

**T.R.**  
**BOLU ABANT İZZET BAYSAL UNIVERSITY**  
**INSTITUTE OF GRADUATE STUDIES**  
**DEPARTMENT OF FOREIGN LANGUAGE EDUCATION**



**PRE-SERVICE EFL TEACHERS' TECHNOLOGICAL  
PEDAGOGICAL AND CONTENT KNOWLEDGE**

**MASTER OF ARTS**

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**BOLU, JULY - 2023**

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**Nazım ÜNLÜ**

## **ABSTRACT**

### **PRE-SERVICE EFL TEACHERS' TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE**

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**(SUPERVISOR: ASSOC. PROF. DR. ABDULLAH COŞKUN)**

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**XIII+149**

This mixed-method study is aimed at investigating the perceived Technological Pedagogical Content Knowledge (TPACK) competency levels of pre-service English as a Foreign Language (EFL) teachers and examines the relationship between their TPACK competency levels and demographic characteristics, namely, age, gender, computer experience, and year of education in the program. The participants of the study included 215 pre-service teachers, all of whom partook in the quantitative phase, while 14 of them and five teacher educators partook in the qualitative phase. The quantitative data were collected through a demographic background questionnaire and a TPACK-EFL questionnaire, while the qualitative data were gathered using semi-structured interview questions, adapted for both pre-service teachers and teacher educators. The findings of the study indicated a relatively high level of overall perceived TPACK competency among pre-service EFL teachers, with some notable variations across the sub-components. Regarding the influence of gender and age, statistically significant differences were found in Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK) sub-components. It was found that male participants scored higher in TK, while females scored higher in PK and PCK. In addition, pre-service teachers older than 24 years of age revealed lower CK scores. Regarding the influence of computer experience and years of education in the program, higher overall TPACK scores were observed in favor of those with more computer experience and those in their later years in the program. The current study is expected to enrich the literature, aiding the ongoing enhancement of teacher education programs, and promoting the integration of technology into English language education.

**KEYWORDS:** Technological Pedagogical and Content Knowledge (TPACK), Pre-service EFL Teachers, Teacher Education, Technology Integration

## ÖZET

**İNGİLİZCE ÖĞRETMEN ADAYLARININ TEKNOLOJİK PEDAGOJİK  
ALAN BİLGİSİ  
YÜKSEK LİSANS TEZİ  
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LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ  
YABANCI DİLLER EĞİTİMİ ANABİLİM DALI  
İNGİLİZ DİLİ EĞİTİMİ BİLİM DALI  
(TEZ DANIŞMANI: DOÇ. DR. ABDULLAH COŞKUN)**

**BOLU, TEMMUZ 2023  
XIII+149**

Bu karma yöntemli çalışma, Yabancı Dil Olarak İngilizce (EFL) öğretmen adaylarının Teknolojik Pedagojik Alan Bilgisi (TPAB) yeterlilik düzeylerini araştırmayı ve TPAB yeterlilik düzeyleri ile yaş, cinsiyet, bilgisayar deneyimi, ve bölümdeki öğrenim yılı gibi demografik değişkenler arasındaki ilişkiyi incelemeyi amaçlamaktadır. Araştırmanın katılımcılarını nicel aşamada 215 İngilizce öğretmen adayı, nitel aşamada ise nicel aşamaya katılmış 14 öğretmen adayı ile beş öğretmen eğitimsi oluşturmaktadır. Nicel veriler, bir demografik bilgi anketi ve bir TPACK-EFL anketi aracılığıyla toplanırken, nitel veriler hem öğretmen adayları hem de öğretmen eğitimcileri için uyarlanmış yarı yapılandırılmış görüşme soruları kullanılarak toplanmıştır. Çalışmanın bulguları, alt bileşenler arasında bazı dikkate değer farklılıklarla birlikte, İngilizce öğretmen adaylarının genel TPAB yeterliliğinin nispeten yüksek düzeyde olduğunu göstermiştir. Cinsiyet ve yaşın etkisi ile ilgili olarak, teknolojik bilgi (TB), alan bilgisi (AB), pedagojik bilgi (PB) ve pedagojik alan bilgisi (PAB) alt bileşenlerinde istatistiksel olarak anlamlı farklılıklar bulunmuştur. Erkek katılımcıların TB’de, kadın katılımcılarınsa PB ve PAB bileşenlerinde daha yüksek puanlar aldığı bulunmuştur. Ayrıca 24 yaşından büyük öğretmen adayları daha düşük alan bilgisi puanları ortaya koymuştur. Bilgisayar deneyimi ve programdaki eğitim yılının etkisi ile ilgili olarak ise daha fazla bilgisayar deneyimine sahip olanlar ve programdaki son yıllarında olan adayların lehine daha yüksek TPAB puanları gözlemlenmiştir. Çalışmanın literatürü zenginleştirmesi, öğretmen eğitimi programlarının süregelen gelişimine yardımcı olması ve teknolojinin İngilizce eğitime entegrasyonunu teşvik etmesi beklenmektedir.

**ANAHTAR KELİMELELER:** Teknolojik Pedagojik Alan Bilgisi (TPAB), İngilizce Öğretmen Adayları, Öğretmen Eğitimi, Teknoloji Entegrasyonu

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## **LIST OF ABBREVIATIONS AND SYMBOLS**

|              |                                                   |
|--------------|---------------------------------------------------|
| <b>CALL</b>  | : Computer-Assisted Language Learning             |
| <b>CK</b>    | : Content Knowledge                               |
| <b>EFL</b>   | : English as a Foreign Language                   |
| <b>ICT</b>   | : Information and Communication Technology        |
| <b>PK</b>    | : Pedagogical Knowledge                           |
| <b>PCK</b>   | : Pedagogical Content Knowledge                   |
| <b>TCK</b>   | : Technological Content Knowledge                 |
| <b>TPACK</b> | : Technological Pedagogical and Content Knowledge |
| <b>TK</b>    | : Technological Knowledge                         |
| <b>TPK</b>   | : Technological Pedagogical Knowledge             |
| <b>XK</b>    | : Contextual Knowledge                            |

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# 1. INTRODUCTION

The first chapter introduces the background, purpose, research questions, and significance of the study at hand. The definitions of the key terms used in the study are also provided at the end of the chapter.

## 1.1. Background of the Study

The world has always been influenced and shaped by the technology of its time. In the 21<sup>st</sup> century, humanity has witnessed significant advancements in the field of technology and the use of technology has become indisputably important thanks to these advancements. Mishra and Koehler (2006) stated that the emergence of digital technology has changed almost all fields of human work dramatically and the field of education is no exception to these fields. The advancements in technology have appeared to be a remarkable opportunity to enhance learning and teaching, especially in higher education (Turney et al., 2009). Regarding the advancements in technology, it goes without saying that the most rapidly advanced technology in today's world is the Internet (Akayoğlu, 2011). With the advent of the Internet, a considerable number of new technologies and concepts have emerged with the aim of assisting human communication and interaction, and concepts such as Web 2.0, Information and Communications Technology, and the Technological Pedagogical Content Knowledge framework have become prominent in integrating 21<sup>st</sup>-century technologies into education (Livingstone, 2015).

The concept of Web 2.0 originated and gained popularity following a collaborative brainstorming session at a conference hosted by O'Reilly and MediaLive International (O'Reilly, 2007) and has been one of the most influential developments the Internet has ever had since it has provided internet users the ability to create their own content (Bennett et al., 2012; Stephens, 2007), interact with others (Bennett et al., 2012; Sclater, 2008), and express their thoughts (Shang et al., 2011) unlike the read-only Web 1.0. The benefits of Web 2.0 have a considerable influence on the education field because Web 2.0 technologies offer powerful information-sharing and collaboration opportunities for learners (Ajjan & Hartshorne, 2008).

Another prominent aspect of 21<sup>st</sup>-century technology, ICT has become an "indispensable part of the contemporary world" (Yusuf, 2005, p. 316) and it plays

an influential role in integrating the technology of the 21<sup>st</sup> century into education. The use of ICT in schools is considered a significant opportunity because it improves student achievement, enhances access to schooling along with a wide range of resources, and is cost-efficient (Kozma, 2011). ICTs have advanced to a great extent and with the advancement of ICTs and the widespread technology use, reaching information anywhere and at any time has become much easier (Akayoğlu, 2021). As reaching information has become easier thanks to ICTs, education beyond the classroom walls is now more reachable than ever, and learning can occur anytime and anywhere (Fu, 2013; Noor-Ul-Amin, 2013; Purnamasari, 2019; Tinio, 2003).

Taking the potential benefits of using ICTs in educational settings into consideration, numerous institutions are choosing to incorporate the latest ICT advancements into their systems (Başer et al., 2021) and teachers have been gaining access to more ICT resources continuously (Prestridge & Tondeur, 2015). Nevertheless, putting the theory of using technology into practice is far behind the vision, as there has been a tendency to focus solely on the technology itself instead of its usage (Mishra & Koehler, 2006). Embracing the idea of using technology for teaching and learning is not enough by itself. In order to achieve a successful technology integration, barriers such as lack of teacher competence, lack of resources, lack of training, and lack of technical support (Bingimlas, 2009; Ertmer, 1999; Khan et al., 2012; Kopcha, 2012; Lim & Khine, 2006; Pelgrum, 2001; Tondeur et al, 2016; Toprakçı, 2006) need to be dealt with. As Teo (2008) stated, the attitudes of the teachers hold great importance for successful technology integration. Thus, eliminating the barriers that teachers are likely to encounter is of great importance. One of the most frequently mentioned barriers to successful technology integration was teachers' lack of competence in using ICTs for educational purposes and many studies reported that in order to integrate technology into education successfully, teachers need to be competent in using ICTs (Aslan & Zhu, 2016; Bingimlas, 2009; Galanouli et al., 2004; Williams et al., 2000). Aslan and Zhu (2016) found that pre-service teachers were anxious about using ICTs and needed more training to be competent in using such technologies and suggested that some improvements are required in teacher education programs in terms of using ICTs for educational purposes. The lack of ICT resources was also frequently mentioned as one of the main barriers to successful technology

integration (Albugami & Ahmed, 2015; Bingimlas, 2009; Khan et al., 2012; Pelgrum, 2001; Toprakçı, 2006). Albugami and Ahmed (2015) mentioned that the lack of ICT resources and technical assistance put teachers in constant fear of technical failures and had an impact on their confidence. The lack of training is also among the most frequently mentioned barriers and holds great importance in terms of motivating teachers towards using technology in their teaching (Agyei & Voogt, 2011). Considering the influence of the aforementioned barriers, solving only one of them may not suffice. In Turkey, for example, the FATİH Project (Movement of Enhancing Opportunities and Improving Technology) is aimed at providing the required infrastructure and devices to schools and classes for integrating technology into education (<http://fatihprojesi.meb.gov.tr/en/>). Even though the project seemed a breakthrough at first, it included only in-service training, and pre-service teacher training was overlooked (Rakıcıoğlu-Söylemez & Akayoğlu, 2019). According to Akayoğlu (2017), without sufficient training for pre- and in-service teachers and observing their classroom practices, it is unfeasible to assess to what extent such innovations are effective, and “the investments on technological devices would be worthless without efficient training of pre-service teachers” (p. 1222). These findings show that providing the required infrastructure for technology integration is not enough by itself. In addition, Gudmundsdottir and Hatlevik (2017) found that novice teachers reported poor quality of and contribution from their pre-service ICT training. Thus, not only the existence but also the quality of technology-related courses in pre-service teacher training is of great importance to successful technology integration.

Among frequently highlighted frameworks in ICT-related studies and the main subject of this study is Mishra and Koehler’s (2006) TPACK. Mishra and Koehler (2006) highlighted the significance of technology in education and incorporated technology knowledge (TK) into Shulman’s (1987) pedagogical content knowledge (PCK) concept, which he described as the blending of content and pedagogy into an understanding of how specific topics are structured, represented, and adapted to address the varied interests and abilities of learners for instructional purposes. The TPACK framework (Mishra & Koehler, 2006) consists of seven intertwined knowledge components (see Figure 1.1).

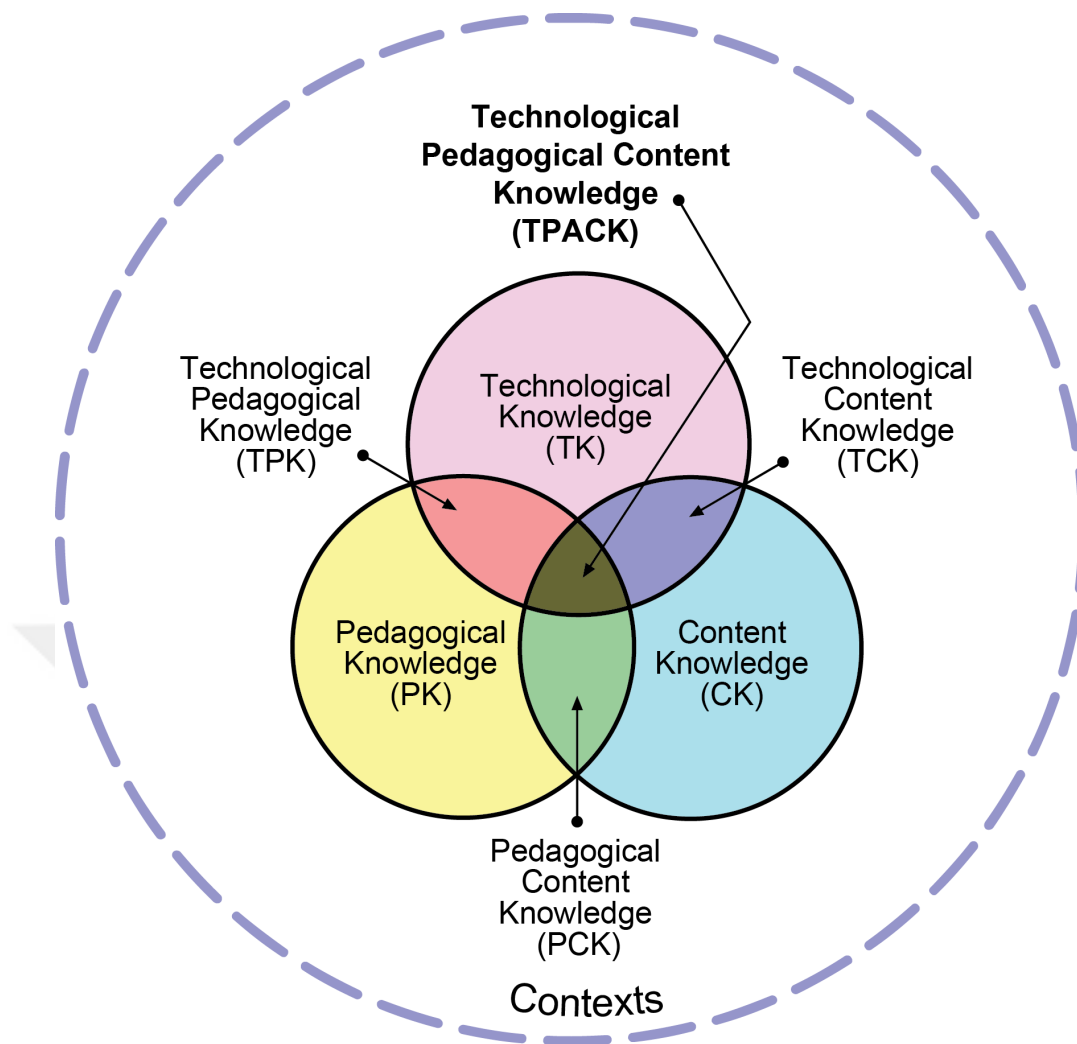


**Figure 1.1** The TPACK framework (Koehler & Mishra, 2009)

The knowledge components of the TPACK framework are defined as follows:

- I. Technology Knowledge (TK):** This term refers to the understanding of diverse technologies, which can range from conventional tools like books and paper to more high-tech resources (e.g., the Internet) (Mishra & Koehler, 2006; Schmidt et al., 2009). This type of knowledge includes the skills needed to use various technologies (e.g., a projector or presentation software).
- II. Content Knowledge (CK):** This term refers to the understanding of the subject matter that is intended to be taught or learned (Mishra & Koehler, 2006).
- III. Pedagogical Knowledge (PK):** This term is used to describe the strategies, techniques, and procedures of teaching. It encompasses knowledge related

to managing a classroom, creating lesson plans, and conducting assessments (Mishra & Koehler, 2006; Schmidt et al., 2009).

- IV. Pedagogical Content Knowledge (PCK):** This term is used to describe the knowledge of both the subject matter and the pedagogical strategies to effectively teach that subject (Mishra & Koehler, 2006; Schmidt et al., 2009; Shulman, 1986). It involves the knowledge of the teaching approaches that are suitable for specific content, as well as how to organize, represent, adapt, and present the content to learners (Mishra & Koehler, 2006; Shulman, 1986).
- V. Technological Content Knowledge (TCK):** This term refers to the comprehension of how technology can be utilized to provide new representations of specific content (Schmidt et al., 2009). It implies that teachers should be aware of not only the subject matter but also how the use of technology can transform the way the content is delivered (Mishra & Koehler, 2006).
- VI. Technological Pedagogical Knowledge (TPK):** This term is used to describe the knowledge needed to incorporate technology into teaching (Schmidt et al., 2009). It involves knowing about various technologies and their capabilities as well as understanding how the use of specific technologies can alter the teaching process (Mishra & Koehler, 2006).
- VII. Technological Pedagogical Content Knowledge (TPACK):** This term refers to the combination of the three core knowledge components (i.e., technology, pedagogy, and content). It describes the knowledge that teachers need to incorporate technology into their teaching across any content area effectively (Mishra & Koehler, 2006; Schmidt et al., 2009).

As Mishra and Koehler (2006) mentioned, there has been a lack of a framework that would tell the complete story about the complex and multifaceted nature of technology integration, and TPACK was no exception. It was, however, “better than no framework at all” (p. 1047). Even though the TPACK framework was considered not the sought-after answer even by the creators of the framework, it has had a major impact on the idea of integrating technology into education and inspired many teachers, teacher educators, and researchers around the world to reconsider their knowledge and use of technology in education (Cox & Graham, 2009). In addition to the seven components, the TPACK framework was recently

updated, and a new knowledge component called Contextual Knowledge (XK) was added to the framework (Mishra, 2019). Mishra (2019) describes the XK as the knowledge that teachers need about the specific context in which they are teaching, including the students, the school, the community, and the curriculum.

Since the development of educational technologies began to expand, technology integration into foreign language education has become one of the most frequently discussed issues (Ekmekçi, 2021). Using technology is significantly valued in the field of teaching English as a foreign language (Başer et al., 2016) since the 21<sup>st</sup>-century technology allows students to interact and collaborate with others without physical limitations (Ajjan & Hartshorne, 2008; Lee, 2000; Talebian et al., 2014), to learn at their own pace (Akayoğlu, 2021; Lai & Kritsonis, 2006; Mutlu & Eröz-Tuğa, 2013; Nouri, 2016; Singhal, 1997; Talebian et al., 2014), and to reach authentic language (Alsied & Pathan, 2013; Lee, 2000; Sert & Li, 2019; Singhal, 1997; Zhao, 2003), as well as increasing the students' motivation (Alsied & Pathan, 2013; Altun, 2015; Lee, 2000; Sert & Li, 2019), and providing rich resources (Sert & Li, 2019). English is regarded as the world's language since it is used in almost every aspect of life ranging from academia to international relations (Karakaya, 2010), and the technology of the 21<sup>st</sup> century plays an important role in the globalization of the English language since the Internet has allowed learners of English to reach more resources (Chapelle, 2003). The intersection of language education and technology has given rise to concepts such as Computer-Assisted Language Learning, which is defined as the exploration and study of computer applications in language teaching and learning (Levy, 1997). Using computer technologies for teaching and learning foreign languages offers several advantages, especially in countries where language learners have limited opportunities to practice the language they seek to learn (Alsied & Pathan, 2013). All the advantages offered by computer technologies are considered, it is undeniable that technology has become more interwoven into language learning and is well on its way to becoming a commonplace aspect of everyday practice (Otto, 2017).

## **1.2. Purpose of the Study**

The main purpose of the study at hand is to investigate pre-service EFL teachers' technological pedagogical content knowledge (TPACK) competency

levels and the influence of demographic variables on their TPACK levels. In line with this purpose, the current study addressed the following research questions:

1. What are the perceived Technological Pedagogical Content Knowledge (TPACK) competencies of pre-service EFL teachers?
2. How do EFL teacher educators perceive the Technological Pedagogical Content Knowledge (TPACK) competencies of their students?
3. Is there a relationship between pre-service EFL teachers' perceived Technological Pedagogical Content Knowledge (TPACK) competency levels and their
  - 3.1. gender?
  - 3.2. age?
  - 3.3. computer experience?
  - 3.4. year of education in the program?

### **1.3. Significance of the Study**

The 21<sup>st</sup> century has witnessed a major technological revolution and cultures, languages, and the world can now be represented, conveyed, and understood in new ways thanks to today's technology (Chun et al., 2016). The advancements in technology have seemed to be an exceptional opportunity to improve teaching and learning, particularly in higher education and instructional technologies have expanded rapidly (Turney et al., 2009). As integrating 21<sup>st</sup>-century technologies into education has become more relevant, new barriers for teachers have emerged such as lack of teacher competence, lack of resources, lack of training, and lack of technical support (Bingimlas, 2009; Ertmer, 1999; Khan et al., 2012; Kopcha, 2012; Lim & Khine, 2006; Pelgrum, 2001; Rogers, 2000; Tondeur et al, 2016; Toprakçı, 2006).

Numerous studies reported that the lack of teacher competence and training are primary barriers to integrating technology into education (Albirini, 2006; Bingimlas, 2009; Ertmer, 1999; Khan et al., 2012; Kopcha, 2012; Lim & Khine, 2006; Pelgrum, 2001; Tondeur et al, 2016; Toprakçı, 2006). Available literature indicated that Mishra and Koehler's (2006) TPACK framework was used in a noticeable number of studies with the goal of investigating pre- and in-service teachers' competencies in integrating technology into education. However, the

number of studies investigating pre-service EFL teachers' TPACK levels was found to be limited (Erşanlı, 2016; Öz, 2015; Solak & Çakır, 2014; Turgut, 2017a) and most of the data were collected only via TPACK surveys and background questionnaires. Hofer and Grandgenett (2012) pointed out that TPACK should be examined through a variety of ways for successful program refinement. Hence, in addition to the TPACK-EFL survey developed by Başer et al. (2016), this study includes semi-structured interviews with both students and teacher educators in the department. Hofer and Grandgenett (2012) pointed out the drawback of self-report surveys to lead to under- or over-reporting by students (p. 102). Therefore, it is believed that the data gathered through semi-structured interviews will make a significant contribution to the literature. The teacher educators' perceptions about their students' TPACK levels also hold vast importance in terms of observing to what extent the pre-service EFL teachers can put their knowledge about integrating technology into practice. By fulfilling its aims, the study at hand can provide valuable data to the literature related to pre-service EFL teachers' TPACK levels and their technology integration competencies.

#### **1.4. Definition of the Key Terms**

The definitions for the key terms that are used throughout the study at hand are provided below:

*Information and Communications Technology (ICT)* is characterized as a broad array of digital tools and resources utilized for communication, creation, dissemination, storage, and management of information (Tinio, 2003).

*Technology Integration* is the use of instructional technologies to improve and support educational environments, teacher instruction, and student learning (Van Allen, 2020).

*Content Knowledge (CK)* is the understanding of the subject matter that is intended to be taught or learned (Mishra & Koehler, 2006).

*Pedagogical Knowledge (PK)* is the understanding of teaching and learning methods and processes, which includes educational purposes, values, and objectives (Mishra & Koehler, 2006).

