of technology into education, TPACK (technological pedagogical content knowledge) has gained much popularity. Integrating technology effectively into lessons combined with pedagogical and content knowledge is a significant issue to develop meaningful learning experiences with technology. Teacher education institutions are expected to raise educators who are able to link content, pedagogical, and technological knowledge coordinately and ready to teach students according to the norms of 21st century. Thus, research has focused on measuring teachers' TPACK levels using surveys, interviews, documents, or observations with a range of variables. This review study attempts to analyze studies focusing on the digital literacy and TPACK levels of pre-service EFL (English as a Foreign Language) teachers to portray the pedagogical and research outcomes obtained.	
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Yabancı Dil Olarak İngilizce Öğretmen Adaylarının Dijital Okuryazarlık ve TPACK Düzeyleri

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ÖZET	MAKALE BİLGİSİ

Eğitimde dijitalleşme 21. yüzyılda büyük önem kazandı. Geleneksel yöntem ve tekniklerin teknolojiyle zenginleştirilmiş öğrenme ortamlarına sorunsuz bir şekilde aktarılabilmesi için hem öğretmenlerin hem de öğrencilerin dijital becerilere ve teknolojik bilgilere sahip olmaları bir zorunluluk haline gelmiştir. Gilster'e (1997) göre dijital okuryazarlık, yeni bir ortam olarak interneti de kapsadığından eleştirel ve şüpheci olmayı içeren bir teknik olmaktan ziyade bilişsel bir kavramdır. Öğrencilerin dijital vatandaş olabilmeleri ve teknolojiyi sadece örgün eğitimde değil, okul dışında da, kişisel yaşamlarında da doğru şekilde kullanabilmeleri için dijital okuryazarlığın öğrencilere tanıtılması gerekmektedir. Benzer şekilde ikinci dil eğitimi, öğrencilerin iletişimsel yeterliliğini geliştirmek için dijital teknolojilerin olanaklarından yararlanır. Ayrıca, teknolojinin eğitime aniden entegre edilmesiyle birlikte TPACK (teknolojik pedagojik içerik bilgisi) büyük bir popülerlik kazanmıştır. Teknolojinin pedagojik ve içerik bilgisi ile birlikte derslere etkili bir şekilde entegre edilmesi, teknolojiyle anlamlı öğrenme deneyimleri geliştirmek için önemli bir konudur. Öğretmen yetiştiren kurumların içerik, pedagojik ve teknolojik bilgileri koordineli bir şekilde birbirine bağlayabilen, öğrencilere 21. yüzyıl normlarına göre ders vermeye hazır eğitimciler yetiştirmesi beklenmektedir. Bu nedenle araştırmalar, çeşitli değişkenlerle anketler, görüşmeler, belgeler veya gözlemler kullanarak öğretmenlerin TPACK düzeylerini ölçmeye odaklanmıştır. Bu inceleme çalışması, elde edilen pedagojik ve araştırma sonuçlarını tasvir etmek için Yabancı Dil Olarak İngilizce öğretmen adaylarının dijital okuryazarlık ve TPACK düzeylerine odaklanan çalışmaları analiz etmeyi amaçlamaktadır.

Anahtar Kelimeler: Yabancı dil olarak İngilizce öğretmen adayları, dijital okuryazarlık, TPACK

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Introduction

Digital technologies not only reshape the elements of work and society but also education. When used skillfully, fairly, and efficiently by educators, digital technology may completely support the goal of inclusive, high-quality education and training for all students. Therefore, digital competence attracts attention and it becomes a fundamental part of education (Li & Yu, 2022). Researchers have conducted studies to be able to find best strategies to develop digital competency in pre-service teacher education (Howard et al., 2021; Tondeur et al., 2012). Digital education emphasizes to improve digital competencies of learners and teachers as well as the pedagogical use of digital technologies. Gaining much popularity in the field, digital competency starts to find a place in educational policies and frameworks (Ntebutse & Bourgeois, 2021).