*Pedagogical Content Knowledge (PCK)* is the understanding of which teaching strategies are suitable for specific content and how to organize elements of the content for more effective teaching (Mishra & Koehler, 2006).

*Technological Knowledge (TK)* is the understanding of both basic technologies (e.g., blackboard, books, chalk) and more advanced technologies (e.g., the Internet) (Mishra & Koehler, 2006).

*Technological Content Knowledge (TCK)* is the understanding of how technology can be employed to create new representations for specific content (Schmidt et al., 2009).

*Technological Pedagogical Knowledge (TPK)* is the understanding of the existence and potential applications of various technologies in educational settings (Mishra & Koehler, 2006).

*Technological Pedagogical and Content Knowledge (TPACK)* is the understanding required by teachers to integrate technology into teaching across any content area (Mishra & Koehler, 2006; Schmidt et al., 2009).

## **2. THEORETICAL FRAMEWORK AND RELATED RESEARCH**

This chapter presents the theoretical framework and related literature regarding the variables of the study at hand. First, Information and Communications Technology (ICT), the role of teacher education programs, and Computer-Assisted Language Learning (CALL) are discussed. Afterwards, the theoretical framework of the study, which is Mishra & Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) is dwelled on. Then, the literature related to the TPACK framework was reviewed and organized under the following sub-headings: TPACK Studies in Turkey and International Studies on TPACK.

### **2.1. Information and Communications Technology (ICT), The Role of Teacher Education Programs, and Computer-Assisted Language Learning (CALL)**

Information and Communications Technology (ICT), a significant component of 21<sup>st</sup>-century technology, is now an integral part of our daily lives and is crucial to the integration of technology into education (Yusuf, 2005). According to Kozma (2011), utilizing ICTs in education is a beneficial opportunity because it improves student accomplishment, expands access to education and a variety of resources, and is cost-effective. Additionally, accessing information at any time from anywhere has become considerably simpler (Akayoğlu, 2021) and education outside of the classroom is now more accessible than ever (Fu, 2013; Purnamasari, 2019; Tinio, 2003). Since employing ICTs in education has numerous benefits, many institutions are updating their systems to take advantage of the most recent ICT developments (Başer et al., 2021).

The integration of technology into foreign language education has emerged as one of the most hotly debated topics since the expansion of educational technologies (Ekmekçi, 2021). Başer et al. (2016) stated that using technology is specifically recognized in the English Language Teaching field. As a result of the junction of language education and technology, valuable concepts such as Computer-Assisted Language Learning, which is described as the inquiry and study of computer applications in language teaching and learning have emerged (Levy, 1997). Computer-Assisted Language Learning has a number of benefits such as offering language exposure and practice opportunities, which is especially crucial

in countries where language learners have limited opportunities to practice the language they wish to learn (Alsied & Pathan, 2013). It is apparent that technology has become increasingly prevalent in language learning and is quite likely to be a commonplace component of our daily lives (Otto, 2017).

## 2.2. The TPACK Framework

Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) framework was fundamentally inspired by Shulman's (1986) concept of Pedagogical Content Knowledge (PCK). Shulman (1986) argued that the content of lessons was often overlooked in the research related to teaching and teacher education. To address this, he proposed the concept of PCK, which encapsulates the fusion of a teacher's knowledge of pedagogy and subject matter. This integrated understanding allows teachers to effectively structure, present, and teach specific topics, taking into account the varied interests and abilities of their students.

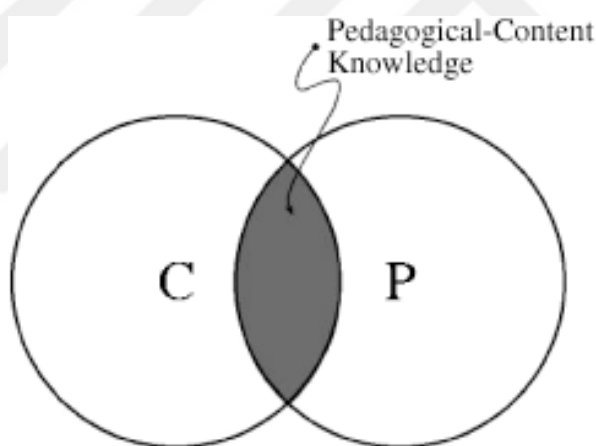


**Figure 2.1.** Shulman's (1986) Pedagogical Content Knowledge (PCK) (Mishra & Koehler, 2006)

However, with the increasing use of computers and countless applications of ICT, PCK needed to include the educational uses of technology (Angeli & Valanides, 2009). In this direction, Mishra and Koehler (2006) highlighted the importance of integrating technology into education and offered to include the technology sub-domain in Shulman's (1986) pedagogical content knowledge (PCK) with their TPACK framework. The TPACK framework (Mishra & Koehler, 2006) consists of three primary knowledge constructs that are technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK); and

goes further by emphasizing four other constructs that lie at the intersections of the three core components: pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). Even though Mishra and Koehler (2006) pointed out that the TPACK framework is not the long-desired answer to the question of integrating technology into education, there was a need for a framework and the TPACK framework was “better than no framework at all” (p. 1047).

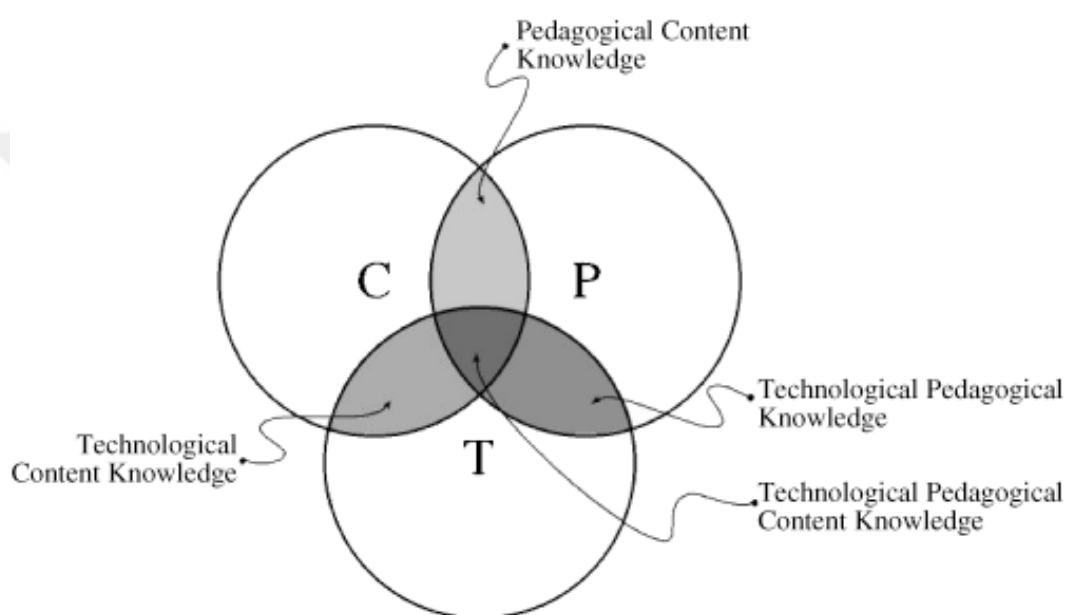


**Figure 2.2.** The initial representation of the TPACK framework (Mishra & Koehler, 2006)

Based on Shulman’s (1986) PCK, the TPACK framework (Mishra & Koehler, 2006) has emerged as an effective framework for describing and understanding the objectives of using technology in pre-service teacher education (Schmidt et al., 2009, p. 123).

Most recently, Contextual Knowledge (XK), a new knowledge component, was added to the TPACK framework in addition to the other seven components (Mishra, 2019). According to Mishra (2019), the rationale behind XK is that teachers need to understand the context in which they are teaching and this includes factors such as the students’ prior knowledge and skills, the school’s culture and climate, the community, and the curriculum standards and requirements. XK is

important because it helps teachers to make informed decisions about how to teach specific content while using technology in the classroom. For instance, a teacher who knows that their students are struggling with a particular concept may allocate more time or use additional resources. Figure 2.3 represents the updated version of the TPACK framework.

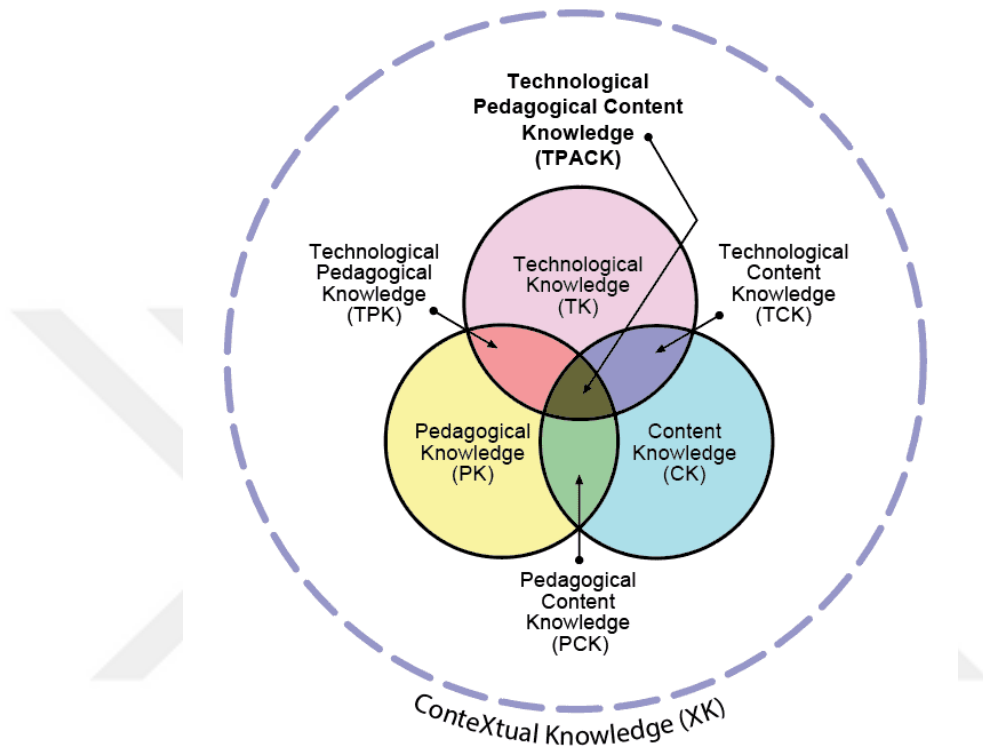


**Figure 2.3.** The Updated TPACK Framework (Mishra, 2019)

The framework was influential for many teachers, teacher educators, and researchers to reconsider their thoughts on integrating technology into education (Cox & Graham, 2009) and it gives teacher educators a means of conceptualizing and evaluating to what extent pre-service teachers are able to integrate technology into their teaching (Başer et al., 2016).

### 2.3. TPACK Studies in Turkey

An initial investigation into the TPACK of pre-service EFL teachers was conducted by Koçoğlu (2009). The objective of the study was to examine the development of TPACK in pre-service EFL teachers through a CALL course. The study involved 27 pre-service EFL teachers in their final year at a university in Turkey. The data was gathered through interviews that focused on their perceptions of TPACK. The analysis of the data revealed that the participants primarily

discussed their pedagogical content knowledge (PCK). Given that they were in their final year and undergoing their practicum, this result was anticipated by the researcher. The participants were able to acquire technological content knowledge (TCK) through the use of Weblogs and WebQuests in their CALL course. Furthermore, the opportunity to work collaboratively allowed the pre-service teachers to develop technological content knowledge (TCK), as they learned how to utilize technological tools in language teaching. The participants also noted that they were able to present various concepts to their students through technology, as they had the opportunity to use different multimedia applications throughout their education. In conclusion, the CALL course was found to be effective in enhancing the TPACK of pre-service EFL teachers and supporting their application of TPACK. Additionally, all participants highlighted how their educators demonstrated the use of technology for educational purposes and how this inspired them to incorporate technology into their own teaching.

In a similar vein, Kurt et al. (2013) conducted a preliminary study with the objective of exploring Turkish pre-service EFL teachers' TPACK developments. The study involved 22 pre-service EFL teachers who had not received prior training in technology use in education due to the lack of trained teacher educators in their department. A course spanning 12 weeks was designed with the specific aim of fostering the development of the pre-service EFL teachers' TPACK. Throughout the course, the pre-service teachers were introduced to the TPACK framework, exposed to a variety of different technologies, guided in the development of technological materials, and tasked with designing technology-integrated lessons. They also had the opportunity to apply their knowledge in real classroom settings. The TPACK-EFL scale, adapted and consisting of 29 items, was used to gather quantitative data. The study found a significant increase in the pre-service EFL teachers' TK, TCK, TPK, and TPACK scores from the beginning to the end of the course. The most significant increase was examined in the TPK levels. The study concluded that technology courses in teacher education programs should prioritize teaching pre-service teachers to consider technology, content, and pedagogy in a holistic manner for effective technology integration. The study also demonstrated the potential impact of a TPACK-oriented course in enhancing pre-service teachers' TPACK levels, their knowledge of technology integration, and their ability to design their own lessons.

In another study focusing on Turkish pre-service EFL teachers' TPACK competencies, Solak and Çakır (2014) sought to understand the TPACK levels of pre-service EFL teachers and to determine the influence of gender and academic achievement variances. The study involved 137 pre-service EFL teachers from a state university in Turkey. Data was collected using a survey method and a 24-item TPACK competency survey. The findings revealed a significant difference in the technological knowledge (TK) domain, with male pre-service teachers scoring higher, and higher levels in the pedagogical knowledge (PK) domain for female pre-service teachers. However, no significant difference was found between TPACK scores and academic achievement. The study concluded that the pre-service teachers had a positive view towards TPACK, and suggested that courses, seminars, and programs could help teachers improve their TPACK competencies.

In her master's thesis, Tunçer (2014) explored Turkish pre-service EFL teachers' perceptions of their overall teacher efficacy, their TPACK level, and the relationship between their teacher efficacy perceptions and TPACK competencies. The study involved 110 senior-year students from four different universities. The findings indicated that Turkish pre-service EFL teachers' TPACK and teacher efficacy levels were high. In addition, a significant relationship was found between teacher efficacy and TPACK competency. Furthermore, TPACK was found to influence all three sub-scales of teacher efficacy (i.e., instructional strategies, classroom management, and student engagement).

In a related study, Öz (2015) sought to evaluate pre-service EFL teachers' TPACK levels. The study involved 76 Turkish pre-service EFL teachers. Data were gathered using a TPACK scale and open-ended questions. The study found generally high levels of TPACK. Furthermore, a statistically significant gender difference was observed in the TK and PK domains, with male participants demonstrating higher levels of TK and females showing more knowledge in the PK domain. The study also found that teacher educators in the department utilized TPACK in classrooms more than cooperating teachers.

In a study focusing on pre-service EFL teachers' TPACK, Erşanlı (2016) aimed to examine the influence of a five-week training program on pre-service EFL teachers' TPACK. The study involved 59 pre-service EFL teachers from a state university. Data was collected using a TPACK scale and journal entries from pre-service EFL teachers that are collected before and after the training. The findings

indicated a statistically significant improvement in the TPACK scores of pre-service EFL teachers, regardless of gender. The study also found that journal entries showed a significant increase in the use of applications and websites for educational purposes. The pre-service teachers also demonstrated improved performance in developing and customizing language learning materials with specific objectives.

In her study, Turgut (2017a) compared the TPACK levels of pre-service EFL teachers in Turkey and Denmark. The study involved 46 pre-service EFL teachers from Denmark and 53 from Turkey. Data was collected using a TPACK scale, open-ended questions, and classroom observations conducted in both countries. The study found differences not only in defining technology but also in technology applications and teaching processes. Turkish pre-service teachers reported higher levels of TPACK, except in the TPK domain. However, qualitative data analysis revealed that Danish pre-service teachers had more advanced TPACK levels and applications. The study also found that practicum teachers' TPACK modeling was very limited in both countries. The findings highlighted that “technology” is defined differently by Turkish and Danish pre-service teachers. While Turkish pre-service teachers focused more on hardware and TK, Danish pre-service teachers emphasized software that enables interaction among students and teachers. The study underscored the importance of using multiple data sources to examine TPACK.

In a study by İşler and Yıldırım (2018), the perceptions of Turkish pre-service EFL teachers regarding their TPACK levels were investigated, along with the factors influencing these perceptions and their beliefs about integrating technology into EFL classrooms. The study involved 94 pre-service EFL teachers from Turkey who completed two questionnaires on the use of TPACK in learning and teaching processes. Additionally, six pre-service teachers were interviewed about their TPACK competency perceptions and technology integration beliefs. The results showed high levels of perceived TPACK competency, with personal interest, experience, knowledge, access, and educational support from teachers being highlighted as influential factors. The study recommended that pre-service teacher education programs should include instruction on how to combine technology, content, and pedagogy, and provide opportunities for pre-service teachers to design their own technologically mediated materials.

In her master's thesis, Şenen (2019) aimed to identify the technology adopter categories of pre-service EFL teachers, investigate their attitudes toward technology, determine their TPACK competency levels, and examine the relationship between their technology adopter categories and TPACK levels. The study involved 130 senior-grade pre-service EFL teachers from both private and public universities in different cities in Turkey. Data was collected using a Technology Adopter Category Index (TACI) survey and the TPACK-deep scale. The findings revealed that the pre-service EFL teachers' technology adopter category was predominantly the early majority, and their TPACK levels were high. No statistically significant difference was found between participants regarding their gender, academic success, and TACI scores. Additionally, no relationship was found between pre-service EFL teachers' TPACK levels and their technology adopter categories.

In a recent master's thesis by Bal (2021), the impact of TPACK-based Web 2.0 tools on the TPACK competency perceptions of pre-service English teachers was examined. The study involved 57 first-year pre-service English teachers, divided into two groups: an experimental group of 29 teachers and a control group of 28. The experimental group was tasked with using four TPACK-based Web 2.0 tools to develop instructional materials for 4th-grade subjects from the Ministry of National Education's (MoNE) curriculum and to design their own lesson plans. The control group, however, was asked to create products using the same TPACK-based Web 2.0 tools on any subject or related to their personal interests. Data was collected using a demographic information form, a TPACK-EFL scale, and semi-structured interview questions. The study found no significant difference between the control group's pretest and posttest scores. However, in the experimental group, a significant improvement was observed in all sub-domains in the post-test. Furthermore, when comparing the posttests of both groups using an independent sample t-test, a significant difference was found only in the PCK sub-domain, favoring the experimental group.

In the study by Yüksel and Yasin (2014), the aim was to determine the TPACK levels of in-service English teachers and to examine these levels in relation to gender, teaching experience, and workplace. The study involved 124 in-service EFL teachers in Turkey, and data was collected using a TPACK survey. The findings suggested that the competency levels of the in-service teachers who

participated in the study were average. In terms of gender and workplace, the TPACK scores did not differ significantly. However, teachers with five years or less of experience reported higher TPACK scores.

In her master's thesis, Saraç (2015) investigated the TPACK levels of in-service English teachers, their attitudes toward the use of interactive whiteboards, the relationship between their TPACK levels and attitudes toward interactive whiteboards, and the influence of in-service English teachers' genders and teaching experience on their TPACK competency levels. The study involved 106 in-service English teachers from a total of 24 different Anatolian High Schools. The data were collected through a TPACK-EFL questionnaire and an attitude questionnaire. The findings suggested that in-service English teachers' TPACK levels were high and they indicated positive attitudes towards the use of interactive whiteboards. In terms of in-service English teachers' TPACK levels and their attitudes, a significant relationship was found. However, no significant relationship was observed between gender and TPACK competency. The findings also revealed a strong correlation between teaching experience and TPACK as well as between attitude and teaching experience.

In his master's thesis, Delen (2016) sought to explore Turkish EFL teachers' TPACK levels and the influence of their gender and experience on these levels. The study involved 33 high school EFL teachers with varying levels of experience. Data was collected through a two-section TPACK-EFL questionnaire, with the first section gathering general participant information and the second section assessing their TPACK levels. The findings revealed that Turkish EFL teachers' TPACK levels were high. No statistically significant relationship was found between gender and TPACK. However, a negative correlation was found between teachers' teaching experience and TPACK levels.

In a comparative study, Turgut (2017b) set out to evaluate the TPACK levels of pre-service teachers, in-service teachers, and teacher candidates in the English as a Foreign Language (EFL) formation program. The study involved 53 senior-year pre-service EFL teachers, 39 EFL teacher candidates in the Teacher Certificate Program, and 103 in-service EFL teachers. Data was gathered through a TPACK survey, open-ended questions, and classroom observations conducted in both the ELT department and practicum schools. The analysis of the quantitative data revealed significant differences in self-perceptions of TPACK among the three

groups, except for the TPACK sub-domain. Interestingly, certificate program students and pre-service teachers reported higher self-efficacy in the TK, TPK, PK, and CK components than in-service EFL teachers. The study also underscored the importance of PCK and TCK in overall technology integration. Despite the FATİH project, participants reported that technology integration in schools was not up to par. The study recommended a revision in pre-service teacher education and teaching certificate programs in line with the FATİH project.

Akkoç (2011) carried out a study focusing on pre-service mathematics teachers' TPACK, with a particular emphasis on a specific TPACK component that investigates how pre-service teachers incorporate technology into their lessons to address student difficulties. The study involved 40 pre-service teachers participating in a teacher preparation program aimed at enhancing their TPACK. The participants attended TPACK-focused workshops, designed and implemented their own lessons before and after the workshops, and were interviewed at the conclusion. The study's findings indicated that the workshops effectively raised pre-service teachers' awareness of student difficulties. The participants were able to more effectively integrate technology into their teaching and used technology to address students' difficulties. These findings suggest that content-specific teacher preparation can significantly influence pre-service teachers' TPACK in relation to student difficulties.

In another study, Yavuz-Konokman et al. (2013) aimed to scrutinize the TPACK perceptions of pre-service primary education teachers, particularly in relation to their technology usage, technology accessibility, and interest in new technologies. The study utilized a TPACK scale adapted for Turkish and an open-ended questionnaire designed to elicit metaphoric responses. The participants of the study were a total of 128 senior-grade pre-service primary education teachers. The results of the study showed that primary education pre-service teachers who indicated high levels of technology use, access to technology, and interest in new technologies perceived higher TPACK scores than others. Overall, it was indicated that pre-service teachers of primary education reported high levels of TPACK perceptions and were positive in terms of developing their TPACK.

Regarding the relationship between learning strategies and TPACK, a master's thesis conducted by Gündoğmuş (2013) evaluated pre-service teachers' TPACK while determining their learning strategies and examining if there is a

correlation between these two variables. The participants of the study were a total of 493 senior-year pre-service teachers from different departments. The data were collected through a TPACK scale and Motivated Strategies for Learning Questionnaire. The data then were categorized into the following groups: TPACK scores, learning strategies scores, and demographic characteristics. The results of the study showed that elaboration and organization-based and metacognitive learning strategies were chosen the most; pre-service teachers' TK, TPK, and PCK levels were high, and field of study and gender were decisive in pre-service teachers' choice of learning strategies. Moreover, higher levels of TK, PK, TCK, PCK, and TPACK in favor of male pre-service teachers were reported. In addition, a significant relationship between TPACK and learning strategies was found. Finally, it was indicated that organizing and critical thinking strategies predict pre-service teachers' TPACK.

In another study, Altun (2013) sought to analyze the TPACK levels of in-service teachers in relation to different variables. The study involved 322 classroom teachers and utilized a TPACK scale, adapted for Turkish, to collect data. The study found significant relationships and statistically significant differences between variables such as gender, access to the Internet and an ICT lab in the school, the use of educational technologies, and the sub-factors of the TPACK scale. In terms of gender, female participants reported higher scores in CK, PK, and TCK sub-domains than males, although no significant difference was found in the remaining dimensions. The study concluded that frequent use of ICT resources, IT labs, and educational software can positively influence teachers' TPACK development.

In a related study, Şahin et al. (2013) explored the connections between pre-service teachers' TPACK and their self-efficacy beliefs regarding educational Internet use. The study involved 163 pre-service teachers from eight different departments, including social sciences, primary education, science and mathematics education, educational leadership and policy studies, foreign language education, Turkish language education, computer and instructional technologies education, and art education. Data was gathered using a 28-item self-efficacy survey and a 47-item TPACK survey. The study found significant relationships among TK, PK, CK, and their intersections. Furthermore, the canonical correlation analysis revealed a significant and strong relationship between the knowledge dimensions of the TPACK framework and the pre-service teachers' self-efficacy

beliefs in educational Internet use. Specifically, the domains of TK, CK, and TCK were identified as significant predictors of pre-service teachers' self-efficacy beliefs in educational Internet use.

In another preliminary study, Sancar-Tokmak et al. (2013) sought to examine pre-service early childhood teachers' confidence levels in TPACK, taking into account their gender and grade levels. The study involved a total of 154 pre-service teachers from the second, third, and fourth grades. Data was collected through an adapted TPACK Self-Confidence scale and a demographics questionnaire. The analysis of the data indicated that the pre-service early childhood teachers' TPACK self-confidence levels were high, and no relationship was found between their TPACK self-confidence levels, gender, and grade levels. However, a significant difference was found between pre-service teachers' grade levels and TK self-confidence levels, with higher grades showing more confidence.

In a related study, Sancar-Tokmak et al. (2014) focused on the TPACK perceptions of pre-service science teachers. The study involved 21 pre-service science teachers, and their TPACK development was assessed after they created digital stories based on various science topics from the Ministry of National Education's (MoNE) curriculum. Data was collected through a demographic background questionnaire, a TPACK diagram, an open-ended questionnaire, interviews, and observations. The findings suggested that the process of creating digital stories led to an increase in the pre-service teachers' TK, PK, and CK.

In his master's thesis, Burmabıyık (2014) examined the influence of various variables such as age, gender, major, seniority, graduation, level of technology use, and the number of in-service trainings on in-service teachers' TPACK competency levels. The study involved 377 in-service teachers from various fields. Data was collected using a TPACK scale adapted for Turkish and a personal information form questionnaire. The findings suggested that there was no significant relationship between teachers' TPACK acceptance levels and their gender, age, seniority, major, graduation, and the number of in-service trainings they attended. However, a significant and weakly positive relationship was found between teachers' technology use and TPK, TCK, and TPACK, and a moderately positive relationship with TK. No significant relationship was found with CK, PK, and PCK. Teachers who had access to technology in schools reported higher scores of TK,

TCK, and TPACK. The study concluded that teachers who are proficient in using technologies had better TPACK scores.

In another master's thesis, Karataş (2014) investigated secondary school mathematics teachers' technology-integration self-efficacy beliefs (TISE) and TPACK perceptions as well as their relationship with different variables such as gender, age, and years of experience. The study involved 138 in-service mathematics teachers from 28 different FATİH project schools. Data was collected using TPACK-M and TISE scales, both adapted for Turkish. The findings revealed that the TPACK and TISE levels of secondary mathematics teachers were moderate. In addition, there is a significant correlation between the TPACK and TISE variables found. Despite the fact that a considerable difference in teachers' TISE in favor of males was found, demographic variables revealed no significant difference in TPACK perceptions in general regarding their gender. A small negative correlation was found between mathematics teachers' TISE and age, while no significant difference was revealed between TPACK perception and teaching experience. The study concluded with a recommendation for professional development programs for teachers to ensure successful technology integration.

In a study by Tatlı et al. (2016), the aim was to equip pre-service teachers from various disciplines with the skills to develop materials in their respective fields by introducing techniques to enhance the use of Web 2.0 tools for educational purposes. The study also investigated the impact of this training on pre-service teachers' TPACK self-confidence levels. The study involved 46 senior-grade pre-service teachers from 13 different fields. The Technological Pedagogical Content Knowledge Self-Confidence (TPCKSC) scale and a survey on the effectiveness of using Web 2.0 technologies in education were used to collect the data. The research design employed a pre-test/post-test pattern with a single group. The results showed a significant increase in pre-service teachers' self-confidence levels regarding the TK, TCK, and TPCK components of the TPCKSC scale. However, TPK scored lower due to the pre-service teachers' lack of experience. The study recommended the inclusion of courses in teacher education programs that allow pre-service teachers to improve their TPACK and TPACK self-confidence levels.

In another study focusing on pre-service science teachers' TPACK, Kartal and Afacan (2017) sought to explore pre-service science teachers' TPACK levels based on various demographic variables such as gender, access to computers,

computer usage, and grade level. The study involved 591 pre-service science teachers. Data was collected using an adapted TPACK survey and a personal information form. The results showed a positive correlation between each TPACK factor, with CK being the most influential predictor. The study also found higher scores in the TK, CK, and TPACK sub-domains for males, for pre-service teachers with personal computers, and for those with higher grade levels.

Altun and Akyıldız (2017) conducted a study to examine pre-service teachers' TPACK in relation to different variables. The study involved 609 senior-year pre-service teachers from five different subject areas. Data was collected using an adapted TPACK scale. The results showed that pre-service teachers' TPACK levels were generally adequate. The study found significant relationships and differences between gender, subject area, access to computers and the Internet, and TPACK. Although gender did not significantly influence overall TPACK scores, a significant difference was found in PK scores, with females scoring higher. The study also found a significant difference in the TK sub-domain in favor of those who had access to a personal computer and Internet connection at home. The researchers recommended that the pre-service teacher education curriculum should include effective TPACK education.

In a study by Dinçer (2018), the aim was to assess pre-service teachers' skills and attitudes toward technology use. The study involved 712 pre-service teachers from five universities and 227 in-service teachers from primary and middle schools. Data was collected using the Technology Literacy Skills Exam (TLSE), Technology Literacy Knowledge Test (TLKT), and a TPACK scale. The findings suggested that pre-service teachers' competencies were not as high as they perceived them to be. This was attributed to the fact that the pre-service teachers in the study had not taken any technology-related courses before, or the existing courses were not sufficient. The researcher recommended a revision and adequate provision of technology-related courses in teacher training programs.

In a study conducted by Baş and Şentürk (2018), Turkish in-service teachers' TPACK perceptions were investigated. The study involved 200 in-service teachers from various public elementary and high schools. A survey method was used to examine the teachers' perceptions of TPACK. The results showed that the teachers' TPACK perceptions were influenced by factors such as gender, educational level, teaching level, work experience, and participation in seminars

related to educational computer and Internet use. The teachers' perceptions of TPACK were found to be moderate overall, with perceptions in the TCK sub-dimension being relatively lower. The study found significant gender differences in the TK, PCK, and TPACK domains, with male participants reporting higher mean scores. Younger or less experienced teachers were found to have higher scores in all TPACK sub-dimensions. The study also found significant differences in the CK, TCK, and TPACK domains between elementary school teachers and high school teachers, with the former reporting higher mean scores. The study concluded that developing TPACK programs for in-service teachers to enhance their TPACK skills is both urgent and crucial.

In another study, Şimşek and Yazar (2018) set out to examine pre-service teachers' technology integration self-efficacy beliefs within the TPACK framework, in the context of the International Society for Technology in Education Standards (TPACK-ISTE). The study involved 3932 senior-level prospective teachers and pedagogical formation certificate program participants from 18 different state universities in Turkey. The study used correlational and causal-comparative research designs, and data was collected using a TPACK scale based on ISTE's standards. The results showed a significant difference in the technological knowledge (TK) domain in favor of male teacher candidates. Furthermore, prospective teachers who had previously taken computer courses with certificates reported significantly higher TK and TPACK-ISTE self-efficacy scores. The study found no significant differences in all components and general scores of TPACK-ISTE self-efficacy in terms of the prospective teachers' field of study.

In another study, Karataş and Akgün (2014) aimed to examine teachers' TPACK proficiencies. The study involved 445 teachers from 17 secondary schools in Turkey, with data collected using a TPACK scale. The results showed higher levels of TPACK proficiency among male teachers, teachers under the age of 30, teachers who use computers for more than an hour a day, and teachers who can use computers at high levels. The study concluded that more and better computer use leads to better TPACK self-competence, and recommended providing necessary resources, organizing training programs, and offering positive experiences to help teachers utilize TPACK during learning and teaching processes.

Özkara et al. (2018) conducted a study to examine the TPACK self-confidence perceptions of in-service teachers who had been trained for the FATİH

Project in Turkey. The study involved 232 secondary school teachers, with data collected using a TPACK self-confidence scale. The study found that teachers' pedagogical content knowledge was higher than average and their overall TPACK self-confidence level was also high. The study also found a significant gender difference in teachers' TPACK self-confidence levels, with male teachers reporting higher levels of TK and TPACK than female teachers. The study concluded that gender can be considered a factor that affects teachers' TPACK self-confidence levels, and recommended increasing the amount of education related to TPACK.

In a study by Açıkgül and Aslaner (2019), the relationship between TPACK efficacy and self-efficacy perception levels of pre-service mathematics teachers was analyzed. The study involved 88 junior-year pre-service mathematics teachers who were taking the Special Teaching Methods II course. Data was collected using the TPACK Regarding Geometry Instrument and Multiple-Choice Achievement Test on Polygons, Question Forms, Lesson Plan Preparation Method, and Participant Report. The results showed no statistically significant relationship between the TPACK efficacy scores and self-efficacy scores. The researchers suggested that more research should be conducted in this context.

In another study, Özüdoğru and Özüdoğru (2019) aimed to develop and validate a TPACK scale to investigate mathematics teachers' TPACK levels with respect to their gender, teaching experience, and level of school. The study involved 202 mathematics teachers, with data collected through a TPACK scale with 39 items developed by the researchers. The results indicated that the TPACK scale developed by the researchers was valid and reliable. There were significant differences between teachers' gender and the TK sub-domain in favor of males. However, no significant relationship was found between teachers' teaching experience, the level of school they are teaching, and TPACK levels.

In a recent investigation, Başer et al. (2021) explored the views of in-service teachers regarding the individualized technology-related (ITR) mentoring processes, grounded in the TPACK framework. The study involved 17 mathematics and 14 language teachers from three public middle schools located in the northwestern region of Turkey. Data was gathered using both quantitative and qualitative methods. A TPACK survey was administered at the start and end of the ITR mentorship process for quantitative data collection. Concurrently, qualitative data were obtained through semi-structured interviews to understand teachers'

perspectives on the mentorship process. The study found a significant enhancement in technology-related TPACK constructs through one-on-one mentoring. These findings suggest that ITR mentorship could be a valuable approach to the professional development of teachers and should be considered in in-service teacher training.

Şahin (2011) conducted a study to develop a TPACK survey. The study was carried out in five stages: item pool creation, validity and reliability testing, discriminant validity analysis, test-retest reliability, and survey translation. The validity and reliability of the scale were assessed with a sample of 348 pre-service EFL teachers. To verify language equivalence, pre-service EFL teachers were asked to respond to both the Turkish and English versions of the survey. The Explanatory Factor Analysis (EFA) demonstrated that the survey items effectively measured each variable. Furthermore, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity (BTS) indicated that the data met the psychometric criteria for the EFA. Finally, the internal consistency of the subscales in the scale was demonstrated by Cronbach's alpha coefficients. In conclusion, the TPACK survey was validated and found to be reliable.

In another comprehensive study, Kabakçı-Yurdakul et al. (2012) developed a TPACK scale to evaluate pre-service teachers' TPACK levels. The scale's validity and reliability were tested with a sample of 995 pre-service teachers from Turkey. Two random subsamples were used, with 498 pre-service teachers for the Exploratory Factor Analysis (EFA) and 497 for the Confirmatory Factor Analysis (CFA). The scale consisted of 33 items and four factors: design, exertion, ethics, and proficiency. The Cronbach's alpha coefficient value for the entire scale was .95, and individual factors of the scale ranged between .85 and .92. Additionally, the test-retest reliability coefficient of the scale was .80. Based on these results, the scale was confirmed as a valid and reliable tool for measuring pre-service teachers' TPACK levels.

In a preliminary exploration of TPACK studies in Turkey, Baran and Bilici (2015) conducted a detailed systematic review of 30 research articles that examined the TPACK framework in teacher education contexts within the country. They analyzed the subjects, contexts, research methods, TPACK approaches, participants, data collection tools, data analysis methods, TPACK-based activities, validity and reliability studies, and the results of the studies to gain a better

understanding of the research trends in the literature. The study found that surveys were the most commonly used data collection instruments, pre-service teachers were the most frequent participant group, and math and science were the most commonly investigated subject domains.

In another study aimed at analyzing TPACK studies in Turkey, Yılmaz (2015) examined 59 studies published between 2008-2014 using the meta-synthesis method. The studies were analyzed in terms of their purpose, subject area, method, sample, data collection tools, teaching applications, and results, and were subjected to content analysis. The results suggested that a significant portion of the studies aimed at scale validation and adaptation, and examination of TPACK competencies and developments. Surveys were the most commonly used data collection tools and most of the participants were prospective teachers. It was also found that participants of quantitative studies reported high levels of TPACK competency, while qualitative studies reported the opposite. Finally, different teaching applications such as TPACK workshops or blended learning were found to increase TPACK levels. Based on these findings, it was recommended that education faculties should update their courses in accordance with TPACK and both in-service and pre-service teachers should receive training accordingly.

#### **2.4. International Studies on TPACK**

Habibi et al. (2019) undertook a study to examine the use of ICT for pedagogical purposes by pre-service language teachers in the context of the TPACK framework. The study aimed to ascertain if the TPACK framework could adequately explain the use of ICT by Indonesian pre-service language teachers in their teaching. The study involved 287 pre-service language teachers from three universities in Indonesia. A 38-item survey based on TPACK and the use of ICT was administered to the participants. The findings suggested that the TPACK sub-domains are interconnected, and the framework was a valid model for explaining the ICT usage of Indonesian pre-service language teachers.

Hsu (2016) conducted a preliminary study to examine the TPACK proficiency levels of EFL teachers and to explore how TPACK affected the adoption of mobile-assisted language learning (MALL). The study involved 158 in-service EFL teachers from Taiwan. The data was collected using the TPACK-EFL survey and a MALL acceptance survey. The results showed that the TPK sub-

domain had the highest mean score, followed by TPACK and TCK sub-domains, while PK had the lowest. The study also found a strong willingness among participants to use MALL technologies. The study concluded that TPACK significantly influences the acceptance of MALL.

Nazari et al. (2019) conducted a study to explore the differences in TPACK perceptions between novice and experienced English teachers, and how these perceptions influence their professional development. The study involved 427 EFL teachers from Iran for the quantitative phase and 16 EFL teachers for the qualitative phase. The data was collected using a 39-item TPACK-EFL survey for the quantitative phase and structured interview questions for the qualitative phase. The findings suggested that experienced teachers scored higher in the PK and PCK sub-domains, while novice teachers reported significantly higher scores in TK, TCK, TPK, and TPACK sub-domains.

Fathi and Yousefifard (2019) conducted a study to evaluate Iranian EFL students' perceptions of their teachers' TPACK. The study involved 148 Iranian EFL students, with data collected using a TPACK questionnaire. The results revealed that the students perceived their teachers as competent in TPACK, particularly in the TK, PK, CK, and PCK sub-domains. However, the teachers were seen as less proficient in the TCK, TPK, and TPACK sub-domains. The students believed their teachers had sufficient knowledge of the English language, pedagogical knowledge, and technology use, but lacked adequate knowledge of integrating technology into their teaching.

In a study conducted by Graham et al. (2009), the researchers examined the TPACK of in-service science teachers. The study involved 15 teachers who participated in a professional development program focused on science education. The teachers were introduced to various technologies through a three-phase instruction process. Data was collected using a questionnaire based on the TPACK framework, both before and after the instruction process. The results showed a significant improvement in all TPACK sub-domains from the pre-test to the post-test. The TK component had the highest score, followed by TPK, TPACK, and TCK. This suggested that TK was a fundamental aspect in developing confidence in the other three sub-domains.

In a study by Banas (2010), the focus was on examining teachers' attitudes toward the use of technology and their understanding of TPACK. The study

involved 225 active teachers or certified education professionals. The findings showed that more than half of the participants (52%) had positive attitudes towards the integration of technology, while 28% also had positive attitudes but mentioned various challenges. About 13% were integrating technology without any issues, and 7% were not integrating technology at all in their teaching. The most common barriers to technology integration included a lack of necessary knowledge, skills, confidence, access, and time. The study concluded by recommending that these barriers need to be addressed for successful technology integration.

Koh et al. (2010) conducted a study to explore the TPACK of pre-service teachers in Singapore. The study involved 1185 pre-service teachers, with 545 being trained for primary education and 640 for secondary education. Data was collected using a survey designed to measure the TPACK competencies of pre-service teachers. The results showed that male pre-service teachers reported higher scores in the TK sub-domain. Furthermore, it was found that the pre-service teachers had difficulty distinguishing between PK and PCK domains, which was attributed to them being at the beginning of their teacher training. The study also found that the TK and CK sub-domains were distinct within the knowledge perceptions of pre-service teachers.

Abbitt (2011) conducted a significant study to examine the correlation between pre-service teachers' TPACK and their technology-integration self-efficacy beliefs. The study involved 45 pre-service teachers specializing in early childhood education (ECE). Data was collected using a survey of pre-service teachers' knowledge of teaching and technology, and a computer technology integration survey. The study found that the TK, PK, PCK, and TPK sub-domains were significant predictors of pre-service teachers' self-efficacy beliefs in TPACK. Additionally, a change over time was observed between TPACK sub-domains and self-efficacy beliefs after analyzing pre-test and post-test data. The study concluded by highlighting the complex relationship between knowledge and self-efficacy beliefs and identifying the TPACK sub-domains that may influence pre-service teachers' technology integration beliefs.

In a study by Chuang and Ho (2011), the TPACK of early childhood teachers was explored. The study involved 335 in-service early childhood teachers from Taiwan, and data was collected using a modified TPACK survey. The findings showed that the highest scores were in the PK, CK, and PCK sub-domains of

TPACK. The teaching experience was found to have a significantly positive correlation with early childhood teachers' PK, CK, and PCK. There was also a significant positive correlation between the participants' PK, PCK, and age. However, a significant negative correlation was found between TK and age, meaning older teachers scored higher in PK and PCK sub-domains, while younger teachers scored better in the TK sub-domain. Finally, higher TK and TCK scores were reported for early childhood teachers who used information technology for more than 20 hours a week.

Koh and Chai (2011) conducted a study to examine pre-service teachers' TPACK perceptions and to analyze the influence of demographic factors such as age and gender. The study involved 350 pre-service teachers, and data was collected using a 30-item TPACK survey designed for pre-service teachers. The results showed no differences in the TPACK levels of pre-service teachers based on gender. Regarding age and TPACK, significant but small negative correlations were found with PK, TK, and Technological Pedagogical Knowledge (TPK) sub-domains. The pre-service teachers reported relatively high scores in TK, PK, and CK sub-domains, but their scores were below average in the PCK, TCK, and TPK domains. The study concluded that TPK and TCK sub-domains were significant predictors of TPACK.

In a study by Lin et al. (2012), the perceptions of science teachers regarding TPACK were investigated. The study involved 222 pre- and in-service science teachers in Singapore, and data was collected using a Pre-service Teachers' Knowledge of Teaching and Technology survey. The findings indicated that female science teachers had higher self-confidence levels in the PK sub-domain, while male teachers reported higher scores in the TK sub-domain. Additionally, a statistically significant negative correlation was found between the age of female science teachers and their TK, TPK, TCK, and TPACK competencies.

In a similar vein, Jang and Tsai (2013) conducted a study to understand the TPACK of secondary school science teachers using a newly developed contextualized TPACK model. They also examined the relationship between the TPACK of in-service teachers and factors such as teaching experience and gender. The study involved 1292 secondary school science teachers in Taiwan. The results showed that the TPACK levels of these teachers were significantly influenced by their gender and teaching experience. Male science teachers scored higher in the

TK sub-domain, while experienced teachers scored higher in CK and PCK sub-domains. However, less experienced teachers scored higher in TK and TCK sub-domains. The study concluded that gender and teaching experience significantly influence the TPACK of secondary school science teachers.

Hosseini and Kamal (2013) conducted a study to determine pre- and in-service teachers' TPACK proficiencies, their attitudes toward computer use, and the influence of demographic variables such as age, gender, field of study, and teaching experience on their TPACK levels. The study involved 236 pre- and in-service teachers from five different fields. The data was collected using three instruments: a computer attitude questionnaire, a demographic questionnaire, and a TPACK questionnaire. The results showed that the PK sub-domain had the highest score, while the TPK had the lowest. The study found no significant relationship between age and gender variables and the components of TPACK. However, a significant relationship was found between TPACK components, participants' fields of study, and teaching experience. The study also found no correlation between participants' attitudes toward technology use and TPACK.

Cheng (2017) conducted a study to understand the TPACK perceptions of in-service Hakka language teachers in Taiwan. The study involved 172 teachers and used an adapted TPACK survey for data collection. The findings suggested that while the teachers were generally satisfied with their overall TPACK, they scored lower in the CK, TK, and TPK sub-domains. The study also found that older male teachers scored higher in CK, while older female teachers scored lower in TK. In addition, teaching experience was identified as a significant factor influencing teachers' TPACK perceptions, with more experienced teachers scoring higher in CK, PK, and PCK.

Bingimlas (2018) utilized a study to explore the TPACK levels of in-service teachers in Saudi Arabia. The study involved 243 teachers from primary, middle, and secondary grades. The data was collected using a TPACK self-assessment survey. The results showed that most teachers reported average scores in CK, TK, TCK, TPK, and TPACK sub-domains, and high scores in PK and PCK sub-domains. The study found significant gender differences in TK and TCK sub-domains, but no significant differences in PK, CK, and PCK sub-domains. The study also found significant differences in teachers' TK scores based on their teaching experience.

Abu-Hardan et al. (2019) conducted a study to evaluate the effectiveness of TPACK in enhancing the reading performance of EFL students. The study involved 66 secondary school students in Jordan, divided into an experimental group and a control group. The experimental group was taught by a teacher trained in the TPACK framework, while the control group received conventional instruction. The findings suggested that the group taught by the TPACK-trained teacher, using technology, demonstrated superior reading skills. This underscores the potential benefits of incorporating technology in EFL education, which can potentially improve students' proficiency in all language skills, not just reading.

Valtonen et al. (2020) conducted a study that offered fresh insights into research aimed at assessing the TPACK levels of pre-service teachers. The study involved 86 pre-service teachers from Finland, with the data sourced from 86 lesson plans that integrated technology, written by first-year pre-service teachers. Each lesson plan included a section where the students identified areas in the lesson plan where they felt confident or challenged. The results showed that the students felt most confident in the PK component, followed by PCK, while TPK was deemed the most challenging. The researchers emphasized the importance of the PK sub-domain based on these findings.

In a study by Fuad et al. (2020), the TPACK levels and readiness of language teachers to teach online during the COVID-19 pandemic were explored. The study involved 318 in-service teachers from Indonesia, with data collected through questionnaires related to attitude and TPACK. The results showed that Indonesian language teachers have adapted to online education and the use of various educational platforms. While some senior teachers had negative attitudes towards technology use, the majority of the teachers had positive attitudes towards technology use and TPACK.