At an international level, the International Society for Technology in Education (ISTE) puts a framework (2017) for educators to plan curriculum and design lessons by integrating technology. It is a roadmap to empower learners using the benefits of technology and sets standards for teacher digital competence. In addition to international standards, several countries recently updated their actions and policies to reform their education systems by setting standards for digital integrations and developing teachers' digital competence. With this aim in mind, European Commission (2020) has published Digital Education Action Plan covering the period from 2020 to 2027. This action plan mainly aims to present the steps to increase quality in digital education and training and to build proper digital competences and skills among Member States. It has gathered information from all relevant stakeholders and offered guiding principles in order to adapt education and training to digital transformation. According to European Commission (2020), digital literacy is requisite for all citizens in a digital world where people need to manage loads of information and fight for disinformation. Education institutions should teach learners how to approach information critically and detect disinformation for a safer and healthier Internet usage.

OECD (2021) has also published a recent report called 21st Century Readers: Developing literacy skills in a digital world. This report presents how literacy has changed in the 21st century and it highlights that literacy today is to validate and construct knowledge and to differentiate facts from opinions. People need these skills as global citizens because they continue to use digital technologies in every part of life, such as employment. The report shows that students who learn digital literacy skills at schools are more likely to separate facts from opinions in online platforms. Accordingly, it underlines the need to integrate digital literacy into learning and teaching and this requires developing teachers' digital literacy above all (Minea-Pic, 2020).

Digital technology eventually becomes a significant part of L2 education as it affords to reach to authentic content and communicate with people from other cultures. It is especially important in English as a foreign language (EFL) context because schools are only places where learners are exposed to language. Technology can grant distinctive types of learning

activities in EFL by giving opportunities to use language in a meaningful way, enabling communication between students and native speakers and building knowledge together, and offering auditory and visual authentic materials produced by different speakers in a real context (Başer et al., 2016). Moreover, digital technologies are used to increase motivation of students and engage them with lesson as well as to provide feedback and assessment by language teachers (Kessler & Hubbard, 2017). Hence, language teachers have a key role to decide what technology is used and how it is integrated into pedagogy to deliver the subject matter. With the varieties of digital tools, teachers can design lessons to reach learning goals for L2 reading, writing, speaking, listening, discourse, and pragmatics (Chun et al., 2016). They are also supposed to be aware of new literacies that the Internet brings and enrich lessons with important aspects of multimedia and they train learners to become autonomous users of the technology. Although language teachers generally graduate with positive attitudes towards technology, they may struggle to manage technology integration when they start to work as a professional (Kessler & Hubbard, 2017).

Digital Literacy

Recently, a considerable literature has grown up around the theme of digital literacy and it has been addressed from different points of views. Several definitions of digital literacy have been proposed to date. Since the definition of digital literacy varies among researchers, it is important to clarify how the term is discussed in the literature. Paul Gilster is one of the pioneers who defined digital literacy as a concept which is close to current understanding in meaning. He published a book called "Digital Literacy" in 1997. In this book, Gilster (1997, p. 1) introduced digital literacy as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers". He claims that digital literacy is beyond the realm of traditional literacy because Internet has a different medium. Information is unfiltered and unedited. Although this is an elementary and broad definition, Gilster points out that digital literacy includes being skeptical and critical and it is more cognitive than technical. Throughout his book, he summarizes four skills that are connected to digital literacy. They are Internet searching, hyper-text navigation, knowledge assembly, which is "building a "reliable information hoard" from diverse sources" (Bawden, 2008, p. 20), and content evaluation. According to Bawden (2008), there are also other aspects of digital literacy expressed throughout the book but not included in the list. They are "awareness of the value of traditional tools in conjunction with net-worked media, awareness of "people networks" as sources of advice and help, and being comfortable with publishing and communicating information, as well as accessing it" (Bawden, 2008, p. 20).

Scholars have long debated about the definition of digital literacy and there are many explanations with some changing elements. Because of these disagreements, measuring the digital literacy, procedures and steps needed in developing literacies are also open to debate. There are several studies discussing essential cores of digital literacy and, accordingly, frameworks are provided not only for scholars who want to construct their research on but also for educators who want to raise digitally literate learners.