In another study, Schmid et al. (2021) conducted a study to explore the correlation between the incorporation of digital technologies in lesson plans and teachers' self-reported TPACK. The study scrutinized 173 lesson plans crafted by pre-service teachers to determine if they incorporated digital technologies and whether these technologies were intended for use by teachers or students. The study found that pre-service teachers scored highest in the Content Knowledge (CK) sub-domain and lowest in the Technological Content Knowledge (TCK) sub-domain. Out of the lesson plans, 37 did not include any digital technologies, while 136 did.

Of these, 90 were designed for teacher use and 46 for student use. Interestingly, the study found no significant difference in any self-reported TPACK sub-domain between pre-service teachers who chose to integrate technology into their lessons and those who did not.

In a study by Lee and Tsai (2010), the researchers focused on creating a tool to measure teachers' confidence and understanding of TPACK in the context of using the internet for educational purposes. The study involved 558 practicing teachers from elementary and high schools in Taiwan. The analysis of the survey, developed by the researchers, showed satisfactory reliability and validity scores. However, the teachers who took part in the survey expressed a general lack of knowledge about using the Internet in education. The study also explored the connections between teachers' attitudes toward web-based teaching, their TPACK self-efficacy beliefs, and their background characteristics. The results showed links between teachers' confidence in their TPACK and positive attitudes toward web-based teaching. Interestingly, the study found that older and more experienced teachers reported lower levels of TPACK self-efficacy, while teachers with more web usage experience had higher levels of TPACK self-efficacy.

Schmidt et al. (2009) conducted a comprehensive study to develop an instrument for assessing TPACK among pre-service teachers. The study outlined the need for such an instrument, described the process of its development, and presented results from a pilot study where the newly developed survey was used. The pilot study involved 124 pre-service teachers. The results indicated that the newly developed survey was a statistically reliable and valid tool for assessing the TPACK of pre-service teachers.

Luik et al. (2018) carried out a study with the objective of developing a universally applicable TPACK assessment tool. The study aimed to validate the developed instrument and explore pre-service teachers' TPACK perceptions in Estonia, a country known for its widespread use of technology in education. The study also examined the influence of demographic variables on TPACK perceptions. The results showed that male pre-service teachers had higher perceptions of TK and CK than their female counterparts, but there was no difference in PK. The study also found a negative correlation between age and TK, and a positive correlation between age and CK. The study concluded that pre-

service teachers lacked PK but had better perceptions regarding the integration of technology into their teaching.



### **3. METHODOLOGY**

This chapter presents the overall methodology of the study at hand under six sub-headings, namely the research design, research setting, participants, data collection instruments, data collection procedure, and data analysis procedure.

#### **3.1. Research Design**

The current study is aimed at investigating pre-service EFL teachers' TPACK levels and examining the relationship between pre-service EFL teachers' perceived TPACK competency levels and demographic variables, namely gender, age, computer experience, and educational year. In this regard, the following research questions were addressed:

1. What are the perceived Technological Pedagogical Content Knowledge (TPACK) competencies of pre-service EFL teachers?
2. How do EFL teacher educators perceive the Technological Pedagogical Content Knowledge (TPACK) competencies of their students?
3. Is there a relationship between pre-service EFL teachers' perceived Technological Pedagogical Content Knowledge (TPACK) competency levels and their
  - 3.1. gender?
  - 3.2. age?
  - 3.3. computer experience?
  - 3.4. year of education in the program?

As stated by Hofer and Grandgenett (2012), students may tend to under- or over-report in self-report surveys and TPACK should be examined through more than one instrument. In addition, Creswell (2014) stated that employing a mixed-methods approach provides a better comprehension of the research problem when compared to using only one type of data. Therefore, this study was conducted through a mixed-methods approach with the intention of enhancing the data with more in-depth remarks obtained through semi-structured interviews in addition to self-assessment questionnaires. The quantitative data of the study were obtained through a TPACK-EFL questionnaire along with a demographic background questionnaire while the qualitative data were collected through semi-structured interview questions with a number of the students who attended the initial data

collection procedure and volunteered to be a part of the qualitative data collection procedure as well. In addition, a set of adapted semi-structured interview questions were asked to the teacher educators in the department as well to understand to what degree can pre-service EFL teachers integrate technology into their micro-teaching sessions and teaching practices while reflecting on their TPACK levels.

### 3.2. Research Setting

The current study was carried out at the Department of English Language Teaching of a state university in the spring term of the 2021-2022 academic year. Along with other courses, the program offers an Instructional Technologies course specifically aimed at teaching the principles of educational technology along with a wide variety of tools and platforms that can be used for educational purposes. The academic staff of the program values and encourages the integration of digital technology into education, as stated by both the students and the teacher educators.

### 3.3. Participants

The participants of the current study were a total of 215 pre-service EFL teachers from different educational years and five teacher educators in the Department of English Language Teaching of a state university. The convenience sampling strategy was employed to choose the participants. As defined by Dörnyei (2007), convenience sampling is the most common sampling strategy as it is both time- and budget-efficient for researchers. In convenience sampling, the participants are selected for the study if they are geographically accessible, available at a certain time, and willing to participate. Table 3.1 displays the distribution of the participants based on their gender:

**Table 3.1.** The distribution of the participants based on their gender

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Female | 155       | 72.1    |
| Male   | 60        | 27.9    |
| Total  | 215       | 100.0   |

As can be seen in Table 3.1, the majority of the participants who volunteered to participate in the questionnaires were female (72.1%) while the number of male participants was 60 (27.9%).

**Table 3.2.** The distribution of the participants based on their year of education

| <b>Year of education</b> | <b>Frequency</b> | <b>Percent</b> |
|--------------------------|------------------|----------------|
| First year               | 59               | 27.4           |
| Second year              | 54               | 25.2           |
| Third year               | 40               | 18.6           |
| Fourth year              | 62               | 28.8           |
| Total                    | 215              | 100.0          |

As illustrated in Table 3.2, the participants varied from freshman to senior year in the program. Most of the participants were in their senior year (28.8%) followed by first-year students (27.4%), second-year students (25.2%), and third-year students being the smallest group with 40 students (18.6%).

**Table 3.3.** The distribution of the participants based on their age

| <b>Age</b>         | <b>Frequency</b> | <b>Percent</b> |
|--------------------|------------------|----------------|
| 18-20 years        | 79               | 36.7           |
| 21-23 years        | 118              | 54.9           |
| 24 years and above | 18               | 8.4            |
| Total              | 215              | 100.0          |

The age of the participants varied substantially. Therefore, they were divided into three groups. Table 3.3 reveals that the majority of the students were aged between 21 and 23 (54.9%), followed by 18-20 years (36.7%), and 24 years and above with only 18 participants (8.4%). In addition to the participants' age, the participants' computer experience was also questioned and the findings are displayed in Table 3.4:

**Table 3.4.** The distribution of the participants based on their computer experience

| Computer experience | Frequency | Percent |
|---------------------|-----------|---------|
| 1-5 years           | 15        | 7.0     |
| 6-10 years          | 43        | 20.0    |
| 13-15 years         | 107       | 49.7    |
| 16 years and above  | 50        | 23.3    |
| Total               | 215       | 100.0   |

As illustrated in Table 3.4, the majority of the participants had between 13 and 15 years of computer experience (49.7%) followed by 16 years and above (23.3%), and 6 to 10 years (20.0%). The smallest group with only 15 participants had only 1-5 years of computer experience (7.0%). In the context of this thesis, “computer experience” refers to the extent of exposure that pre-service teachers have with computers only.

After collecting the quantitative data, the participants were asked whether they would like to volunteer for the qualitative data procedure. Five participants from each grade volunteered and were invited for semi-structured interviews excluding the freshman-year students since they had not yet received enough pedagogical training to answer the interview questions. The overall distribution of the interviewees is displayed in Table 3.5:

**Table 3.5.** The distribution of the participants who attended the semi-structured interviews

| Group                | Frequency | Percent |
|----------------------|-----------|---------|
| Pre-service teachers | 14        | 73.7    |
| Teacher educators    | 5         | 26.3    |
| Total                | 19        | 100.0   |

Only one of the participants could not attend the interview, reporting medical issues at the planned time. Teacher educators in the department were also asked to answer adapted versions of the interview questions not only to enrich the data but also to determine if the students can in fact put their TPACK knowledge into practice in their micro-teaching sessions presentations, and teaching

practicums. A total of 5 teacher educators participated in the study along with the pre-service teachers.

### 3.4. Data Collection Instruments

According to Creswell (2014), using a mixed-methods approach “provides a better understanding of the research problem than either form of data alone” (p. 2). Therefore, this study was conducted through a mixed-method design to enrich the data with more in-depth comments collected through semi-structured interviews in addition to self-assessment surveys. As for the data collection instruments, a demographic background questionnaire, a TPACK-EFL survey, and a set of semi-structured interview questions were utilized in the study. The data collection instruments utilized in the current study are displayed chronologically in Figure 3.1:



**Figure 3.1.** Data collection tools

### 3.5. Demographic Background Questionnaire

The quantitative data of the current study were obtained through a two-section questionnaire. In the first section, a demographic background questionnaire designed by the researcher was utilized (see Appendix 1). The questionnaire consisted of the participants' age, gender, educational year, and computer experience.

### 3.6. TPACK-EFL Scale

In the second section, a TPACK-EFL scale developed by Başer et al. (2016) (see Appendix 2) that comprises a total of 39 nine-point Likert scale items with labels ranging from “nothing/none (1)” to “a great deal (9)” was used. As stated by the corresponding author, the scale was originally developed in Turkish and translated into English later. The original version was utilized in the current study with the permission of the corresponding author. The items are divided into seven dimensions of TPACK as follows:

**Table 3.6.** The distribution of the items in the TPACK-EFL Scale (Başer et al., 2016)

| Dimension | Number of items | Question numbers |
|-----------|-----------------|------------------|
| TK        | 9               | 1-9              |
| CK        | 5               | 10-14            |
| PK        | 6               | 15-20            |
| PCK       | 5               | 21-25            |
| TCK       | 3               | 26-28            |
| TPK       | 7               | 29-35            |
| TPACK     | 4               | 36-39            |

The current study also utilized a reliability analysis to examine the reliability of the TPACK-EFL scale through Cronbach's alpha values of the scale items. Table 3.7 illustrates the Cronbach's alpha coefficient values of the TPACK-EFL scale.

**Table 3.7.** Cronbach's alpha coefficient values of the TPACK-EFL Scale (Başer et al., 2016)

| Dimension | Number of items | Cronbach's alpha value |
|-----------|-----------------|------------------------|
| TK        | 9               | .892                   |
| CK        | 5               | .885                   |
| PK        | 6               | .885                   |
| PCK       | 5               | .902                   |
| TCK       | 3               | .811                   |
| TPK       | 7               | .912                   |
| TPACK     | 4               | .851                   |
| Total     | 39              | .951                   |

According to Muijs (2004), Cronbach's alpha values above .70 are considered acceptable. Hence, the TPACK-EFL can be considered a reliable scale with Cronbach's alpha values ranging from .811 to .951.

### **3.7. Semi-structured Interviews**

Following the quantitative data collection phase, semi-structured interviews were conducted with a number of pre-service EFL teachers who attended the initial data collection phase and volunteered to participate in the interviews as well. The interview consisted of seven questions generated by the researcher, one for each sub-component of the TPACK framework (see Appendix 3). The interview questions were initially piloted with a group of pre-service EFL teachers for the purpose of testing the questions' clarity. The questions were edited to include more detailed examples as the volunteers pointed out the importance of giving detailed examples for each knowledge component. The volunteers in the piloting phase were not included in the interviews later but their invaluable feedbacks were crucial for the final versions of each question. In addition, expert opinions were also received to refine and finalize the interview questions. Apart from the pre-service teachers, the teacher educators in the department were also given a set of adapted versions of the same interview questions (see Appendix 4) in an effort to determine the extent to which pre-service EFL teachers can incorporate technology into their presentations, micro-teachings, and practicums while reflecting on their TPACK levels.

### **3.8. Data Collection Procedure**

This section is to cover the procedures followed to collect the data of the study at hand. First and foremost, permissions required before collecting the data were granted by the corresponding author of the TPACK-EFL scale (Başer et al., 2016) and the Human Subjects Ethics Committee of Bolu Abant İzzet Baysal University. Later, the target population of the quantitative data collection phase was informed about the aim and scope of the study, data collection instruments, and procedures. Afterwards, the demographic background and TPACK-EFL questionnaires were distributed to the participants. The quantitative data from all sampling groups were collected over a week-long period. Each sampling group was also informed about the semi-structured interviews right after collecting the questionnaires and five pre-service EFL teachers from each grade (excluding the freshman-year students) volunteered to participate in the interviews as well.

The interviews with each volunteer were conducted in the week following the quantitative data collection phase. At the beginning of the interviews, the

participants were asked for their consent since their answers were to be recorded and transcribed later. The teacher educators in the department were also asked to participate in the qualitative data collection phase through semi-structured interviews as well. The data collection phase ended after the teacher educators in the department were interviewed in the following two weeks after pre-service EFL teachers' interviews. The overall data collection procedure is displayed in Figure 3.2. in a chronological manner.

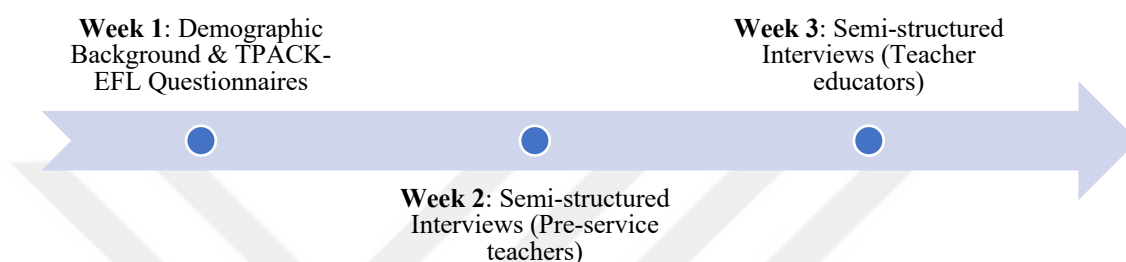


**Figure 3.2.** Data collection procedure

### 3.9. Data Analysis Procedure

The current study was conducted through an explanatory sequential mixed-methods design (see Figure 3.3.), in which the statistical results found through quantitative data analysis are further explained through qualitative results (Creswell, 2014). The quantitative data were collected through demographic background and TPACK-EFL questionnaires first. Then, qualitative data were collected through semi-structured interview questions and both data were analyzed separately. For the final remarks, statistical findings drawn from quantitative data analysis were explained with the help of more in-depth findings drawn from qualitative data analysis.

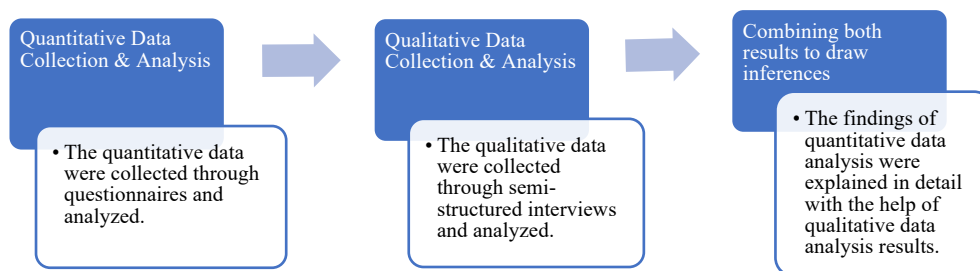


**Figure 3.3.** Explanatory sequential design as applied in the current study

As for the data analysis, the quantitative data were analyzed through descriptive statistics to answer the first research question in which the pre-service EFL teachers' TPACK levels are questioned. The descriptive statistics included minimum, maximum, mean, and standard deviation values for each TPACK component. In addition, the distribution of the participants based on their gender, age, computer experience, and year of education was also analyzed through descriptive statistics. Afterwards, the distribution of the quantitative data was examined by running the Shapiro-Wilk test to determine if the data were distributed normally. As a result, each TPACK component revealed that the data were not distributed normally ( $p < 0.05$ ). Hence, the data were analyzed through nonparametric tests, namely Mann-Whitney U for the gender variable and Kruskal-Wallis for the rest of the variables to answer the remaining research questions, which are to determine whether demographic variables influence pre-service EFL teachers' TPACK levels. All the quantitative data were analyzed via IBM SPSS Statistics 29.0.

As for the qualitative data analysis, the recordings of semi-structured interviews were transcribed, then analyzed by utilizing content analysis (Stemler, 2000). The excerpts from the interviews which are related to the dimensions of the TPACK-EFL questionnaire (Başer et al., 2016) were used to explain the statistical results obtained through quantitative data with more in-depth comments. Figure 3.4. illustrates the overall data analysis procedure:

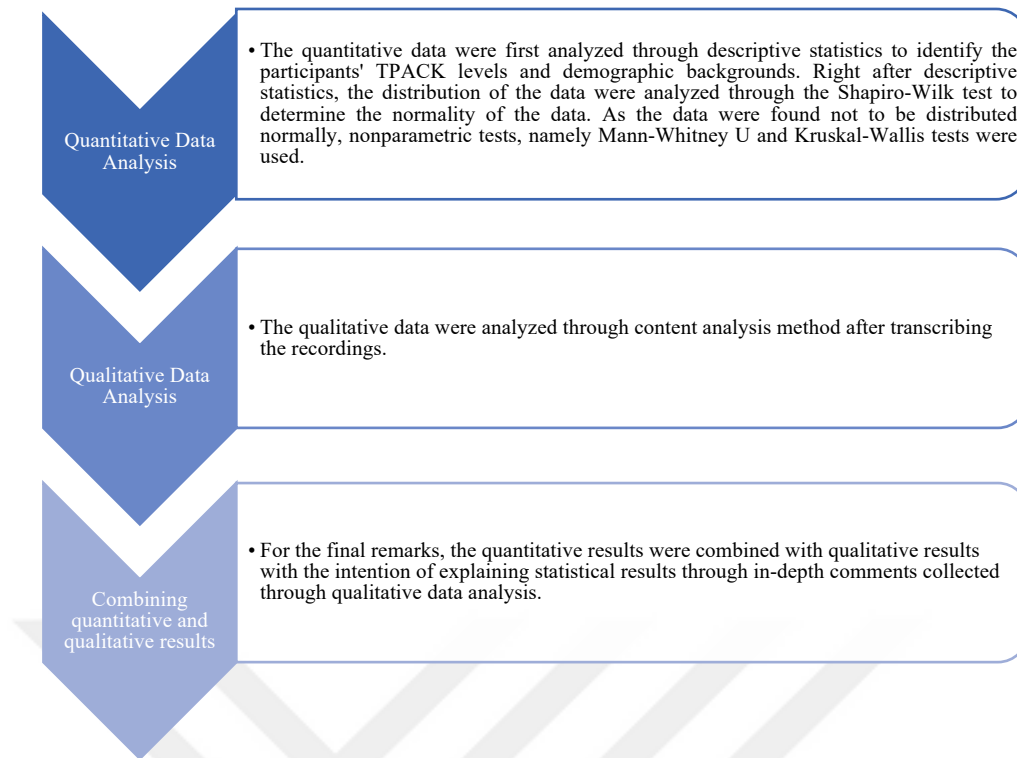


**Figure 3.4.** The overall data analysis procedure

## 4. RESULTS

This chapter is aimed at presenting the findings of the current study in line with the research questions. First, the quantitative data collected through the TPACK-EFL scale (Başer et al., 2016) were analyzed through descriptive statistics and examined in detail. Afterwards, the relationship between pre-service EFL teachers' TPACK levels and demographic variables, namely gender, age, computer experience, and year of education was questioned through the Mann-Whitney U test for the gender variable and the Kruskal-Wallis test for the remaining variables. The quantitative data were analyzed through IBM SPSS Statistics 29.0 and the results were supported with excerpts from the interviews.

### 4.1. Pre-service EFL Teachers' Perceived TPACK Competency Levels

The first and second research questions were to identify pre-service EFL teachers' perceived TPACK competency levels. In this sense, the TPACK-EFL scale was administered to a total of 215 pre-service EFL teachers, and the data were analyzed through descriptive statistics. Table 4.1. illustrates the minimum, maximum, mean, and standard deviation values of each TPACK component. Along with the sub-components, the statistical results for all 39 items in the scale are given under the label TPACK-EFL.

**Table 4.1.** Descriptive analysis results of the TPACK-EFL components

| TPACK Component | n   | Minimum | Maximum | Mean | SD   |
|-----------------|-----|---------|---------|------|------|
| TK              | 215 | 2.33    | 9.00    | 6.80 | 1.40 |
| CK              | 215 | 3.80    | 9.00    | 8.14 | 0.93 |
| PK              | 215 | 2.33    | 9.00    | 7.43 | 1.16 |
| PCK             | 215 | 1.80    | 9.00    | 7.57 | 1.24 |
| TCK             | 215 | 1.67    | 9.00    | 7.23 | 1.41 |
| TPK             | 215 | 2.86    | 9.00    | 7.42 | 1.16 |
| TPACK           | 215 | 2.25    | 9.00    | 7.42 | 1.29 |
| TPACK-EFL       | 215 | 3.77    | 9.00    | 7.38 | 0.92 |

As shown in Table 4.1., the participants' scores ranged from 1.67 to 9.00. In addition, the participants' mean scores ranged from 6.80 to 8.14 with the CK

component having the highest mean score ( $M=8.14$ ) and the TK component having the lowest ( $M=6.80$ ). The descriptive results for each TPACK component are examined in detail under the following sub-headings.

#### 4.1.1. Pre-service EFL Teachers' Technology Knowledge (TK)

The descriptive analysis results reveal that the TK component has the lowest overall mean score ( $M=6.80$ ) among all TPACK components (see Table 4.1). In addition, the scale item with the lowest mean score ( $M=6.00$ ) is also under the TK component (TK1). The descriptive analysis findings for the TK component are shown item by item in Table 4.2.

**Table 4.2.** Descriptive analysis results for the TK items

| Item                                                                                                                                | Minimum | Maximum | Mean | SD   |
|-------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|------|
| <b>TK1:</b> I can use basic technological terms (e.g., operating system, wireless connection, virtual memory, etc.) appropriately.  | 1       | 9       | 6.00 | 2.26 |
| <b>TK2:</b> I can adjust computer settings such as installing software and establishing an Internet connection.                     | 1       | 9       | 6.50 | 2.29 |
| <b>TK3:</b> I can use computer peripherals such as a printer, a headphone, and a scanner.                                           | 1       | 9       | 7.00 | 1.75 |
| <b>TK4:</b> I can troubleshoot common computer problems (e.g., printer problems, Internet connection problems, etc.) independently. | 2       | 9       | 6.49 | 2.07 |
| <b>TK5:</b> I can use digital classroom equipment such as projectors and smart boards.                                              | 1       | 9       | 6.60 | 1.99 |
| <b>TK6:</b> I can use Office programs (i.e., Word, PowerPoint, etc.) with a high level of proficiency.                              | 1       | 9       | 7.00 | 1.60 |
| <b>TK7:</b> I can create multimedia (e.g., video, web pages, etc.) using text, pictures, sound, video, and animation.               | 1       | 9       | 6.67 | 1.90 |
| <b>TK8:</b> I can use collaboration tools (wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives.           | 1       | 9       | 7.20 | 1.76 |
| <b>TK9:</b> I can learn software that helps me complete a variety of tasks more efficiently.                                        | 1       | 9       | 7.80 | 1.46 |

As the mean scores of the items ranged from 6.00 (TK1) to 7.80 (TK9), pre-service EFL teachers' technology knowledge (TK) can be rated as satisfactory. In addition to the statistical results, semi-structured interviews were also administered and analyzed for each TPACK component with the aim of explaining the statistical findings in detail. The majority of the interviewees claimed that their level of technological knowledge (TK) was high or at least satisfactory. Regarding the reasons, the participants frequently referred to the role of being born in the digital era, having an interest in technology, and having access to technology. For example, Student 10 pointed out the role of living in the digital age while mentioning how immensely we are involved in computers, especially in education:

**Student 10:** *"In general, I think I am good with technology. Since we are in the age of technology, we are very involved with computers, and we try to handle most things from the computer. We do most of the things related to education using technological devices, such as our homework."*

In addition, Student 4 mentioned that she was able to learn how to use a printer even though she had never used one prior to her teaching practicum. She also pointed out the advantage of being in the digital age as she can always check a user's manual if she encounters any troubles:

**Student 4:** *"I can say it's not so bad, it's... good actually. I never used a printer before my practicum for example, but I learned it. I think I can deal with internet connection problems, etc. I did not have a lot of experience with projectors, but I think I can use one. I mean, we're in a digital age. Even if I cannot, I can check a user's manual."*

From another perspective, Student 8 mentioned that the Information Technologies course in her first year in the undergraduate program was useful and assisted her in learning what she needed to know:

**Student 8:** *"I think my technological knowledge is good. I did not take a technology-related course in high school before. However, the Information Technologies course we took in our first year at the university was very effective, and I think I learned the subjects I needed to learn."*

Student 6 also mentioned the influence of being born in a generation where technology and the internet are prevalent. In addition, she stated the influence of online education as she improved her technological knowledge during the COVID-19 pandemic:

**Student 6:** *“It's not too bad, not too good, but of course, I'm not bad at simple things. Especially in the generation in which I was born, everything is online, and since I am a person who was educated during the pandemic, I learned some things that I did not know from there. We are constantly using technology, be it phones, tablets, or computers. Both the generation I was born in and my education were very influential on my technology knowledge.”*

On the other hand, Student 14 stated that she is capable of using technology at an advanced level and has a solid comprehension of it. She attributes her proficiency in technology to the generation she was born into. In addition, she mentioned how influential technology-related courses in the university were, especially the Instructional Technologies course:

**Student 14:** *“I think that I have mastered enough in terms of technological knowledge. I can use it at an advanced level. Since we are Generation Z, we were born into technology and grew up with technology. In addition, we have been taking technology-related courses since primary school. We took three technology-related courses at the university. The Instructional Technologies course was quite effective...”*

Even though the majority of the interviewees claimed to have higher levels of technological knowledge, some of them reported only limited proficiency in using technology and stated several reasons. For instance, Student 2 mentioned her limited experience with technology as a kid for several reasons:

**Student 2:** *“I was not very involved with technology as a kid. We had a computer, but my parents would hardly allow it. I started using a smartphone just before I went to high school. However, I cannot say I have good technological knowledge. So, I think I'm open to learning, but I do not have the interest to do so. Unfortunately, I spent my university years without a computer. If I had one, I think I would be much better...”*

Similarly, Student 1 rated her technological knowledge as inadequate and mentioned that it would be better if there was a course including the basics of using technology. She also pointed out that her inadequacy may be related to her lack of interest:

**Student 1:** *“I find myself very inadequate in this regard. I wish we could get more information about using technology, about performing simple*

*things during our education. There was a course about using computers, but the content was a little different. I mean, I would like it to be focused on the basics because I see myself as inadequate. It may also be due to my lack of interest. Technology continues to enter our lives more and more in every field, but I guess I can be considered a bit outdated in this regard.”*

Apart from pre-service EFL teachers, the teacher educators in the department were also asked about their students’ TK levels and to what extent they can display their knowledge in their lessons, presentations, micro-teaching sessions, and teaching practices. After a thorough discussion with Instructor 5 regarding pre-service EFL teachers’ TK and the extent to which pre-service EFL teachers can integrate it into their teaching practice, several noteworthy insights were unveiled such as how using technology is a part of our daily lives rather than an extra skill and how the pre-service EFL teachers are able to use them.

**Instructor 5:** *“I cannot say that all students are very good or very bad. In general, they are good because, after the normalization of the internet and technology, taking a photo with a mobile phone, transferring the photo somewhere, or making a presentation using PowerPoint is a very ordinary skill for them and they no longer see it as an extra skill. It’s like “can you use a pen?” I mean, I use it, but I never thought about if I can use it or not. It also has to do with how much they’ve been exposed to technology. I can say that they are generally interested, and their technological knowledge has increased a lot, especially during distance education. Sometimes even when I ask “how can I do this”, they can come up with very different solutions. However, just because they were born in this era, we cannot say that they use it very comfortably. But as I said, they are good overall. They can use computers very comfortably in daily life. For example, when I want them to share a Google Drive link, none of them say “how do I do it, I’ve never heard of it”. Technology is now a part of their daily lives, not a new thing...”*

From another perspective, Instructor 3 also shared valuable insights regarding her students’ TK levels highlighting pre-service teachers' adaptability and ease in handling technology as they were able to share their screens and present their materials quickly. She also drew attention to the generational differences,

specifically mentioning that the students have a better grasp of technology than the previous generations as they were born into the internet age:

**Instructor 3:** *“I do not know if I have a course to measure this, but at least I can talk through my online courses. For example, our students were able to share the screen quickly in the online lessons, they were able to share the presentations and materials they prepared on PowerPoint or other platforms... So, I can say that they are very good. They were born in the internet age anyway, so they're actually better than all of us. They did not learn later like most of us. For example, I did not have a computer in high school, or until my last year at university, but they were born in the age of technology. Of course, generation is really important in this regard.”*

Providing a rather balanced outlook, Instructor 1 reflected on both the strengths and areas that require development regarding pre-service EFL teachers' TK competence. She also mentioned pre-service teachers' adaptability as they were able to use copiers in schools despite not owning personal printers. In addition, she also emphasized the importance of the generation the students were born into, echoing the comments of Instructor 3:

**Instructor 1:** *“I think they are generally good. They are good at using the smartboard and using peripherals. I think that their problem-solving skills generally improved, but sometimes they cannot find a solution when they face problems... However, I think they are good in general. For example, most of them do not have printers, but I know that they use copiers in schools. They are generally good, but sometimes they need some direction and help during lessons. I think the generation they were born is important...”*

This chapter, in which pre-service EFL teachers' TK levels were evaluated through quantitative and qualitative methods, brings to light the varying degrees of technological proficiency among pre-service EFL teachers. The average TK score, as measured through the study's scale, stood at 6.80 out of 9, which points towards a generally satisfactory TK competency level among the pre-service EFL teachers.

The item-by-item analysis provides a more detailed understanding of the participants' technological capabilities. For instance, while pre-service teachers exhibited the ability to use computer peripherals and demonstrated proficiency with Office programs, a score of only 6.00 out of 9 in using basic technological terms

indicated room for growth in this regard. A similar trend was identified in the capacity to troubleshoot common computer problems and adjust computer settings, where the scores were slightly higher but still left scope for improvement.

The qualitative results, derived from the interviews with instructors, reinforced these findings while adding more-detailed insights. A majority of instructors indicated higher TK scores among their students, attributing it to their inherent comfort with technology due to their generational positioning. However, it was also revealed that access to technology and individual interest level played a crucial role in these scores, resulting in some teachers reporting lower TK scores.

The disparity underscored by both the quantitative and qualitative findings points out that there is a need for more personalized training and resources, focusing on teachers with less access to technology or lower levels of interest. It was also found that TK forms a significant part of the TPACK framework and impacts the effectiveness of English language teaching considering the role of technology in the language teaching field.

In conclusion, the overall moderately satisfactory TK levels among pre-service EFL teachers provide a promising base for further developing their technological skills. It also underscores the need for tailored approaches in enhancing these skills, considering the various factors influencing the TK competencies of pre-service EFL teachers.

#### **4.1.2. Pre-service EFL Teachers' Content Knowledge (CK)**

Moving forward to the next pillar of the TPACK framework, the focus of the current study shifts to Content Knowledge. The descriptive analysis results show that the CK component has the highest overall mean score ( $M=8.14$ ) among all TPACK components (see Table 4.1), suggesting that pre-service EFL teachers feel quite confident in their command of English. The scale item with the highest mean score ( $M=8.47$ ) in this component is CK4, "I can understand texts written in English." The descriptive analysis findings for the CK component are displayed item by item in Table 4.3:

**Table 4.3.** Descriptive analysis results for the CK items

| Item                                                                            | Minimum | Maximum | Mean | SD   |
|---------------------------------------------------------------------------------|---------|---------|------|------|
| <b>CK1:</b> I can express my ideas and feelings by speaking in English.         | 3       | 9       | 7.92 | 1.31 |
| <b>CK2:</b> I can express my ideas and feelings by writing in English.          | 2       | 9       | 8.33 | 1.14 |
| <b>CK3:</b> I can read texts written in English with the correct pronunciation. | 3       | 9       | 7.98 | 1.14 |
| <b>CK4:</b> I can understand texts written in English.                          | 4       | 9       | 8.47 | 0.84 |
| <b>CK5:</b> I can understand the speech of a native English speaker easily.     | 2       | 9       | 8.02 | 1.13 |

The mean scores of the items, ranging from 7.92 to 8.47, show that pre-service EFL teachers' content knowledge (CK) can be rated as considerably satisfactory. In the current study, the pre-service EFL teachers' command of the English language appears to be strong, which is an essential foundation for any in- or pre-service EFL teacher.

In accordance with the descriptive statistics, semi-structured interviews were conducted and analyzed with the aim of providing a more qualitative understanding of the statistical results. A detailed analysis of the interviews related to the CK component helped to shed more light on the reasons behind these satisfactory scores, such as the effectiveness of English language training in the participants' educational journey, their individual interest in the language, or extensive exposure to English through various mediums. The majority of the interviewees reported satisfactory CK levels, in line with the statistical results.

For instance, Student 5 pointed out that she improved her English throughout her university education through active participation in lessons, and even by joining speaking clubs. However, she also mentioned how she was struggling initially due to the English education before university, and the fact that high school English education is focused only on reading and writing without paying attention to listening and speaking skills:

**Student 5:** *“In Turkey, we generally focus only on reading and writing out of the four skills, and we do not focus much on listening and speaking. I did not have any speaking skills at all until I came to university. I’ve always been hesitant to express myself. I had some English knowledge, but I could show it only on paper, not by speaking. Later, when I started my practice teaching this year and participated actively in my lessons as well as speaking clubs, I improved myself. I think I’m better this year since I already finished my courses successfully and I’m graduating this year. At the beginning of the practice teaching, I was struggling, and I found myself switching to Turkish constantly. But now, I’m much more comfortable and I can easily express myself.”*

Moving forward, another perspective is offered by Student 4, who expressed that her high school English education primarily emphasized grammar, which left her underprepared for the remaining language skills. She also pointed out how effective the courses in the program were in developing her English proficiency. Moreover, she critiqued the grammar-translation method prevalent in her high school, which failed to promote practical communication skills:

**Student 4:** *“We only focused on grammar in high school, and I felt like a fish out of water when I got into university because people around me were well-equipped. How did I improve my English?... Through our courses. For example, in literature classes, we read poems, and our speaking skills improved in speaking classes. The courses at the university have definitely contributed a lot to me. In high school, they were using only the grammar-translation method. Only grammar, and translation. There was no speaking, and we could not use English for communication. Only for tests. That’s why I was definitely inadequate in high school, but I believe I’ve improved in university.”*

Adding a different dimension to the discussion, Student 2 shared that she perceives her content knowledge to be quite strong. Similar to Student 4, she pointed out the grammar and exam-oriented nature of high school English education and how worried she was to speak in English. She also noted considerable progress, particularly in her final year at the university, in terms of speaking and using English in general:

**Student 2:** *“I definitely think my content knowledge is good. I think expressing my feelings and thoughts through speech was a skill I developed during university, because we focused more on grammar in high school and because we were exam-oriented. I had a lot of worries about speaking. But since I’ve been in university, especially in this last year, I believe I’ve made a lot of progress in terms of speaking. I think I’m quite good at understanding what is expressed too. So overall, I can say that my knowledge of English is sufficient, maybe even a bit advanced.”*

Building on the previous insights, Student 10 similarly commented on the effectiveness of her university courses in terms of developing her English skills. Similar to Student 2, she emphasized the shift in pedagogy from high school to university, with a heightened emphasis on speaking English. However, Student 10 pointed out occasional difficulties due to living in a non-English speaking environment. Despite this challenge, she found such instances to be rare and believes that her overall English proficiency has been significantly enhanced during her university education:

**Student 10:** *“I can express my emotions and thoughts using English, but I honestly have a hard time sometimes because I live in a country where English is not the first language. For example, sometimes I cannot find the word I want to say, and I get stuck in such situations, but generally, I do not struggle too much. The courses I took at university had a big impact. Unlike high school, our teachers at university focus more on speaking English. They speak English themselves all the time and we understand while listening.”*

From a different viewpoint on CK, Student 9 adopted a fairly confident perspective on her level of English proficiency. In contrast to Student 10, this viewpoint exhibits the ability not only to understand and communicate in English but also to express emotions and thoughts more effectively in her native language. In addition, she pointed out how effective her high school English education was, unlike the other interviewees:

**Student 9:** *“I think my proficiency in the English language is at a good level. I can understand the person in front of me and express myself. Sometimes I think I can express my feelings and thoughts better than in my native language and I feel more comfortable using English. Besides, I was*

*in the foreign language department in high school, and we were taking very intensive English classes. So, I think I'm good."*

Echoing similar sentiments, Student 14 also expressed confidence in her English proficiency. A point of divergence from previous interviewees is her validation to confirm her English level as C1 through proficiency tests that she took for the Erasmus program. She also mentioned that her grounding in English started early, with a completely English-oriented education for approximately 5-6 years, a point which underscores the value of early and extended exposure to language learning:

**Student 14:** *"I consider my level sufficient. I will be going abroad on Erasmus next year, so we have taken proficiency tests and got my English level confirmed as C1. I have been studying in the foreign language department since high school. I have been receiving a completely English-oriented education for about 5-6 years. That's why I find my English level sufficient."*

Transitioning to another perspective on pre-service EFL teachers' CK, Student 13 considered his English proficiency as equal or even somewhat a bit superior to that of his peers. He also pointed out how effective the courses in the program, especially in the first year, in terms of improving his English language proficiency:

**Student 13:** *"I believe my English level is on par or a bit higher than my peers. I think I can express myself well and understand what I read in English. I also think our classes at the university, especially the ones in the first year such as pronunciation or speaking classes, have contributed a lot."*

On a slightly different note, Student 12 also rated her English competency as adequate. She outlined her ability to express thoughts and feelings in English through both spoken and written means with self-assuredness. In addition, she attributed her strong command of English to having a positive attitude toward language learning and early exposure:

**Student 12:** *"I think I'm at a sufficient level. I can express my feelings and thoughts in English, either by speaking or writing. I can understand and translate an article. Sometimes I struggle to understand, but I usually get it. I am enthusiastic about learning a language, especially English, and I've*

*been exposed to the English language since my childhood. That's why I think I'm good at it."*

Building on previous perspectives, Instructor 5 addressed administrative and instructional challenges that influence students' overall English proficiency. He pointed out that the absence of a preparatory class in the program before 2016 led to various deficiencies in students' productive language skills. Delving deeper into the issues in the program, he mentioned how the large size of classes impedes practicing productive language skills, especially writing. Nonetheless, Instructor 5 observed an improvement in students' English levels including all four skills over time, motivated by the students' own necessity to improve year by year. Moreover, he pointed out large-scale issues like the number of instructors in the program and the program's quota:

**Instructor 5:** *"Let's put it this way. Since we are in the English Language Teaching department, we assume that students come here with sufficient knowledge of English. However, we did not have a preparatory class before 2016, so the new students were only taking the university exam before coming here and knew very little about the language. I mean, their daily conversation and writing skills were very low, but since the preparatory class started, the students' English levels are good in general. However, there is a problem with the students' writing and since they are very crowded, it is hard to practice writing. For example, there are 123 students in the first grade. If you were to make each student write a paragraph, how long would it take? Also, teachers tend to switch to fill-in-the-blanks or multiple-choice questions instead of writing long essays and commenting on each one of them because they have hundreds of students in total. As for English proficiency in general, they have no problems. They are comfortable in speaking; they do not have big problems in listening and I did not encounter too many problems in reading, either. They only have some deficiencies in writing because they do not write much. Things got better after 2016 when the preparatory class started. Now, they can practice all four skills without worrying about multiple-choice exams, so they can improve there. Also, our program does not have a specific objective to improve the students' English levels since the primary goal is to train teachers. They improve year-by-year but not because the program has an*

*objective specifically to improve the students' English. They improve their English level because they need to... Also, the classes normally need to be divided into maybe 30 people each but there are not enough faculty members. That's why additional faculty members need to be hired. In addition, the program's quota needs to be considered since we are starting with 100 students each year."*

Instructor 2 echoed many crucial points raised by Instructor 5 but put more emphasis on the significant insufficiencies in new students' English skills. He highlighted the issues in grammar, vocabulary, and all four main language skills and how these issues require remedial efforts from the teaching staff, and how this situation becomes an obstacle to delivering vital professional and theoretical education. He concluded his comments by reiterating the necessity for larger teaching staff and/or smaller class sizes to ensure quality education:

**Instructor 2:** *"Well, especially in the early years, it is not enough. The exams the students take for the university do not assess their English levels properly. That's why, they lack a lot in terms of basic language skills, and we try hard to cover these deficiencies in the early years. This process actually continues throughout their entire education. While they are learning about teaching in general, we also need to reinforce their English skills constantly. There are serious deficiencies in grammar, vocabulary, reading comprehension, writing, listening, and speaking skills; and this actually takes up a lot of our time as teachers to solve these problems. We need to solve these basic problems so that we can teach them the vocational and theoretical knowledge they need. We have a lot of work to do at this point. Of course, we can see serious improvements in the following years since we have courses with the aim of improving their English skills but how sufficient are these courses? It's hard to develop a language skill with only two hours a week, and the classes are too crowded. There are 120 students in a class divided into two groups. If we could divide them into three, or ideally four groups, it would be better and they could improve their English skills, especially speaking. The number of teaching staff is low. We still can graduate 100-120 students every year, but the quality of their education would definitely increase with more instructors."*

Shifting the focus slightly, Instructor 1 offered a distinct perspective, focusing primarily on students' comprehension as well as expressive capabilities. She mentioned that the students exhibit strong understanding but have difficulties expressing themselves in English. The instructor perceived this as stemming from a grammar- and translation-oriented mentality, where students prefer translating instead of thinking in English. Moreover, the instructor underscored the value of preparatory classes for enhancing students' English levels, especially in production skills:

**Instructor 1:** *"I think they have no problems in terms of understanding. They understand, but they have trouble expressing themselves. I believe they approach the situation from a test-oriented perspective. Instead of thinking in English, I honestly think they tend to translate. When we explain how important communication is in language teaching, they still insist on the grammar issue... They lack production skills; therefore, I think it is necessary for them to take preparatory classes..."*

The discussion on participants' English language proficiency levels concludes the CK section with a generally good picture. The majority of participants, according to both the quantitative and qualitative data, are able to express their emotions and thoughts effectively in English through both speaking and writing, as supported by the relatively high mean scores for CK1 (M=7.92) and CK2 (M=8.33). Furthermore, the participants exhibit a strong ability to read and understand English texts, as indicated by the respective mean scores for CK3 (M=7.98) and CK4 (M=8.47).

However, it is important to note the qualitative observations raised by the teacher educators in the department. They highlight some major challenges such as an overly exam-focused mentality among students due to the nature of high school English language education, a tendency to translate instead of thinking directly in English, and an overall deficiency in production skills. They also emphasized the value of taking preparatory classes, smaller class sizes, and more instructors for optimal learning outcomes.

In summary, the analyses reveal a generally satisfactory level of CK among the participants, notwithstanding some areas that might need further improvement. The balance of CK appears to be biased more toward comprehension rather than

production, suggesting a need for curricular adjustments that promote holistic language development.

#### 4.1.3. Pre-service EFL Teachers' Pedagogical Knowledge (PK)

In terms of Pedagogical Knowledge (PK), a reasonable degree of PK within our cohort of pre-service EFL teachers is found as the analysis of descriptive statistics yields an overall mean score of 7.43 (see Table 4.1). Within the PK items, the one that achieved the highest mean score ( $M=7.71$ ) is PK5, "I can reflect the experiences that I gain from professional development programs to my teaching process" (see Table 4.4).

**Table 4.4.** Descriptive analysis results for the PK items

| Item                                                                                                                                 | Minimum | Maximum | Mean | SD   |
|--------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|------|
| <b>PK1:</b> I can use teaching methods and techniques that are appropriate for a learning environment.                               | 4       | 9       | 7.28 | 1.25 |
| <b>PK2:</b> I can design a learning experience that is appropriate for the level of students.                                        | 2       | 9       | 7.20 | 1.51 |
| <b>PK3:</b> I can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences. | 1       | 9       | 7.38 | 1.56 |
| <b>PK4:</b> I can collaborate with school stakeholders (students, parents, teachers, etc.) to support students' learning.            | 2       | 9       | 7.48 | 1.59 |
| <b>PK5:</b> I can reflect the experiences that I gain from professional development programs to my teaching process.                 | 2       | 9       | 7.71 | 1.36 |
| <b>PK6:</b> I can support students' out-of-class work to facilitate their self-regulated learning.                                   | 1       | 9       | 7.57 | 1.45 |

The range of mean scores for the items, from 7.20 to 7.71, indicates a relatively consistent, satisfactory rating of PK among these pre-service EFL teachers. Their ability to use teaching methods and techniques effectively, design appropriate learning experiences, consider students' diverse needs, and collaborate with school stakeholders reflects a strong foundation in pedagogical understanding.

To supplement these statistical results, semi-structured interviews were conducted, allowing a deeper, more qualitative understanding of the quantitative results. These interview excerpts, analyzed in the following sections, offer valuable insights into how these pre-service EFL teachers perceive their pedagogical knowledge and provide a more comprehensive narrative behind the scores seen in the table. For instance, Student 5 reflected on the evolution of her understanding of students' pedagogical needs and mentions how the theoretical aspects of PK were taught during her first years in the department and how the real-world application was not fully grasped until she started her teaching practicum in her senior year. She also mentioned how the experience she gained during her teaching practicum allowed her to adapt her teaching approaches and materials to different age groups. In addition, she suggested that earlier opportunities to practice teaching would have enriched her teaching skills:

**Student 5:** *“As for the pedagogical knowledge, I learned the appropriate implications for the students’ ages as I got to the senior year. We actually started learning about the students’ pedagogical needs in our first years, but we were not putting the theory into practice until the fourth year. But this year, we could put it into practice with the practicum. I started my practicum in a middle school in our first term with a very different age group, and I’m in high school this term with another very different age group. I brought more concrete materials to the students in middle school that are suitable for their ages. However, things became a bit more abstract considering their ages. Using my pedagogical knowledge, I was able to bring materials that were suitable to their ages... I was already prepared in theory in the early years, but I tried to remember that theoretical knowledge constantly during my practice teaching. If we had a chance to put the theory into practice back then, it could add more to my teaching, I think.”*

From another perspective, Student 4 shared a candid reflection on her lack of knowledge about teaching and education before starting her university education.