Eshet-Alkalai (2004) creates a conceptual framework to understand how learners behave in a digital world. He aims digital designers and scholars who work on creating user-friendly digital environments for providing a guideline with this study. According to this framework, there are five types of literacy. They are photo-visual literacy, reproduction literacy, branching literacy, information literacy, and socio-emotional literacy. This framework is meant to link technical skills to cognitive and socio-emotional skills.
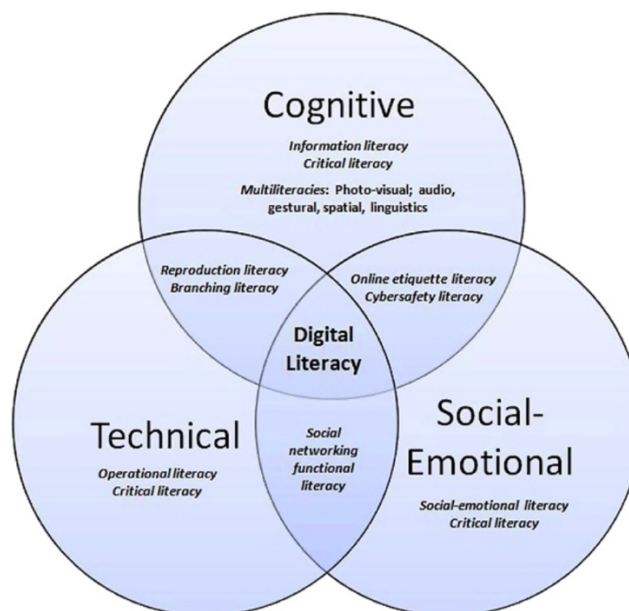

Figure 1: Ng (2012)'s Digital Literacy Framework

Ng (2012) developed a framework drawing on the work of Eshet-Alkalai (2004). According to
this framework, digital literacy consists of technical, cognitive and social-emotional skills as main components. These skills are intertwined into each other at some points and share common parts (Figure 1). Technical dimension represents operational skills to work with a computer or laptop. Cognitive dimension includes information literacy which means search, evaluate, organize, use, and communicate knowledge in a digital world. Information is presented in a multimodal environment; therefore, people are required to read and understand the information using multiliteracies which are photo-visual, audio, gestural, spatial, and linguistics. Technical and cognitive dimensions share two literacies which are reproduction literacy and branching literacy or so-called hyperlinking. Digitally literate person can use hyperlinks efficiently to build up knowledge and to produce new understandings using right tools. Social-emotional dimension involves collaborating and communicating aspects of the Internet. Here, social-emotional dimension and cognitive dimension share online etiquette and cyber safety literacies. These involve behaving appropriately in digital environments and knowing rules of privacy to protect oneself from threats. One shared literacy by all three dimensions is critical literacy which is a necessity for technical, cognitive, and social skills.

Mark Pegrum, Nicky Hockly and Gavin Dudeney developed a framework in 2013 especially for language teachers and they updated it in 2022. According to them, there are four main areas of digital literacies and they all have different sub literacies. The first focus is "communicating" which includes print literacy, hypertext literacy, multimodal literacy, immersive literacy, spatial literacy, mobile literacy, and code literacy. Second focus is called "informing" and that includes tagging literacy, search literacy, filtering literacy, and information literacy. Third main component is "collaborating" which contains personal literacy, network literacy, participatory literacy, intercultural literacy, and ethical literacy. The last part is "(re)designing" which has attentional literacy, critical literacy, and remix literacy. Pegrum et al. (2022) points out that they do not claim that these are all separate components having distinct features. The reason to create this framework is to provide a guidebook for language teachers and learners. They believed that digital literacy skills help language learners to communicate globally.

Pre-Service Teachers' Digital Literacy Levels

Contrary to arguments made by Prensky (2001) that digital natives (born after 1980) are capable of using digital platforms efficiently, research shows that although they are exposed to technology daily and spend so much time on the Internet in their free times, this does not mean that digital natives know every aspect of digital literacy to use the platforms in a good way (Margaryan et al., 2011; Miller & Bartlett, 2012) or they are capable of using digital tools efficiently for educational purposes (Ng, 2012). Teachers are models to show a way to become a good digitally literate person. European commission's DigCompEdu project is one of the few attempts to integrate digital literacy into national curriculums. As mentioned in this report (Redecker, 2017), teachers should have digital skills other than operational knowledge to be able to integrate digital literacy into their lesson plans. There are studies conducted to measure pre-service teachers' digital literacy levels to understand whether higher education is ready enough to support future teachers in this topic.