She also pointed out how she was able to improve her pedagogical knowledge thanks to education-oriented courses such as Introduction to Educational Sciences:

**Student 4:** *“Before coming to this department and taking courses related to teaching, I really had no knowledge about education or pedagogy. I did not actually come here knowing what teaching means and why I’m here. But as I mentioned, I think I really stepped into the field of education thanks to the pedagogical courses such as Introduction to Educational Sciences. I learned how to develop a lesson plan and how to be prepared before going to class thanks to these lessons.”*

Adding another dimension to the analysis, Student 3 presented her experiences with classroom management and student observations, areas that were not mentioned by the previous interviewees. While admitting that she did not face challenging situations regarding classroom management, she pointed out that she would notice the individual differences between her students and highlighted her competency in communication with her students. Similar to the previous interviewees, she also mentioned the effectiveness of teaching-oriented courses in the undergraduate program:

**Student 3:** *“During my practicum, I did not face any difficult situations in terms of classroom management, so I did not have much experience. I do not know how I would deal if a problem arose in the class. However, I think I can notice the individual differences between the students and observe them to see who participated more in the class and who was a little behind or not interested in the lesson. I think I’m good at this. I also think that I’m good at communicating with the students. The teaching-oriented courses in our undergraduate program were adequate in this regard.”*

Moving forward, Student 2 acknowledged some shortcomings in her pedagogical knowledge, especially regarding the practical application of her theoretical knowledge. She mentioned that while course content covered the essentials, opportunities for practice were scarce, so she expressed a desire for more practice-oriented learning:

**Student 2:** *“I have to admit that I fell a bit short here. We covered it in our classes, of course, but what happened was that we just briefly touched on the topic headings and moved on. We did not have much chance to practice or delve deeper. That’s why I find myself a bit lacking. I would suggest*

*putting a bit more emphasis on practice. If we had the chance to experience something like developing a lesson plan or classroom management in a simulation, it would be better. We have this chance in practice teaching but there could be more focus on this beforehand.”*

Delving deeper into the analysis of pre-service EFL teachers' PK, Student 8 took a more confident stance and perceived herself as quite proficient in PK. She pointed out that she was able to adapt and further enhance her knowledge base upon returning to face-to-face education despite the challenges posed by online education during the pandemic. Similar to the previous interviewees, she also found the courses up until her third year adequate in terms of providing her with the necessary insights on proper classroom management:

**Student 8:** *“I believe I’m quite proficient. Even though I could not improve myself significantly during online education, I managed to adapt again when we switched back to face-to-face education, and I believe I have significantly improved my pedagogical knowledge. The courses up to the third year were sufficient to improve my pedagogical knowledge. In the classroom management course, for example, we learned a lot from our teacher about how we should behave in class and how to maintain order in class.”*

Extending on Student 8's viewpoint, Student 7 also rated her PK as strong. She attributed her proficiency to both the quality of education she received and her personal desire to excel as a well-equipped teacher. She considered the courses in the program sufficient even though she had to face a few challenging situations:

**Student 7:** *“I believe I’m good in this regard. I mean, our education was quite good overall even though we had a few troublesome lessons. I also have the curiosity and desire to be good in the field of teaching. Our courses were sufficient.”*

Adding a different dimension to the discussion, Student 6 feels confident in her PK, largely due to the practical experience she gained through tutoring. In addition, she indicates a level of perceptiveness in identifying individual differences and various needs of the students in a diverse classroom. However, she also echoes the sentiments of other interviewees regarding certain shortcomings in the undergraduate program such as insufficient practice opportunities. She also

reflects on how the online learning environment may have hindered her learning experience in significant courses such as Educational Psychology:

**Student 6:** *“I can rate myself as good because I’ve been tutoring for some time. I can say this experience has been very effective in my field. I believe I can notice when there is a different student in the class and implement the necessary processes in a mixed-class environment to address these differences. However, I think our undergraduate education did not prepare us enough. Maybe the pandemic had an impact as well because we took important courses such as Educational Psychology during the pandemic and we could not be productive in the online environment. Maybe there were some problems caused by this. We could not put our knowledge into practice in a school environment yet, and we were only able to do micro-teachings. They were influential because I was able to see the parts where I acted wrongly, or how I should act toward a fourth grader, etc. I also learned what to do in some emergency situations in the classroom...”*

Moving forward, Student 14 presented a slightly different viewpoint as a second-year student and expressed that she perceived her pedagogical knowledge as being at an intermediate level, and she anticipated further development in the following years. Similar to some of the previous interviewees, she also critiqued the structure of the undergraduate program, noting a lack of pedagogical courses in the first year. She also pointed out the need for earlier exposure to pedagogical courses:

**Student 14:** *“Since I am currently in my second year, I believe I am at an intermediate level, not an advanced one. I think it will fully develop in the following years. For now, I think it’s at an intermediate level. The courses we took in the first year were inadequate in my opinion. I started taking teaching courses in the second year. Maybe these courses could be moved to the first year, or the number of pedagogical courses in the first year could be increased.”*

Building on Student 14’s insights, Student 12 added that her understanding of teaching approaches, methods, and techniques has started to build up in the second year as well as pointing out how superficial the first year in the program is:

**Student 12:** *“We just started learning about teaching approaches, methods, and techniques this year. The first year was more superficial. But the second*

*grade is more related to the techniques and methods, so I believe I have a good grasp of the methods and techniques right now...*”

On the other hand, Instructor 5 pointed out that it is unrealistic to expect the students to have solid pedagogical knowledge in the early years as the bulk of pedagogical training begins in the third year with courses such as Teaching English to Young Learners and Teaching Language Skills, supported by micro-teaching sessions that are essential to putting theoretical knowledge into practice before teaching practicum in the fourth year. He noted that students generally demonstrate significant proficiency in PK by the end of the third year. As to comment on pre-service EFL teachers’ request for an earlier chance to practice, Instructor 5 shared some logistical challenges such as budgetary constraints and managing large numbers of students. The instructor concluded by mentioning how sufficient micro-teachings are:

**Instructor 5:** *“So, we cannot expect first-year students to have pedagogical knowledge. They only learn about the theory of it such as linguistics, approaches, and teaching principles and method in the second grade. Everything starts in the third grade. The student who completes the third year becomes really proficient in terms of pedagogy because they take courses such as Teaching English to Young Learners and Teaching Language Skills. In addition, we also have micro-teachings in which the students constantly teach in front of their classmates and when they get to the fourth grade, they can easily carry out the course with a good lesson plan. However, the students who were in the third or fourth grade during the pandemic had a lot of difficulties in this regard because they did not get a chance to teach in front of a class. They even did their practicum online. We could put practice teaching in the third grade too but there are some formal and logistical issues to consider such as budget and the fact that we would have to send over 200 students to the schools. We had practice teaching in the first grade before so that the students could decide if they want to become teachers. It would be better for students to practice before the fourth grade, but we need to consider these issues too. I can say that micro-teachings are sufficient in this regard.”*

Moving forward, Instructor 4 mentioned that fourth-year students are generally capable of designing diverse and detailed lesson plans but often struggle

with age-appropriate content and creating engaging classroom interactions. The instructor observed a tendency to ask yes-no questions, which can limit student participation and engagement. Moreover, she pointed out a gap between the pre-service EFL teachers' ability to prepare robust lesson plans and to the extent which they can actually implement them. The instructor also suggested that earlier teaching practice opportunities could help to address these issues:

**Instructor 4:** *"Generally, in my classes, the students in the fourth grade sometimes struggle to prepare lessons suitable for their students' age even though they can diversify the content of their lessons. They also struggle in terms of interaction in class because their questions are mostly yes-no questions and they do not actively engage the students in the process. I believe they struggle in terms of preparing engaging activities but they are successful in terms of preparing lesson plans in general. The lesson plans are good and well-detailed, but they sometimes face problems when it comes to implementing them... I think it would be better if they could start practicing teaching in the second term of the third grade."*

Transitioning to another perspective on pre-service EFL teachers' PK, Instructor 3 provided insights from the perspective of someone who does not teach pedagogical courses but supervises the pre-service EFL teachers' practicum. The instructor identified a disparity between pre-service teachers' theoretical knowledge and their ability to put the theory into practice. She also added that this issue is not due to any lack on the pre-service teachers' part but rather is a structural issue related to the ratio of pre-service EFL teachers to faculty members and the lack of opportunity for practical application of the theories taught in the program. Regarding this, she suggested this gap could potentially be covered with an increase in micro-teaching sessions:

**Instructor 3:** *"I can comment on this in the context of the students I observed in the practicum course. Since I do not teach any pedagogical courses, I do not know the content of them. However, I've developed a certain understanding over time. I realized that whatever theoretical knowledge is given to our students here for four years, there is not much opportunity for them to put their theoretical knowledge into practice when they go to public schools for their teaching practicum. So, in a sense, I am the one giving feedback to the students, but I do so hesitantly. After all, there*

*is a conflict between theory and practice. However, practice teaching should not be done earlier. It is already too complicated as it is. Micro-teachings can be increased instead even though they do not offer a real experience. I think our students are sufficient in terms of theoretical knowledge, but they are not as good at putting their knowledge into practice but that's not their fault. There is a problem in terms of the number of students. The ratio of pre-service EFL teachers per faculty member is increasing constantly. I have twelve pre-service EFL teachers and I have to observe each..."*

In summarizing the PK section, it is noteworthy to consider both the qualitative insights gathered from the interviews and the quantitative data obtained from the statistical analysis.

On the one hand, the interviewees' narratives of the path to pedagogical knowledge proficiency highlight areas for improvement, particularly in the application of theory to practice, early exposure to teaching environments, and dealing with particular difficulties such as differentiation and lesson planning. These themes are particularly resonant in the context of the need for more practical experience and the existing gaps between theory and practice.

The statistical findings, on the other hand, reveal that students generally feel competent in their pedagogical knowledge, with all mean scores ranging between 7.20 and 7.71. The range of minimum and highest scores as well as the standard deviation scores, however, makes it clear that there is room for improvement.

All the findings put together suggest that while there is a good foundation of pedagogical knowledge among the students, certain areas, especially opportunities for practice need further enhancement. Moreover, the findings also underscore the importance of a more immersive and continuous hands-on learning experience to narrow the gap between theoretical knowledge and its practical application in real-world teaching settings.

#### 4.1.4. Pre-service EFL Teachers' Pedagogical Content Knowledge (PCK)

Examining the Pedagogical Content Knowledge (PCK) component, the quantitative data reveals a strong command of pedagogical content knowledge within the pre-service EFL teachers as the overall mean score for the PCK component is 7.57. Among the PCK items, the highest mean score ( $M=7.73$ ) is attributed to PCK5, "I can adapt a lesson plan in accordance with students' language skill levels" (see Table 4.5).

**Table 4.5.** Descriptive analysis results for the PCK items

| Item                                                                                                                        | Minimum | Maximum | Mean | SD   |
|-----------------------------------------------------------------------------------------------------------------------------|---------|---------|------|------|
| <b>PCK1:</b> I can manage a classroom learning environment.                                                                 | 1       | 9       | 7.35 | 1.60 |
| <b>PCK2:</b> I can evaluate students' learning processes.                                                                   | 2       | 9       | 7.65 | 1.40 |
| <b>PCK3:</b> I can use appropriate teaching methods and techniques to support students in developing their language skills. | 1       | 9       | 7.47 | 1.50 |
| <b>PCK4:</b> I can prepare curricular activities that develop students' language skills.                                    | 1       | 9       | 7.68 | 1.48 |
| <b>PCK5:</b> I can adapt a lesson plan in accordance with students' language skill levels.                                  | 2       | 9       | 7.73 | 1.34 |

With item mean scores ranging from 7.35 to 7.73, the assessment of pre-service EFL teachers' PCK could be interpreted as being generally satisfactory to strong. Their abilities to manage a classroom, evaluate learning processes, use effective teaching methods, prepare curricular activities, and adapt lesson plans to students' language levels are all pivotal skills to excel as successful English teachers.

In addition to the quantitative results, the semi-structured interviews will provide qualitative insights into the participants' perspectives on their PCK. The

subsequent in-depth analysis of these interviews will enrich our understanding of the pre-service EFL teachers' pedagogical content knowledge, revealing nuances that statistics alone might overlook. As we delve into the analysis of pre-service EFL teachers' PCK, Student 4 recounted the valuable role of pedagogy-oriented courses in the program in her understanding of PCK:

**Student 4:** *"I talked a lot about the courses at university, but they are indeed my primary sources. For instance, there's the Ministry of National Education's curriculum and I learned where to look at the curriculum to figure out what they need to learn. I also learned what to prepare according to the needs of each age group. We have a course called "Teaching English to Young Learners", and we learned what to teach at which level thanks to this course."*

As we move forward, Student 3 underscored the influence of university education on her proficiency in material preparation and the use of diverse teaching techniques and technologies while expressing that she had no prior knowledge regarding the pedagogy part of English language education:

**Student 3:** *"For instance, I enjoy preparing materials, using different techniques and technologies and I learned about all of them at university. I had no prior knowledge. Now, I can prepare lesson plans suitable for the students' language levels and choose appropriate teaching techniques."*

Transitioning to another perspective, Student 2 expressed confidence in her ability to customize lessons to match her students' language levels and to employ appropriate techniques to enhance English language proficiency. Unlike the previous interviewees, she mentioned how her strong command of English compensates for the deficiencies in her pedagogical knowledge. With the combination of both, she rated her PCK fairly high:

**Student 2:** *"To be honest, I can say that I am much more confident about adapting and preparing a lesson suitable for the language levels of the students and supporting them by using suitable teaching techniques to improve their English language skills. Content knowledge, an area in which I am confident, covers up my lack of overall pedagogical knowledge. Therefore, when the two come together, I can rate myself as 7-8 out of 10."*

Further enriching the findings, Student 1 rated herself as being fairly competent in terms of PCK while acknowledging the current limits of her

experience and capabilities, given that she is yet to start teaching in a real teaching environment. Despite recognizing certain insufficiencies in her teaching skills, she held a positive outlook toward improvement, underlining the importance of experience and personal dedication:

**Student 1:** *“As I am currently in my fourth year and have not had any official teaching experience yet, I believe I’m a bit deficient in teaching. However, I think I can improve myself with experience and personal effort. I would not say that I’m too insufficient, but I can certainly improve. Overall, I would say I’m sufficient but there is room for improvement.”*

Moving forward, Student 10 mentioned a valuable course in the third year of the program, that is, “Teaching English to Young Learners” which provided an alternative practical application with micro-teachings, allowing pre-service EFL teachers to gain hands-on experience and improve their ability to effectively apply teaching techniques. By creating lesson plans and receiving active feedback from her peers, the interviewee felt that she has significantly enhanced her PCK thanks to this course:

**Student 10:** *“There is a course in the third year called ‘Teaching English to Young Learners’. In this course, we do micro-teachings, and they are quite beneficial in this regard. It allows us to see the techniques we can use and so on. We prepare a lesson plan, then our classmates act as if they are our students. I think this course has greatly improved us in this regard, and I think it will be very useful for us in the field of English teaching when we start teaching. We already use the techniques here, so it enables us to master them. Concisely, I can say that my pedagogical content knowledge is good thanks to this course.”*

From another perspective, Student 9 mentioned some challenges she faced while helping others with learning English. She found it difficult to determine where to start and how to structure her tutoring even though having the theoretical background through the courses on teaching methods. She also echoed other interviewees on the importance of the practical part starting earlier as only one year may not suffice:

**Student 9:** *“I have not taught professionally yet because I’m still a student but there are people among my friends or family who ask for help and there were times that I helped them. When I did, I struggled a little because I did*

*not have a clear idea of where to start, and how to proceed but I gave them advice or helped in areas where they struggled. I tried to help in accordance with their level. We had a course on teaching methods, that's why I feel proficient, but I would have preferred the practical part to start in the third grade because only one year may not be enough..."*

Delving deeper into PCK, Student 6 presented a well-detailed perspective on her PCK. She mentioned that she feels uncertain when it comes to teaching different age groups and stated that theoretical knowledge may not usually translate into practical ability and how important being able to put theoretical knowledge into practice is. Moreover, she stated that it would be better if the practicum started earlier, possibly in the third year:

**Student 6:** *"My command of English teaching is good, but there are some points where I might not know what to do. For instance, we made presentations aimed at primary and secondary school levels, but I might have trouble teaching an adult. We have theoretical knowledge, but the really important part is putting that knowledge into practice. When it comes to practice, I might not be able to predict what I can do. Working with younger age groups is easier and we experienced working with these groups in our courses, but older ages might cause some troubles for me. I think the practical part comes too late because it's very difficult to see how to teach different groups within a year. Therefore, I think the practicum should have started in the third year, not the fourth year. I think it would be much better to work with different age groups."*

Moving forward, Student 13 stated confidence in his PCK, for which he credited certain courses, and mentioned that he designed lessons for specific age groups:

**Student 13:** *"I find my pedagogical content knowledge sufficient. This year, we had certain courses, and I prepared a lesson in one of them. It was for sixth graders, and I did things to attract their attention such as dancing or singing songs..."*

Student 12 also perceived a notable improvement in her PCK and highlighted her awareness of how she needs different methods and approaches depending on the age and individual differences of her students:

**Student 12:** *“I now have a better understanding of the techniques I can use for different age groups. Compared to the first year, I think I now have a better understanding that different techniques can be used for each person, whether I’m teaching a young student or an adult.”*

From an instructor’s perspective, Instructor 5 highlighted the pre-service EFL teachers’ proficiency in both pedagogical knowledge and the English language while mentioning how pre-service teachers feel more comfortable combining the two, which, in turn, provides them with a strong PCK proficiency:

**Instructor 5:** *“Since our students’ command of English is good and they are also proficient in pedagogical terms, they feel more comfortable when the two are combined. They feel safer in the class because they can use classroom language very comfortably, such as “sit down”, “stand up”, “write that down”, “who wants to speak”, “well done”, etc. They improved their pedagogical knowledge in the third grade and when it is combined with their content knowledge, they are good. When I went to observe their practice teaching this year, I clearly saw that students had no problems with their English use in either semester. They can easily communicate with their students, give instructions, and explain everything again in a different way if their students cannot understand them. Both their command of English and pedagogical knowledge are good, so their pedagogical content knowledge is also good when the two are combined.”*

For the final remarks on PCK, Instructor 4 mentioned that pre-service EFL teachers sometimes struggle with classroom communication even though they have a strong command of English and can prepare solid lesson plans in general. The instructor also raised the point about how important it is to elevate the level of English in Turkey beyond elementary as the teachers need to push the students a bit for continual learning and improvement:

**Instructor 4:** *“In general, I really like my students’ mastery of English but sometimes, when they enter the classroom, I think they do not know how to communicate with their students. As teachers, we need to consider everything thoroughly before entering the classroom. We need to be able to filter our language. They can use inappropriate language sometimes. However, they can prepare good lesson plans and use different teaching techniques and technology really well although sometimes they may have*

*problems in terms of preparing lesson plans suitable for their students' language level. In my opinion, one of the major problems in English education in Turkey is keeping the lessons at an elementary level. We need to push our students so that they can move on to the next levels."*

In summarizing the PCK section, it is essential to mention that the evaluation of both the quantitative and qualitative data reveals promising insights with pre-service EFL teachers demonstrating a strong command of PCK with mean scores ranging between 7.35 and 7.73, as well as the supporting data from the interviews.

The pre-service EFL teachers rated themselves highest in their capacity to adapt a lesson plan in accordance with their students' language skill levels (PCK5, M=7.73) and to prepare curricular activities that develop students' language skills (PCK4, M=7.68). These findings reveal that the pre-service EFL teachers feel particularly comfortable with both developing effective curricular activities and tailoring teaching materials addressing the individual differences as well as the needs of their students.

Overall, both quantitative and qualitative data analysis highlight the effectiveness of the current undergraduate program in terms of preparing pre-service teachers. However, there is always room for improvement, especially in terms of equipping them with better communication strategies and lesson preparation abilities.

#### **4.1.5. Pre-service EFL Teachers' Technological Content Knowledge (TCK)**

Moving on to the Technological Content Knowledge (TCK) component, the average scores reveal a noteworthy understanding of this area among the pre-service EFL teachers, with an overall mean score of 7.23 (see Table 4.1). The scale item "I can take advantage of multimedia (e.g., video, slideshow, etc.) to express my ideas about various topics in English" (TCK1) had the highest mean score (M=7.81) within the TCK component (see Table 4.6).

**Table 4.6.** Descriptive analysis results for the TCK items

| Item                                                                                                                                                     | Minimum | Maximum | Mean | SD   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|------|
| <b>TCK1:</b> I can take advantage of multimedia (e.g., video, slideshow, etc.) to express my ideas about various topics in English.                      | 2       | 9       | 7.81 | 1.41 |
| <b>TCK2:</b> I can benefit from using technology (e.g., web conferencing and discussion forums) to contribute at a distance to multilingual communities. | 1       | 9       | 7.03 | 1.75 |
| <b>TCK3:</b> I can use collaboration tools to work collaboratively with foreign persons (e.g., Second Life, wiki, etc.).                                 | 1       | 9       | 6.87 | 1.77 |

The mean scores of the items illustrated in Table 4.6 display a rather strong proficiency in TCK among pre-service EFL teachers, ranging between 6.87 (TCK3) and 7.81 (TCK1). This competence in utilizing multimedia to express ideas, using technology for contributing to multilingual communities, and working collaboratively with foreign individuals using online tools is of great importance in terms of keeping up with the fast-paced developments in our age.

To further examine these quantitative results, the subsequent section will focus on the semi-structured interview analysis, providing a richer, qualitative layer of understanding. It is anticipated that the following interview excerpts will enhance the depth of the quantitative findings.

Student 4 emphasized the role of the course assignments in aiding the acquisition of technology skills related to creating multimedia content in English, specifically mentioning experiences with video editing programs such as Camtasia. She credited her courses in the undergraduate program for improving her knowledge in this regard:

***Student 4:** “We actually had many assignments regarding this. We recorded videos introducing ourselves in English, etc. We learned how to use video editing programs such as Camtasia. I think I’ve become better in this area thanks to our courses. I had no prior knowledge in this area before*

*university. Even if I'm not too good, I think I'm at least at an intermediate level."*

Moving forward, another perspective was offered by Student 1, who reflected on how the university courses have involved creating various forms of digital content such as videos and digital books. She also mentioned that the experience she gained through the undergraduate courses has helped her to boost her TCK to a certain level of competency:

**Student 1:** *"I believe I am competent because we have created things like videos and digital books in English in our courses. Also, I believe I could discuss a book I like on a social media platform using my English skills."*

Meanwhile, Student 6 regarded herself as quite proficient in TCK and reflected on her ability to participate actively in English discussions on popular social media platforms such as Twitter and Instagram while associating this competency with the requirements of her generation:

**Student 6:** *"I can actively participate in discussions on social media platforms such as Twitter and Instagram using my English. Therefore, I think I am good in this regard. It's actually a skill required by the generation we live in, so we all know it to some extent."*

Transitioning to another perspective, Student 13 expressed confidence in his ability to use English effectively on various platforms. He stated a certain level of comfort in terms of expressing himself in English on platforms such as YouTube and Twitter:

**Student 13:** *"I think I'm good at this because I believe I can express myself comfortably in English whether in comment sections on YouTube or sharing posts on Twitter."*

In a similar vein, Student 11 also expressed proficiency in TCK while elaborating on how she utilized technology as a tool for improving her English skills. She referenced her active participation in global discussions on Twitter, underlining her comfort in engaging in debates in English. Moreover, she also mentioned using apps to enhance her speaking skills:

**Student 11:** *"I benefitted a lot from technology during the process of improving my English. I also follow the world agenda on Twitter and have frequent debates with foreign people. In addition, there were applications that I used to improve my speaking skills."*

On the other hand, offering an educator's perspective on pre-service EFL teachers' TCK competencies, Instructor 4 mentioned how she was able to observe the students' TCK as she assigned projects such as creating videos in English. The instructor pointed out how the pre-service teachers were able to create unique content while expressing some concerns about the educational value as well as the classroom-appropriateness of the content they prepare. In conclusion, the instructor pointed out that the pre-service EFL teachers are proficient in terms of TCK, but they may need some guidance regarding the content:

**Instructor 4:** *"I can observe this in my first-year courses because I assign projects to students such as creating videos or slideshows in English. They prepare impressive videos about themselves, automobiles, etc. They create very unique and diverse things. However, sometimes they can bring things with no educational value. They are quite capable in this regard, but they can sometimes bring things that are not appropriate for a classroom environment, and that worries me a bit. I think they need some guidance regarding the content."*

Transitioning to another perspective, Instructor 3 provided further insights into pre-service teachers' TCK as she mentions an elective course she taught which is directly associated with the TCK component. The instructor pointed out how she was able to observe the pre-service EFL teachers' TCK as she gave students the opportunity to create videos in English as end-of-term projects. The instructor highlighted that the students displayed a certain proficiency in combining their technology knowledge and English proficiency to create multimedia content. However, the instructor also pointed out certain areas for improvement, particularly regarding the accuracy of language use as some students tend to make typographical and punctuation errors:

**Instructor 3:** *"I once gave a course and among the end-of-term projects, there were things such as creating a vlog and shooting a YouTube video and all of them had to be in English. We then watched all their work in class. Some of them promoted the university, introduced their departments, or recorded a city tour. I was very surprised at how incredibly good they were. They use the technology really well but sometimes they are not very good with language. They can make typos, punctuation errors, etc. Overall, they are good."*

In conclusion, this section has highlighted the pre-service EFL teachers' ability to combine their command of English and technology knowledge to take advantage of multimedia to express their ideas in English as well as to benefit from using technology to further improve their English competencies. The pre-service EFL teachers were able to demonstrate proficiency in video creation, digital book development, and active participation in online discussions in English through various assignments and projects. Nevertheless, as the instructors pointed out, there is room for improvement in the language used within the digital content created by the pre-service EFL teachers. Additionally, there is a requirement for more guidance regarding the selection of appropriate content. The blending of English competency and technology use proves to be an essential skill in the digital era we live in, and the pre-service EFL teachers have shown promising abilities in this regard.

#### **4.1.6. Pre-service EFL Teachers' Technological Pedagogical Knowledge (TPK)**

In the context of Technological Pedagogical Knowledge (TPK), the overall mean score stands at 7.42 (see Table 4.1), indicating a respectable level of TPK among the pre-service EFL teachers. The TPK item with the highest mean score ( $M=7.84$ ) is "I can use multimedia such as videos and websites to support students' language learning" (TPK7) (see Table 4.7).

**Table 4.7.** Descriptive analysis results for the TPK items

| Item                                                                                                                                              | Minimum | Maximum | Mean | SD   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|------|
| <b>TPK1:</b> I can meet students' individualized needs by using information technologies.                                                         | 2       | 9       | 7.39 | 1.37 |
| <b>TPK2:</b> I can lead students to use information technologies legally, ethically, safely, and with respect to copyrights.                      | 1       | 9       | 7.28 | 1.64 |
| <b>TPK3:</b> I can support students as they use technology such as virtual discussion platforms to develop their higher order thinking abilities. | 3       | 9       | 7.26 | 1.40 |
| <b>TPK4:</b> I can manage the classroom learning environment while using technology in the class.                                                 | 1       | 9       | 7.37 | 1.41 |
| <b>TPK5:</b> I can decide when technology would benefit my teaching of specific English curricular standards.                                     | 2       | 9       | 7.37 | 1.38 |
| <b>TPK6:</b> I can design learning materials by using technology that supports students' language learning.                                       | 2       | 9       | 7.49 | 1.45 |
| <b>TPK7:</b> I can use multimedia such as videos and websites to support students' language learning.                                             | 2       | 9       | 7.84 | 1.41 |

In Table 4.7, item mean scores ranging from 7.26 to 7.84 provide evidence of a strong overall aptitude for TPK among pre-service EFL teachers. As these results suggest, the pre-service teachers who participated in this study demonstrate a keen ability to meet their students' individual needs, foster ethical and safe use of technology, support the development of higher-order thinking abilities, manage technology-infused classrooms, decide when to integrate technology into their

lessons, design learning materials that support language learning, and utilize multimedia tools effectively.

Further qualitative insights will be provided in the following sections, in which the semi-structured interviews conducted with the pre-service EFL teachers, and the instructors in the department will be analyzed. This analysis will offer a deeper exploration of pre-service EFL teachers' TPK, serving to contextualize and make sense of the findings from the quantitative data.

Transitioning to discussing pre-service EFL teachers' TPK, the first insight came from Student 5, who believed in the power of technology to support teaching beyond traditional methods and materials. She emphasized the diversity of teaching resources available today, and how these materials can be tailored to meet the needs of students, regardless of their age. Regarding her TPK competency level, she rated herself as moderately proficient:

**Student 5:** *"I think that when we are going to teach something to someone, we need to take advantage of technology, videos, or websites instead of just using written materials. I believe the more different methods and materials we use, the better the students receive that information. So, instead of just showing our students some written materials, I think using websites is more lasting in this regard. Depending on the age-specific necessities of the students, I can prepare different videos and so on, at least at a moderate level."*

Moving forward, Student 3 underscored the importance of meeting the digital expectations of today's generation as well as outlining a need for teachers to create a learning environment that not only incorporates technology but also does so in a fun and engaging manner through materials such as videos, fun activities, and games. Drawing from her personal practicum experiences, she expressed confidence in her ability to integrate technology into her teaching:

**Student 3:** *"I mean, we need to integrate technology into education constantly because students always want this. The new generation is accustomed to technology because they have grown up with it, and they actually want us to use technology. We also need to teach in a fun way, and we need to do this not only by writing things on the board or reading something, but also by incorporating technology with videos, fun activities, and games. I have experienced this a lot during my practicum, and I think I*

*will be able to use technology in this regard when I become a teacher in the future.*

Shifting the focus slightly, Student 7 brought a fresh perspective to the discussion, acknowledging the pervasive role of technology in the era we live in while also highlighting potential challenges, especially regarding classroom management. She pointed out that classroom management difficulties may arise while using technology in class, such as students diverting to social media. Despite her sufficient theoretical background and personal comfort with technology-related tasks, she expressed uncertainty about the practical application in a classroom setting:

**Student 7:** *“Since our age is the age of technology, we are inevitably accustomed to using technology and can use it to a certain extent. However, while doing this, it seems like there could be significant difficulties in terms of managing the classroom. For instance, there is a possibility that the students can navigate to social media instead of opening a dictionary. Therefore, I’m not entirely sure if I can manage the classroom. We did not get much chance to practice, but I think I can handle it because usually, I am the one who does the computer tasks when we have presentation assignments with my friends. I do not think I’ll have a problem with that. But as I said, I’m not very confident about whether I could manage the classroom. I’m good in theory but I’m not sure how it would turn out in practice.”*

Moving forward, Student 14 offered another perspective on the matter as she conveys a slightly moderate level of confidence in her TPK, attributing this proficiency to her decent command of technology and intermediate-level pedagogical skills. She associated the fact that she is in her second year in the program with her self-perceived limitations in pedagogical knowledge. This indicates an understanding of the ongoing nature of her professional growth and the role of further education in enhancing both her PK and connectedly, TPK:

**Student 14:** *“I had mentioned that my pedagogical knowledge is at a slightly intermediate level compared to my English proficiency. I also mentioned that I can use technology well. Combining the two, I think it will still turn out to be at the intermediate level because I do not think my pedagogical knowledge is yet sufficient as I’m in the second year.”*

Student 12, on the other hand, expressed knowledge of specific technological tools such as EdPuzzle and Scratch, which she gained from the Instructional Technologies course. She pointed out that she understands the benefits of such tools for an interactive and engaging lesson while underlining her lack of practical experience as it limits her current proficiency regarding TPK, similar to Student 14. Both perspectives reveal a recognition of the importance of practice in converting theoretical knowledge into practical teaching skills:

**Student 12:** *“In the Instructional Technologies course I took, there were a few websites I learned about, such as EdPuzzle and Scratch. There are sites that make the lessons more fun for the students, and I learned to use them to create more interactive lessons. I have not had the chance to use them yet so I only know as much as I’ve seen in class, but I believe I will improve as I practice.”*

Delving deeper into the issue of TPK, Instructor 5 provided an insightful critique of the pre-service EFL teachers’ ability to integrate technology into educational contexts. The instructor pointed out that while students are proficient in personal uses of technology, there appears to be a gap in transferring these skills for educational purposes. He also mentioned that if students take a technology-related course earlier in the program, they perform better in terms of integrating technology into teaching. Notably, he praised how the other instructors in the department use different technologies and platforms such as Edmodo and even Google Drive for educational purposes, which normalizes the use of such tools in the classroom setting:

**Instructor 5:** *“We generally teach this in the Instructional Technologies course. We teach things such as “you can use this for writing, this for speaking” etc. However, students often cannot think of using the things they normally use for educational purposes. For example, they use social media very well, even better than me but when you tell them to use it for educational purposes, they cannot integrate it. If they take a technology-related course beforehand, they can use it. Furthermore, the fact that the teachers in our department use technology a lot is very effective in this matter. All the teachers here use Edmodo, share Google Drive links, etc. Therefore, the students see this and think of it as a normal thing. For*

*example, they ask for the Edmodo code of a course. They cannot think of a class without Edmodo...*"

From another perspective, Instructor 3 acknowledged how good the students are at sourcing suitable video materials relevant to the topics at their hand, and their proficiency in leveraging technology to access information. However, she also raised a concern about technology replacing traditional forms of study, especially in literature classes. For instance, students may have a tendency to watch movie adaptations or read summaries instead of engaging directly with the original texts, leading to a divergence from the intended learning experience. While technology enhances accessibility to diverse resources, there is a challenge in ensuring that students prioritize the original material over supplementary sources that may not reflect all the elements of the original correctly:

***Instructor 3:*** *"They are really good in this regard. They can find videos suitable for the topic very easily. My classes are mostly text-focused, and I notice that the students are not reading the text I give them, they read about the text instead. They usually find those on YouTube or homework sites in which there are short summaries of these texts. They use technology very well to access information. However, they may watch the film of the work I want them to read instead, and the person who adapts the original work into the film is not required to remain loyal to the original text. So, they can change the original. If they read the original text and do research on it, that's fine. However, technology replaces my material and that's a disadvantage to me. If the material they access through technology replaces my main material, which happens most of the time, it's disinformation for both the students and me. The original material should come first."*

In conclusion, both the quantitative and qualitative results reflect a compelling narrative of the theory and the practice of TPK. The interviewees show a keen awareness of the role of technology in shaping the learning and teaching experience, demonstrating both their ability to utilize various tools and a recognition of the importance of this particular skill set in English language teaching. However, concerns related to maintaining effective classroom management and ensuring correct prioritization of resources when integrating technology into education underscore the complexity of this shift. Overall, it is clear that the subjects are prepared to integrate technology into their teaching, but they

also acknowledge areas that need improvement, exploration, and practice. Their recognition of the importance as well as challenges reflects a mature understanding of the evolving dynamics of language education and a willingness to continue refining their skills to meet the new demands.

#### 4.1.7. Pre-service EFL Teachers' Technological Pedagogical Content Knowledge (TPACK)

Shifting toward the TPACK component, the quantitative data analysis suggests a satisfactory level of TPACK among the pre-service EFL teachers with an overall mean score of 7.42 (see Table 4.1). Among the TPACK items, TPACK4: "I can support my professional development by using technological tools and resources to continuously improve the language teaching process" recorded the highest mean score (M=7.73) (see Table 4.8).

**Table 4.8.** Descriptive analysis results for the TPACK items

| Item                                                                                                                                                       | Minimum | Maximum | Mean | SD   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|------|
| <b>TPACK1:</b> I can use collaboration tools (e.g. wiki, 3D virtual environments, etc.) to support students' language learning.                            | 2       | 9       | 7.32 | 1.62 |
| <b>TPACK2:</b> I can support students as they use technology to support their development of language skills in an independent manner.                     | 3       | 9       | 7.34 | 1.41 |
| <b>TPACK3:</b> I can use Web 2.0 tools (animation tools, digital story tools, etc.) to develop students' language skills.                                  | 1       | 9       | 7.32 | 1.80 |
| <b>TPACK4:</b> I can support my professional development by using technological tools and resources to continuously improve the language teaching process. | 3       | 9       | 7.73 | 1.35 |

Investigating the range of mean scores from 7.32 to 7.73, it is evident that the pre-service EFL teachers have a substantial capability in the TPACK area. Their adeptness in using collaboration tools to support students' language learning, assisting students in using technology to independently develop their language

skills, applying Web 2.0 tools to enhance students' language skills, and using technology for their own professional development indicates a robust integration of technological, pedagogical, and content knowledge.

The qualitative analysis of semi-structured interviews provides more insights into the participants' experiences and perceptions, complementing the statistical findings. Through the interview excerpts, a richer understanding of the pre-service EFL teachers' TPACK competencies and the underlying factors influencing their competency levels will be gained.

Delving deeper into the issue of pre-service EFL teachers' TPACK levels through interviews, Student 5 emphasized the importance of engaging multiple senses through the use of various resources in language teaching, particularly highlighting the role of technology. She also expressed a clear appreciation for the CALL course she took earlier, describing it as highly beneficial for her professional development regarding the integration of technology and language teaching as well as in her presentations and teaching practicum. Moreover, she saw the use of technology in education as a means of connecting lessons to students' digital-age realities and considers it vital for productive learning. Even though the interviewee found her education sufficient in this regard, she acknowledged the need for continuous self-improvement:

**Student 5:** *“When teaching a language, I think that the more different resources, visuals, and sounds we use; the more senses we address, the better the students learn the language. In this regard, the CALL course we took in the second grade was very helpful for me both in my presentations and during my practicum. Besides, I can integrate technology into my English teaching tutoring, regardless of the students’ age. For example, I can use StoryJumper. I think courses such as CALL are so important. All the theoretical knowledge we learn makes us more traditional teachers unless we integrate technology. When I do not use technology, I feel that the lessons are less productive. I need to refer to my students’ desires, needs, and real lives as they are living in the digital age. I can still give them worksheets but when they get home, they do everything on their computer. Therefore, I need to be able to relate my lessons to their daily lives. The things I learned in four years are quite useful for me now but I will try to improve myself further.”*

Reflecting on their teaching journey, Student 4 noted how she progressed significantly over time, particularly in terms of integrating technology into her teaching. She shared a compelling observation from her practicum where she noticed an increase in student engagement when using interactive digital tools such as WordWall, instead of using traditional materials. Moreover, she mentioned other Web 2.0 tools such as Socrative and Kahoot as effective means to stimulate student competition and interest through visual and auditory stimuli:

**Student 4:** *“Looking at the past, I think I’ve made a lot of progress. When we went to our practicum schools, there were times when I only used worksheets and times when I played games with them using WordWall. When I compared their participation, the children wanted to participate more in the lesson when I used WordWall saying: “Teacher, let’s play again”. There are Web 2.0 tools such as Socrative and Kahoot! in which you can make the students compete, so they become more ambitious and actually attracted by the visuals and the sounds. For example, when we use smartboards to listen to something instead of reading the material ourselves or making the students read, they listen eagerly. I think such tools are definitely good for involving the students in the class. I try to use these tools all the time and I have not had any trouble during my lessons. I use WordWall a lot. We definitely should integrate technology into education, and we need to support the ones who do. We’ve always talked about it, we are in the age of technology. Besides, I think it’s even easier to use technological tools and resources and it’s also more fun for the children.”*

Moving forward, Student 3 mentioned using digital tools such as StoryJumper and Scratch during her practicum and expressed confidence in her ability to use these tools effectively. She also appreciated the role of her teaching practicum in gaining hands-on experience with such applications and highlighted how all the technology-oriented courses reinforced each other during her undergraduate education:

**Student 3:** *“There are lots of applications on the internet for English language learning and people can actually improve their English levels without taking classes or attending a course thanks to these apps. We also used applications such as StoryJumper and Scratch during our practicum and I think I’m good at using them. There were times when I asked for help*

*when I could not use them, of course. However, I think I learned how to use them and I can make use of them by myself now. Our practicum was extremely beneficial in using and experiencing these. Also, we had a course related to online education and we actually had the chance to refresh our knowledge. I took four technology-related courses in total and I can say that they all reinforced each other."*

Continuing with the analysis, Student 2 revealed how she feels a degree of discomfort and struggle when it comes to integrating technology into teaching even though she feels confident in terms of her command of English. She partly attributed this insufficiency to her limited access to technology as she has no access to a computer. However, she recognized her own potential to improve provided that she can access technological tools in the future, and expressed a positive attitude toward covering up her deficiencies. Drawing from her teaching experiences, she noted how effective integrating technology into education was on student engagement and attitude toward English learning. In a similar vein as the previous interviewees, she appreciated the value of undergraduate courses in terms of using technology:

**Student 2:** *"I would not give myself a high score in this regard. We prepared a digital story for homework before, and that turned out to be really good but I would struggle if I was on my own. When it comes to the language aspect, I do not have any problems but when technology is involved, I may fail a bit. However, I think I have potential. I've never owned a computer before, and that's why my interaction with technology is limited, which is something I feel upset about. But as I said, when I have a computer or some other technological tools, I believe I'll be able to do these things. It's not quantum physics, in my opinion, so I believe I can do good things with a little bit of effort. We've been practicing teaching for two semesters and we taught both in middle and high school, and I noticed that the students' attitudes towards English were not very positive. However, when we use technology, it captures their attention more, especially in middle school. They genuinely participate. Therefore, technology plays a significant role in promoting an interest in language learning. I believe teachers who lack technological knowledge should definitely improve themselves in this regard. For this reason, I will definitely improve myself. The courses in our*

*undergraduate program were definitely efficient in this regard and I've learned a lot."*

Transitioning to another perspective, Student 1 expressed a rather moderate-level TPACK competency. She pointed out how technology is a constantly evolving field as well as advocating for ongoing training for in-service teachers to keep up with the technological advancements so that she can meet the needs of her students better. Unlike the other interviewees, Student 1 stated that the technology-related courses in the undergraduate program were insufficient and suggested that the number of such courses should be increased:

**Student 1:** *"I can say that I'm partially competent, but since technology is an ever-evolving field, we need to keep up with it constantly. I support the continuous provision of this kind of education for in-service teachers because the era is changing constantly, technology is evolving, and we need to stay updated so that we can address our students. I do not think the technology-integration-related courses in our undergraduate program were sufficient and I think the number of these courses should be increased. I guess my suggestion is that teachers need to engage with technology constantly, both during undergraduate education and afterwards. Technology is a very useful tool in terms of addressing the students, that's why I can say that it is of vital importance."*

Reflecting on her undergraduate education, Student 10 acknowledged the value of the Instructional Technologies course as it helped her learn about useful Web 2.0 tools such as Scratch and StoryJumper. She also expressed her feelings about how important it is to use such tools to help students enjoy the language-learning process:

**Student 10:** *"The Instructional Technologies course we took in the second year taught us Web 2.0 tools that will help us a lot in this regard. I am planning to use most of them when I start my teaching career. We learned quite a lot of technological tools such as Scratch and StoryJumper which I think could be quite effective. Generally, since we live in the age of technology, I think it is important to use these types of Web 2.0 tools. These tools help the students have more fun while learning."*

Moving forward, another perspective was offered by Student 9, who reflected on her journey from having no prior experience with even creating

slideshows to becoming competent in using a variety of digital tools such as Scratch, Socrative, and Google Forms. She attributed her successful learning journey to the repeated use of these tools during her education. In addition, she emphasized the importance of incorporating technology due to the potential lack of inspiration that students may perceive from traditional learning materials:

**Student 9:** *"I had never even prepared a slideshow before university. I learned it all here. We prepared digital stories and quizzes and used Scratch, Socrative, and Google Forms. I think I can do all of them now because we tried and used them again in other classes. I think it's very important to integrate technology into English teaching because using only a book, for example, would be quite boring. Tools such as Quizlet and StoryJumper attract a lot of student attention."*

Building on the previous insights, Student 8 also expressed a certain level of confidence in her TPACK competency, adding that there is always room for improvement. She also mentioned her ability to use various tools and attributed her current competency largely to the Instructional Technologies course in the program:

**Student 8:** *"I think I'm at a sufficient level in this regard. I can always improve myself, though. I can create stories using StoryJumper, create forms using Google Forms, and use Quizlet and Kahoot for games. The Instructional Technologies course was very effective in this regard."*

In a similar vein, Student 14 expressed confidence regarding her TPACK level, recounting her experiences of effectively integrating technology into her teaching. She mentioned that she had the chance to use tools such as videos, digital games, digital stories, and tools like Socrative for assessment in her lessons. She also stated that her generation possesses a good level of technological knowledge. Finally, she proposed the addition of an extra technology-related course each year, suggesting a course specifically focused on using technology in English language teaching:

**Student 14:** *"I believe my technological pedagogical content knowledge is at an advanced level. I was able to use technology appropriately in the field of English teaching before. I had experience teaching English to young learners, and we conducted lessons that were intertwined with technology. We used videos in our lessons, created digital games, and digital stories, and prepared exams using Socrative. As I mentioned before, I think our*

*technological knowledge is good as a generation. Our department is also quite intertwined with technology. Maybe an extra technology-related course could be added to each year. A course focusing on the use of technology in the English language could be added to the program.”*

Adding a slightly different perspective, Student 13 assessed his TPACK level as being at a sufficient level. He also indicated that he has recently started learning about technology integration and anticipates further exposure in the coming years. However, he also mentioned that he used EdPuzzle before and started learning about such Web 2.0 tools in the Distance Education course:

**Student 13:** *“I think it’s at a medium or a sufficient level. We just started learning a bit about it this year, but I think we will start to see more next year. I had some projects in EdPuzzle. I started to learn about these Web 2.0 tools in our Distance Education course.”*

Providing an instructor’s viewpoint, Instructor 5 offered a positive evaluation of pre-service teachers’ TK, CK, and PK, as well as considering them to be quite proficient when these elements are combined too. However, the instructor also mentioned that there is a need for guidance in integrating technology while teaching specific topics. Although pre-service teachers exhibit competency in all three elements of TPACK separately, the instructor saw the integration of technology into education as a point open for improvement. The instructor also commended the effectiveness of the undergraduate program and appreciated the department’s openness to technology use, as well as the encouragement given to students in this regard:

**Instructor 5:** *“They do not have problems with their English, they do not have much trouble in terms of pedagogy, and they use technology very comfortably; sometimes consciously, sometimes unconsciously. So, when we combine the three, I think they are quite proficient. As I mentioned before, they may need a bit of guidance, especially on how to use technology while teaching certain subjects. They are good in all three areas alone, but they need a little assistance when it comes to integrating technology into education. I think the courses in our program are quite effective, at least department-wise. The instructors in our department are always open to using technology and also encourage the students to do so...”*

Contrasting the earlier viewpoint, Instructor 2 provided a rather critical assessment of pre-service EFL teachers' TPACK, suggesting that pre-service EFL teachers are yet to reach an adequate level of proficiency. The instructor noted that while pre-service EFL teachers learn how to use smartboards during their practicum and have access to pre-made content provided by the Ministry of National Education, their ability to create their own material is not highly developed. The instructor mentioned that this might be due to the fact that the pre-made materials are already satisfying enough or that pre-service teachers lack the motivation to create their own. He also acknowledged that pre-service teachers are focusing more on developing their other teaching skills. He also saw the potential for pre-service teachers to create their own materials in the future with enough motivation and guidance. In addition, the instructor pointed out that the faculty members themselves may also need training in using digital tools. Finally, the instructor recognized the skill involved in selecting the appropriate pre-made materials and presenting them effectively:

**Instructor 2:** *“Well, I do not think our students have reached a certain level yet. From my observations, our senior students learn how to use the smartboard when they start their practicum. There is plenty of pre-made content designed by the Ministry of National Education and its experts, and our pre-service EFL teachers can access these materials, such as activities in textbooks, videos, pictures, and so on. When I visit their practice schools for observation, I can see many resources provided by the Ministry of National Education for teachers to use in smartboards. However, their ability to create their own material is not at a high level, or they do not need it much because of the prepared materials available. At this stage, from what I observe, our students are satisfied with the materials they have. They focus more on developing other skills such as classroom control, making the lesson more interesting, relating the content of the lesson to real life, using body language, and calling their students by their names. In terms of using technological tools, I think they could produce their own content in the future with motivation and guidance. But first, we, as faculty members, also need to know how to use these tools ourselves. Maybe, we should be given some training. They are getting better every year but we cannot see any production, maybe because they do not need it or they lack motivation.*

*They can use pre-made materials really well. They can present them with the necessary teaching techniques and this alone means a lot. Choosing the correct material is also a skill and sometimes it can be harder than creating your own."*

In conclusion, the analysis of pre-service EFL teachers' TPACK competency levels reveals a rather complex portrait of teachers' readiness to integrate technology into their teaching. The semi-structured interviews provided various perspectives, from those who felt confident in their ability to integrate technology into their teaching practices to those who felt a need for further training and support.