Guikema and Menke (2014) investigated what preservice foreign languages teachers think about digital literacy in their current and future instructional practice. As part of the research, teacher candidates taking a language teaching methodologies course attended a teleconference in which some experts presented digital tools and their successful integration into language lessons. There was an open discussion at the end so that participants could ask follow-up questions. At the end of the conference, participants' reflections were collected. It was found out that although prospective teachers were ready to learn and use digital tools, they expressed that they felt insecure regarding their technological competence. Interestingly, participants only focused on communication and cultural aspects of digital literacy in their answers, which shows they were not aware of other dimensions of digital literacy or they did not know how to integrate them into teaching. Moreover, they stated that seeing real examples from other practitioners helped them see the gap between theory and practice. Researchers reported that teaching digital literacy and technology integration separately does not raise awareness to understand instructional practices. Teacher education programs need to integrate

digital literacy to courses with pedagogy and demonstrate the significance of digital literacy and offer ways to address them in instruction.

Botturi (2019) also conducted a case study to investigate digital and media literacy in pre-service teacher education. The participants were pre-service primary and pre-primary school teachers in Switzerland and most of them were in the process of completing their teaching practicum or working as part time teachers at the time of the study. They took a 2-credit course on digital and media technology and quantitative pre and post survey data with qualitative interviews were collected to see whether the course had an impact on students' digital and media literacy attitudes. It was found out that the short course affected participants positively and they were more interested in integrating digital and media literacy into their lessons. On the other hand, after the course, students were disposed to find solutions to integrate digital literacy instead of thinking of external barriers such as lack of sources.

In the context of the United States, List (2019) conducted a research to investigate pre-service teachers' beliefs about digital literacy with a specific focus on digital natives, skill-based, and sociocultural perspectives of it. It was found out that most of the participants believed that digital literacy is gained as a skill regardless of being a digital native or becoming a part of digital community. Furthermore, it was stated that digital literacy can be acquired autonomously, being exposed to technologic tools or by creating content for a purpose. Interestingly, pre-service teachers reported that they acquired digital literacy skills in schools rather than daily life.

In a study conducted by Casillas Martin et al. (2019), researchers explored digital knowledge, use, and attitudes towards ICT of Spanish pre-service early childhood education teachers. In this quantitative descriptive study, the data was collected using a questionnaire which is a Likert type scale from 0 to 10 and has 88 items. The findings suggested that pre-service teachers had a positive attitude towards ICT. They were aware of the importance and necessity of ICT for their future career. It was also found out that means for use of ICT were higher than means for knowledge. Moreover, correlation showed that those who scored best in their use of ICT are those who believed they had more knowledge. When it comes to gender variable, in contrast to women, who scored higher on attitude, men had a more positive opinion of their own understanding and usage of ICT. In the end, researchers suggested that ICT knowledge and digital competence are necessary for a successful integration of technology in education, therefore teacher education programs should be designed accordingly.

A similar study was conducted in Israel by Peled (2021) which investigated the digital literacy perceptions of pre-service teachers collecting survey data from 1265 students studying at teachers' colleges. The research showed that students have high perceived digital literacy level, however they experience problems to analyze and evaluate knowledge critically, which is one of the components of 21st century skills and they lack ethical knowledge. The

researcher also could not find a relationship between gender and perceived digital literacy of prospective teachers.

In the local context of Turkey, Ata and Yıldırım (2019) collected data quantitatively and qualitatively from 295 pre-service teachers enrolled in different departments in a state university to understand digital literacy perceptions and views of pre-service teachers. They found out that pre-service teachers had positive perceptions of digital literacy, but the qualitative part showed that participants do not have cognitive skills to search, assess, produce, and communicate knowledge. It was also found out that male participants had higher digital literacy competency than female participants. Another finding of this study showed that participants who spend a lot of time on the Internet had higher digital literacy scores than participants who spend less time.

In another study conducted in Turkey, Akayoğlu et al. (2020) aimed to find out digital literacy perceptions of 113 pre-service English teachers who were senior students having studied at foreign languages department in three universities in Turkey. They found out that there is not a shared common definition of digital literacy among participants. Some participants reported that digital literacy means having technical knowledge, whereas others believed that it is more than technical knowledge and they were aware of other dimensions of digital literacy. Semi-structured interviews showed that participants had knowledge of various digital tools and they believed that digital tools can be included in teaching four skills, which are listening, reading, writing, and speaking. They also supported the use of digital tools for testing, feedback, engagement, and motivation. Another result was that instructors are models to show how to use digital tools in teaching context and there is a need to integrate courses engaging digital literacy with pedagogy in teacher education institutions.

In a study by Reisoğlu and Çebi (2020), a training session was provided to 24 pre-service teachers, covering aspects such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving within the DigComp framework. They investigated to what extent digital competence of pre-service teachers developed and what their views on the topic were. In this qualitative study, the researchers collected diaries and conducted focus group interviews after the training. It was found out that pre-service teachers made a progress in mentioned areas. They improved in searching and finding information, evaluating it in terms of reliability, and storing it in digital environment. This study also revealed that pre-service teachers needed practice instead of being passive learners and trainers were seen as role models and there was a need for integration of pedagogical knowledge so that trainees could see good examples of technology use in education.

Üstündağ, Güneş and Bahçıvan (2017) conducted a study with the 979 junior and senior pre-service science teachers from 13 different universities to explore their digital literacy levels. They found out that the participants had a high level of digital literacy. Similarly, a recent study by Özcan (2022) collected quantitative data from 443 prospective teachers to learn

more about their digital literacy level. In this study, Turkish adaptation of Ng (2012)'s digital literacy scale which has attitude, technical, cognitive, and social-emotional literacy factors was used. The study demonstrated that pre-service teachers had a moderate level of digital literacy in all three factors and there is a difference between female and male participants in that male participants had higher scores. Consequently, apart from the gender differences in digital literacy levels observed in some Turkish studies, what the studies both at the international and local contexts suggest is that pre-service EFL teachers generally acknowledge the importance of digital literacy, but there is a need for enhancing their practical skills and integrating digital literacy with pedagogical knowledge in teacher education programs.

Technological and Pedagogical Content Knowledge (TPACK)

Technological and pedagogical content knowledge (TPACK or TPCK in early works) framework is presented to the literature by Koehler and Mishra in 2009. This framework was based on Shulman's (1986) pedagogical content knowledge (PCK) work which will be further discussed in following part. Koehler and Mishra claim that when technology is taught in isolation from other essential aspects of education, it fails to encourage teachers and pre-service teachers to internalize educational technology and incorporate it effectively within their classrooms. (Koehler & Mishra 2009). In other words, teaching how to operate computers or how to use spreadsheets does not mean that teachers will have enough competency to integrate technology into their teaching.

Shulman (1986) argues that teacher education focuses on pedagogy and content knowledge separately. Teachers are expected to know their subject very well and they are taught methods and approaches to deliver their subject to students. However, teaching is more complicated than that (Shulman, 1986, 1987). According to him, teachers need to use content knowledge and decide the best ways to convey it using right methods depending on learners. Instead of given as separate objectives, pedagogical knowledge (PK) and content knowledge (CK) should be blended into each other and work together. As a result, he puts forward the concept of pedagogical content knowledge (PCK).

Koehler and Mishra (2006) claim that Shulman's (1986) work is significant to define the core aspects of teacher education; nevertheless, it lacks one aspect that has become an indispensable part of educational discussions today, that is technological knowledge (TK). Researchers argue that technology was very basic and stable at the time of Shulman when he had created his notion, therefore, it was not a principal characterization of teacher knowledge. In today's world, however, technology is more advanced and it is changing and evolving with new advancements.

Koehler et al. (2007) conducted design experiments in seminar courses to integrate technology into teaching efficiently and collected data from these experiments. The findings led them to understand how content, pedagogy and technology are integrated into each other and they take shape depending on context.
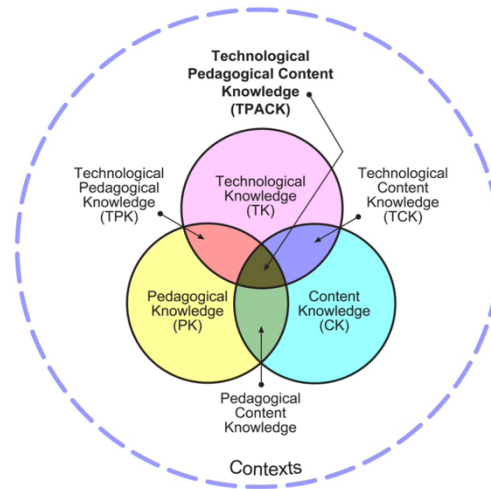
Figure 2: The Technological Pedagogical Content Knowledge Framework (Mishra & Koehler, 2006)

According to TPACK framework (Figure 2), there are three core characteristics of teaching that teachers need to understand thoroughly to be able to coordinate them. Content knowledge (CK) is the knowledge about subject matter that teachers learn and teach. Pedagogical knowledge (PK) is the knowledge about practices and methods to convey subject matter. It includes classroom management and assessment. Technological knowledge (TK) is first defined as computer literacy (Mishra & Koehler, 2006); however, it is widened by defining it as using technology to attain goals and being ready to adapt to new technological developments alongside computer literacy (Koehler & Mishra, 2009; Koehler et al., 2013).

Koehler and Mishra (2009) discuss how these core aspects of teaching blend into each other in actual practice and they generate pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK) in the center. TCK is "an understanding of the manner in which technology and content influence and constrain one another" (Koehler et al., 2013, p. 16). TPK is "an understanding of technology can constrain and afford specific pedagogical practices" and TPACK is "knowledge about the complex relations among technology, pedagogy, and content that enable teachers to develop appropriate and context-specific teaching strategies" (Koehler et al., 2014, p. 102).

TPACK Perceptions of Pre-service Teachers according to Various Factors

Upon Koehler and Mishra's (2009) conceptualization of TPACK, there is growing interest in teachers' technological pedagogical content knowledge particularly from a standpoint of teacher education. The measurements used are generally self-statements of preservice teachers as it is hard to design an instrument to measure each knowledge separately considering that each knowledge change depending on different variables, such as subject matter and age.

Redmond and Lock (2013), as a case in point, conducted a study in Australia with 55 secondary pre-service teachers from different majors. Participants had practicum in schools and they also took a course which was prepared to show the digital technology integration and self-directed and collaborative learning in technology enhanced lessons. Participants self-reported their TPACK levels by completing a survey and answered open-ended questions at the end of the term. The result showed that the perceived level of TPACK of participants was high and participants agreed on the importance of modelling from instructors in terms of technology usage in classroom. Researchers have recommended that teacher educators should have a technology knowledge as well and be models to students and provide students opportunities to engage in practices. Pre-service students should also design TPACK experiences considering context.

As examples of studies conducted across Europe, Lachner et al. (2021) carried out an experimental study in Germany. They designed subject specific TPACK modules in regular program to develop pre-service teachers' TPACK. It was found out that student teachers who were taught how to use technology for subject matter teaching demonstrated high TPACK level than those who did not take the modules. It was also found out that after TPACK-modules, pre-service teachers demonstrated a high level of technology-related self-efficacy. Similarly, Luik et al. (2018) investigated the TPACK perceptions of pre-service teachers in Estonia. They collected data through a questionnaire, which was created by the authors, from 413 student teachers, majority of whom were female (86%). They found out that participants self-rated their TPACK high and they also found out that male participants showed high level of technology and content knowledge than female participants.

In Chinese context, Qiu et al. (2022) investigated to understand 286 pre-service Chinese as a second language teachers' perceived TPACK. Participants completed a questionnaire measuring 6 components of TPACK and answered some demographical questions. It was found out participants perceived their TPACK high whereas they rated their technology knowledge low. It was also reported that experience had a positive effect on the components of TPACK. Depending on the results, it was suggested that teacher education programs should be restructured in China and they should include ICT courses supporting students' development of TPACK and the interaction between technology, content, and pedagogy should be emphasized.

Among the studies conducted in Turkey, Kurt et al.'s (2013) experimental study aimed to measure the change of TPACK level of Turkish pre-service EFL teachers. Participants took a course in which they designed lessons using technology and taught in their practicum school. Before and after the course, data was collected using the survey of pre-service teachers' knowledge of teaching and technology by Schmidt et al. (2009) and it was found out that participants' TK, TCK, TPK and TPACK scores increased significantly. It was revealed that participants learned to take technology as a part of content and pedagogy rather than as an add-on tool at the end of the study. The findings showed the importance of the relationship between theory and practice. Saltan and Arslan (2017) conducted a study that explore and

compare pre-service and in-service teachers' TPACK in relation to different variables which of them is technology use. It was found out that pre-service teachers' technology use has no significant effect on their TPACK, however it is quite opposite for in-service teachers.

Another study conducted by Karaca (2015) investigated pre-service teachers' TPACK level based on different characteristics. Data collected from junior and senior Computer Education and Instructional Technologies department students using TPACK-Deep scale demonstrated that participants had moderate level of TPACK. Moreover, there is no significant relationship between junior and seniors' TPACK scores. Interestingly, the mean score of female pre-service teachers is higher than the mean of male pre-service teachers. In a similar study, Murat and Erten (2016) investigated pre-service junior and senior science teachers' perception of TPACK and they found out that there is no significant difference based on gender and year. Pre-service teachers also showed high level of perceptions on TPACK.

Kabakçı Yurdakul (2018) carried out a study to explore the relationship between the technological pedagogical content knowledge and digital nativity of 1493 Turkish pre-service teachers via the scale constrcuted by the researcher, herself. According to the findings, participants showed a high level of TPACK competence. They also perceived themselves highly competent in design, practice, and ethics dimensions; however, they were moderate in terms of proficiency. These results are similar to that by Kabakçı Yurdakul (2011) in which the participants rated themselves moderate in proficiency competency.

A mixed method study by İşler and Yıldırım (2018) was aimed to explore the perceptions of Turkish pre-service EFL teachers on technological pedagogical content knowledge. Participants were 94 senior pre-service EFL teachers in a public university. The result showed that they had a high level of perception in TPACK competencies. Participants highlighted the importance of personal interest, experience, knowledge and easy access to technology to develop TPACK competency. However, some of the participants cited that their teacher educators are not models to show how to integrate technology into teaching.

In another study conducted by Dinçer (2018), the researcher aimed to examine pre-service teachers' technology literacy and its relationship with TPACK. He collected data from 370 senior pre-service teachers from different fields. Participants had completed one-term teaching practicum at the time of study. According to TPACK scale scores, 45.40% of the participants had high level of TPACK, whereas 53.50% of them had normal level. It was also found out 242 participants said that they had not taken any courses on computer and technology and those who had taken these courses reported that they felt unsatisfied and courses were inefficient. Moreover, none of the participants had taken any courses on use of technology for teaching activities. On the other hand, most of the participants stated that teacher educators did not use technology in courses while those who used were limited to slide projectors, smart boards and computers. Altun (2017) conducted a quantitative study to find out 481 pre-service early childhood education teachers' TPACK level and its relation to digital literacy and other factors. It was reported that gender has an effect on TPACK scores

and its subscales, except for Ethics and Proficiency, in favor of females whereas the grade level is not related to TPACK competencies of the participants. It was also found out that there is a strong relationship between TPACK and digital literacy and digital literacy and daily ICTs using time are some of the predictors of pre-service teachers' TPACK competencies.

In general, studies from both international and Turkish contexts have shown the vital role of TPACK for the development of pre-service teachers. Research conducted outside Turkey revealed how structured TPACK modules and technology-focused courses contribute to enhancing pre-service teachers' TPACK levels and self-efficacy in using technology for teaching. Nation-wide studies, on the otherhand, showed that pre-service teachers generally perceive themselves as having moderate to high TPACK levels, however, there can be some variations according to gender, academic year, and prior technology experience.

Pedagogical Implications and Future Research Directions

On the whole, evidence based reseach emphasized the positive impact of practical experience and the need for pedagogical knowledge integrated with technology training. Studies promoted the significance of digital literacy and TPACK levels of teachers for the needs of digital world and for the successful integration of technology in education. According to Avidov-Ungar and Eshet-Alkai (2014), teachers should master digital literacy to successfully operate in digital context and they argue that digital literacy is an important modifier of TPACK framework to be able to integrate technology effectively. Nevertheless, there is a consistent call for bridging the gap between theory and practice, emphasizing the importance of modeling technology integration by teacher educators, and integrating technology and pedagogy in teacher education programs.

Based on the strong relationship between digital literacy and TPACK, there emerges a need for digital literacy and technology courses to support the development of TPACK competencies in pre-service EFL teachers. On the whole, teacher education programs should adress the need to promote TPACK and provide practical experiences to pre-service teachers so as to prepare them for effective technology integration in the classroom.

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