The quantitative findings generally indicated a high level of TPACK-EFL competency among pre-service EFL teachers, with an overall mean score of 7.38 (see Table 4.1). For the TPACK-EFL components, mean scores ranged from 6.80 in TK to 8.14 in CK, suggesting that the pre-service EFL teachers felt more confident when it comes to their command of English than their technological competencies. In addition, relatively high scores were reported in the areas of PK (M=7.43, SD=1.16), PCK (M=7.57, SD=1.24), TCK (M=7.23, SD=1.41), TPK (M=7.42, SD=1.16), and overall TPACK (M=7.42, SD=1.29).

While the quantitative data suggests a rather high level of TPACK-EFL competency, the semi-structured interview excerpts provide a more in-detail view of the analysis. Even though some interviewees expressed confidence in terms of integrating technology into their teaching practices, there were others who indicated that they are in need of further support and experience. This disparity suggests that while pre-service EFL teachers may feel generally competent in their TPACK-EFL abilities, there are certain insufficiencies and room for improvement.

Furthermore, the semi-structured interviews reveal themes of continuous learning and growth. In addition, a considerable number of participants noted the value and sufficiency of their undergraduate courses in introducing them to Web 2.0 tools and improving their abilities to integrate technology into teaching. This aligns with the quantitative data, which revealed high mean scores for items related to the use of technology for professional development and supporting students' language learning.

The interviews also pointed out various areas for improvement. Some participants suggested a need for more opportunities to practice teaching with

technology in the classroom, as well as more technology-related courses in the program. The latter might explain the lower scores in TK compared to other TPACK components.

In summary, pre-service EFL teachers' perceived competence in TPACK-EFL appears to be strong overall, with some exceptions across all sub-components and among individuals. Moving forward to the next section of the analysis, the relationship between pre-service EFL teachers' demographic variables and TPACK-EFL competency levels will be examined for each sub-component. This will further enhance our understanding of pre-service EFL teachers' TPACK-EFL competency levels and help identify the underlying reasons for the preliminary findings as well as areas where additional support and development may be needed.

#### **4.2. The Relationship Between Demographic Variables and Pre-service EFL Teachers' Perceived TPACK Competencies**

This section, in turn, explores the relationship between demographic variables and pre-service EFL teachers' perceived TPACK competency levels with the aim of answering the third research question of the study. The investigation focuses on key demographic variables, namely gender, age, computer experience, and the year of education of the participants. The rationale behind this investigation is that TPACK competency levels may not be developed in isolation but may be influenced by a variety of factors, including demographic characteristics. Thus, this section will shed light on the influence of the participants' gender, age, computer experience, and year of education on their TPACK competency levels.

The influence of each demographic variable on each component of the TPACK framework will be analyzed in detail under the related sub-headings. Prior to delving deeper into the analysis, it is important to understand the meaning of p-values. In statistical analysis, a p-value greater than 0.05 typically indicates a lack of statistical significance (Fisher, 1992).

##### **4.2.1. What is the relationship between pre-service EFL teachers' gender and their perceived TPACK-EFL competencies?**

The Mann-Whitney U test was conducted to investigate the differences in the TPACK-EFL scores between male and female pre-service EFL teachers. Table

4.9 illustrates the mean rank, sum of ranks, U, Z, and p values for the comparison between participants' gender and overall TPACK-EFL scale scores:

**Table 4.9.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' TPACK-EFL scores and genders

|                  | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|------------------|--------|-----|-----------|--------------|---------|--------|---------|
| <b>TPACK-EFL</b> | Male   | 60  | 115.73    | 6943.50      | 4186.50 | -1.133 | 0.257   |
|                  | Female | 155 | 105.01    | 16276.50     |         |        |         |
|                  | Total  | 215 | -         | -            | -       | -      | -       |

According to the findings displayed in Table 4.9, male participants (n=60, mean rank=115.73) had slightly higher mean ranks compared to female participants (n=155, mean rank=105.01). However, the Mann-Whitney U test ( $U=4186.500$ ,  $z=-1.133$ ) and p-value of 0.257 reveals that this difference is not statistically significant given that the p-value is greater than the conventional 0.05 threshold. In other words, the gender of the pre-service teachers does not seem to play a significant role in determining the overall TPACK-EFL competency of pre-service EFL teachers. Despite the slight differences in mean ranks, both male and female participants display broadly similar levels of overall TPACK-EFL competency. In order not to generalize the findings by only looking at the overall TPACK-EFL score and to further expand the findings, each sub-component of the TPACK framework was also analyzed in accordance with the participants' genders.

#### 4.2.1.1. The Relationship Between Gender and Perceived TK Competencies

In order to investigate the relationship between pre-service EFL teachers' TK levels and their genders, the Mann-Whitney U test was conducted. The results are displayed in Table 4.10:

**Table 4.10.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' TK scores and genders

|    | Gender | N   | Mean Rank | Sum of Ranks | U       | Z     | p-value |
|----|--------|-----|-----------|--------------|---------|-------|---------|
| TK | Male   | 60  | 139.04    | 8342.50      | 2787.50 | -4554 | .000    |
|    | Female | 155 | 95.98     | 14877.50     |         |       |         |
|    | Total  | 215 | -         | -            | -       | -     | -       |

The results displayed in Table 4.10 reveals a significant difference in TK scores of male participants (n=60, mean rank=139.04) and females (n=155, mean rank=95.98). The mean rank of the male participants' TK scores was significantly higher than that of the females. Given the p-value is less than the conventional 0.05 threshold for statistical significance, gender appears to be a significant factor in the TK competency of pre-service EFL teachers. The analysis further continues with the comparison of pre-service teachers' CK levels and genders.

#### 4.2.1.2. The Relationship Between Gender and Perceived CK Competencies

The examination of the influence of gender on pre-service EFL teachers' TPACK levels continues with the investigation of the relationship between pre-service EFL teachers' gender and CK competency levels. The Mann-Whitney U test results in this regard are displayed in Table 4.11:

**Table 4.11.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' CK scores and genders

|    | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|----|--------|-----|-----------|--------------|---------|--------|---------|
| CK | Male   | 60  | 114.39    | 6863.50      | 4266.50 | -0.947 | 0.344   |
|    | Female | 155 | 105.53    | 16356.50     |         |        |         |
|    | Total  | 215 | -         | -            | -       | -      | -       |

The results in Table 4.11 indicate that the difference in the distributions of the CK scores between male ( $n=60$ , mean rank=114.39) and female participants ( $n=155$ , mean rank=105.53) was not statistically significant ( $U=4266.50$ ,  $z=-0.947$ ,  $p=0.344$ ). These findings indicate that the male pre-service EFL teachers' CK scores were not significantly different from the female students'. Even though the test statistic has a negative value, suggesting that males had slightly larger ranks on average, this difference was found not to be large enough to be statistically significant as the p-value is greater than the conventional 0.05 threshold for statistical significance. In this case, gender does not appear to be a significant factor in determining the CK competency levels of pre-service EFL teachers.

#### 4.2.1.3. The Relationship Between Gender and Perceived PK Competencies

In an effort to gain a deeper insight into the role of gender on pre-service EFL teachers' TPACK competency levels, the differences in the PK scores between male and female pre-service EFL teachers were also examined through the Mann-Whitney U test, and the results are displayed in Table 4.12:

**Table 4.12.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' PK scores and genders

|    | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|----|--------|-----|-----------|--------------|---------|--------|---------|
| PK | Male   | 60  | 88.43     | 5305.50      | 3475.50 | -2.875 | .004    |
|    | Female | 155 | 115.58    | 17914.50     |         |        |         |
|    | Total  | 215 | -         | -            | -       | -      | -       |

The results revealed a significant difference in the distribution of the PK scores in favor of female pre-service EFL teachers ( $n=155$ , mean rank=115.58) with  $U=3475.500$ ,  $z=-2.875$ , and  $p=0.004$ . In other words, female pre-service teachers had significantly higher PK scores compared to their male counterparts. As the p-value is less than the 0.05 threshold for statistical significance, gender appears to be a significant factor in pre-service EFL teachers' PK competency levels.

#### 4.2.1.4. The Relationship Between Gender and Perceived PCK Competencies

In a similar vein as the previous findings, a significant difference between male and female pre-service EFL teachers' PCK competency levels was observed. Table 4.13 illustrates the findings drawn from the Mann-Whitney U test:

**Table 4.13.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' PCK scores and genders

|     | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|-----|--------|-----|-----------|--------------|---------|--------|---------|
| PCK | Male   | 60  | 92.73     | 5564.00      | 3734.00 | -2.244 | .025    |
|     | Female | 155 | 113.91    | 17656.00     |         |        |         |
|     | Total  | 215 | -         | -            | -       | -      | -       |

As the test results in Table 4.13 indicated, the female pre-service teachers ( $n=155$ , mean rank=113.91) notably surpassed their male counterparts ( $n=60$ , mean rank=92.73) in terms of PCK competency, as evidenced by the other statistical findings ( $U=3734.000$ ,  $z=-2.244$ ,  $p=0.025$ ). Since the p-value is below the conventional 0.05 threshold for statistical significance, the gender variable appears to play a significant role in determining pre-service EFL teachers' PCK competency levels.

#### 4.2.1.5. The Relationship Between Gender and Perceived TCK Competencies

Moving on to pre-service EFL teachers' TCK, there is no significant distinction found in TCK scores between male and female pre-service teachers. The results of the Mann-Whitney U test in this regard are displayed in Table 4.14:

**Table 4.14.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' TCK scores and genders

|     | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|-----|--------|-----|-----------|--------------|---------|--------|---------|
| TCK | Male   | 60  | 117.68    | 7060.50      | 4069.50 | -1.425 | .154    |
|     | Female | 155 | 104.25    | 16159.50     |         |        |         |
|     | Total  | 215 | -         | -            | -       | -      | -       |

As revealed in Table 4.14, there is no significant difference between male ( $n=60$ , mean rank=117.68) and female ( $n=155$ , mean rank=104.25) pre-service EFL teachers in terms of TCK competency, as further evidenced by the remaining statistical findings ( $U=4069.500$ ,  $z=-1.425$ ,  $p=0.154$ ). Given that p-value is above the 0.05 threshold, it can be suggested that gender does not significantly affect pre-service EFL teachers' TCK competencies.

#### 4.2.1.6. The Relationship Between Gender and Perceived TPK Competencies

Addressing the investigation on pre-service EFL teachers' TPK competencies and the role of their gender in this regard, the Mann-Whitney U test revealed no significant difference. Table 4.15 illustrates the findings drawn from the Mann-Whitney U test:

**Table 4.15.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' TPK scores and genders

|     | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|-----|--------|-----|-----------|--------------|---------|--------|---------|
| TPK | Male   | 60  | 106.88    | 6412.50      | 4582.50 | -0.165 | .869    |
|     | Female | 155 | 108.44    | 16807.50     |         |        |         |
|     | Total  | 215 | -         | -            | -       | -      | -       |

As shown in Table 4.15, there is no significant difference found regarding the TPK scores of male ( $n=60$ , mean rank=106.88) and female ( $n=155$ , mean rank=108.44) pre-service EFL teachers, as indicated by  $U=4582.500$ ,  $z=-0.165$ , and  $p=0.869$  values. Since the p-value is way above the 0.05 threshold, gender is found not to be influential in determining pre-service EFL teachers' TPK scores.

#### 4.2.1.7. The Relationship Between Gender and Perceived TPACK Competencies

Finally, when we analyze the Mann-Whitney U test results regarding the influence of gender in pre-service EFL teachers' TPACK, we encounter a similar trend. The Mann-Whitney U test results are displayed in Table 4.16 and further explained:

**Table 4.16.** The results of the Mann-Whitney U test comparing the pre-service EFL teachers' TPACK scores and genders

|       | Gender | N   | Mean Rank | Sum of Ranks | U       | Z      | p-value |
|-------|--------|-----|-----------|--------------|---------|--------|---------|
| TPACK | Male   | 60  | 107.78    | 6467.00      | 4637.00 | -0.032 | .975    |
|       | Female | 155 | 108.08    | 16753.00     |         |        |         |
|       | Total  | 215 | -         | -            | -       | -      | -       |

Table 4.16 reveals that the gender variable is not influential in determining pre-service EFL teachers' TPACK competency levels ( $U=4637.000$ ,  $z=-0.032$ ,  $p=0.975$ ) as the male ( $n=60$ , mean rank=107.78) and female ( $n=155$ , mean rank=108.08) pre-service EFL teachers scored closely matched mean ranks. Since

the p-value is substantially higher than the conventional 0.05 threshold for statistical significance, it can be inferred that gender does not seem to play a significant role in determining pre-service EFL teachers' TPACK competency levels.

The influence of gender on pre-service EFL teachers' overall TPACK-EFL competencies turned out to be rather inconsistent, as male participants displayed a substantially higher score in TK while their female counterparts had the lead in both PK and PCK competency. However, there were no significant difference regarding the remaining components of the TPACK framework. In conclusion, even though gender may play a role in determining pre-service EFL teachers' TK, PK, and PCK competency levels, gender does not appear to be a decisive factor in overall TPACK competency.

#### 4.2.2. What is the relationship between pre-service EFL teachers' age and their perceived TPACK-EFL competencies?

The Kruskal-Wallis test was conducted to examine the relationship between pre-service EFL teachers' age and their TPACK-EFL competency levels. Table 4.17 displays the mean ranks along with Kruskal-Wallis H and p values for the comparison between participants' age and overall TPACK-EFL scores:

**Table 4.17.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPACK-EFL scores and age

|                  | Age Group          | N   | Mean Rank | Kruskal-Wallis H | p-value |
|------------------|--------------------|-----|-----------|------------------|---------|
| <b>TPACK-EFL</b> | 18-20 years        | 79  | 102.47    | 2.279            | .320    |
|                  | 21-23 years        | 118 | 113.58    |                  |         |
|                  | 24 years and above | 18  | 95.69     |                  |         |

Starting our investigation on the relationship between pre-service EFL teachers' age and overall TPACK-EFL scores, Table 4.17 reveals no substantial influence of pre-service EFL teachers' age on their TPACK-EFL competency levels ( $H(2)=2.279$ ,  $p=.320$ ). As the p-value is greater than the conventional 0.05 threshold for statistical significance, age does not seem to significantly influence

pre-service EFL teachers' TPACK-EFL competencies. In order to avoid generalizing these findings to comment on the relationship between pre-service EFL teachers' age and TPACK levels, each component of the TPACK framework was analyzed the same way.

#### 4.2.2.1. The Relationship Between Age and Perceived TK Competencies

To examine the relationship between pre-service EFL teachers' age and their TK levels, the Kruskal-Wallis H was utilized. The results including the mean ranks, sum of ranks, U, Z, and p values are displayed in Table 4.18:

**Table 4.18.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TK scores and age

|    | Age Group    | N   | Mean Rank | Kruskal-Wallis H | p-value |
|----|--------------|-----|-----------|------------------|---------|
| TK | 18-20 years  | 79  | 102.29    | 1.516            | .469    |
|    | 21-23 years  | 118 | 112.73    |                  |         |
|    | 24 years and | 18  | 102.03    |                  |         |
|    | above        |     |           |                  |         |

As displayed in Table 4.18, the test revealed no statistically significant difference in pre-service EFL teachers' TK scores across all the age groups ( $H(2)=1.516$ ,  $p=.469$ ). The mean rank scores for TK were 102.29 for the 18-20 years group, 112.73 for the 21-23 years group, and 102.03 for the 24 years and above group. Despite the differences in mean ranks, age was not found to have a significant influence on participants' TK scores as the p-value is greater than the standard 0.05 threshold.

#### 4.2.2.2. The Relationship Between Age and Perceived CK Competencies

The analysis further continues with the comparison of pre-service EFL teachers' CK competency levels and their ages. The Kruskal-Wallis test results are presented in Table 4.19:

**Table 4.19.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TK scores and age

|    | Age Group    | N   | Mean Rank | Kruskal-Wallis H | p-value |
|----|--------------|-----|-----------|------------------|---------|
| CK | 18-20 years  | 79  | 109.14    | 7.994            | .018    |
|    | 21-23 years  | 118 | 113.15    |                  |         |
|    | 24 years and | 18  | 69.22     |                  |         |
|    | above        |     |           |                  |         |

The results given in Table 4.19 for CK scores paints a different picture compared to TK scores as a statistically significant difference in CK scores across the three age groups was found ( $H(2)=7.994$ ,  $p=.018$ ). The mean rank CK score for the group aged 24 years and above stood at a significantly lower score than the other two groups with only 69.22. The p-value also indicated that there is a statistically significant difference with a score under the 0.05 threshold ( $p=.018$ ). Therefore, it can be suggested that age plays a significant role in terms of determining pre-service EFL teachers' CK competencies.

#### 4.2.2.3. The Relationship Between Age and Perceived PK Competencies

Moving forward to the investigation of the relationship between pre-service teachers' age and PK competency levels, a similar pattern to TK scores can be observed. Table 4.20 illustrates the statistical findings regarding the issue at hand:

**Table 4.20.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' PK scores and age

|    | Age Group    | N   | Mean Rank | Kruskal-Wallis H | p-value |
|----|--------------|-----|-----------|------------------|---------|
| PK | 18-20 years  | 79  | 101.91    | 1.450            | .484    |
|    | 21-23 years  | 118 | 110.50    |                  |         |
|    | 24 years and | 18  | 118.36    |                  |         |
|    | above        |     |           |                  |         |

There is no statistically significant difference found in the distribution of PK scores among the three age groups ( $H(2)=1.450, p=.484$ ). The mean rank score for the 18-20 years group (N=79) was 101.91 while the 21-23 years group (N=118) scored a mean rank of 110.50, and the 24 years and above group (N=18) stood at 118.36. As the p-value is greater than the 0.05 threshold for statistical significance, age was not found to be influential in determining pre-service EFL teachers' PK competency levels.

#### 4.2.2.4. The Relationship Between Age and Perceived PCK Competencies

As we extend the analysis to the PCK competency levels of pre-service EFL teachers, the Kruskal-Wallis test results indicate that there is no statistically significant difference across all three age groups regarding the participants' PCK levels ( $H(2)=0.553, p=.758$ ). Table 4.21 illustrates the statistical results obtained by the Kruskal-Wallis test:

**Table 4.21.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' PCK scores and age

|     | Age Group          | N   | Mean Rank | Kruskal-Wallis H | p-value |
|-----|--------------------|-----|-----------|------------------|---------|
| PCK | 18-20 years        | 79  | 103.88    | 0.553            | .758    |
|     | 21-23 years        | 118 | 110.50    |                  |         |
|     | 24 years and above | 18  | 109.67    |                  |         |

These findings suggest that the age variable does not seem to affect pre-service EFL teachers' PCK scores significantly ( $p>0.05$ ).

#### 4.2.2.5. The Relationship Between Age and Perceived TCK Competencies

The examination of the influence of age on pre-service EFL teachers' TCK also revealed no significant difference among the age groups ( $H(2)=0.717, p=.699$ ). The statistical results are displayed in Table 4.22:

**Table 4.22.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TCK scores and age

|     | Age Group    | N   | Mean Rank | Kruskal-Wallis H | p-value |
|-----|--------------|-----|-----------|------------------|---------|
| TCK | 18-20 years  | 79  | 104.55    | 0.717            | .699    |
|     | 21-23 years  | 118 | 111.19    |                  |         |
|     | 24 years and | 18  | 102.19    |                  |         |
|     | above        |     |           |                  |         |

As can be seen in Table 4.22, the findings obtained through the Kruskal-Wallis test reveal mean ranks of 104.55 for the age group 18-20 years, 111.19 for 21-23 years, and 102.19 for 24 years and above. As the p-value is also above the 0.05 threshold, the combination of these findings reveals that age has no significant influence on determining pre-service EFL teachers' TCK levels.

#### 4.2.2.6. The Relationship Between Age and Perceived TPK Competencies

Moving on to pre-service EFL teachers' TPK, there is no significant difference found in TPK scores among all three age groups ( $H(2)=2.343, p=.310$ ). The results of the Kruskal-Wallis test in this regard are displayed in Table 4.23:

**Table 4.23.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPK scores and age

|     | Age Group    | N   | Mean Rank | Kruskal-Wallis H | p-value |
|-----|--------------|-----|-----------|------------------|---------|
| TPK | 18-20 years  | 79  | 100.68    | 2.343            | .310    |
|     | 21-23 years  | 118 | 113.88    |                  |         |
|     | 24 years and | 18  | 101.61    |                  |         |
|     | above        |     |           |                  |         |

The mean rank scores in Table 4.23 for the age groups of 18-20 years, 21-23 years, and 24 years and above were 100.68, 113.88, and 101.61, respectively. In addition to the close mean ranks, the p-value ( $p=.310$ ) being at a higher rate than

the conventional 0.05 threshold for statistical significance indicate that age does not possess a significant impact on pre-service EFL teachers' TPK competencies.

#### 4.2.2.7. The Relationship Between Age and Perceived TPACK Competencies

Concluding our analysis regarding the relationship between the age variable and TPACK scores, the Kruskal-Wallis test revealed no significant difference among the age groups ( $H(2)=1.242$ ,  $p=.537$ ). Table 4.24 illustrates the findings drawn from the Kruskal-Wallis test:

**Table 4.24.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPACK scores and age

|       | Age Group    | N   | Mean Rank | Kruskal-Wallis H | p-value |
|-------|--------------|-----|-----------|------------------|---------|
| TPACK | 18-20 years  | 79  | 110.79    | 1.242            | .537    |
|       | 21-23 years  | 118 | 108.44    |                  |         |
|       | 24 years and | 18  | 92.83     |                  |         |
|       | above        |     |           |                  |         |

The statistical results indicated in Table 4.24 illustrates that age does not play an influential role in determining pre-service EFL teachers' TPACK competency levels.

In conclusion, the findings have indicated a consistent pattern, revealing that pre-service EFL teachers' age does not significantly influence their TPACK-EFL competencies, with the exception of the CK component as the age was found to be significantly influential since the results indicated notably lower CK competency scores for the participants aged 24 years and above.

#### 4.2.3. What is the relationship between pre-service EFL teachers' computer experience and their perceived TPACK-EFL competencies?

This section of the study focuses on the influence of pre-service EFL teachers' computer experience on their TPACK-EFL competency levels. The participants' computer experiences are divided into four groups: 1-5 years, 6-10 years, 13-16 years, and 16+ years. The Kruskal-Wallis test was utilized to examine

the relationship between the participants' computer experience and TPACK competencies. Table 4.25 illustrates the statistical findings in this regard:

**Table 4.25.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPACK-EFL scores and computer experience

|                  | <b>Computer Experience</b> | <b>N</b> | <b>Mean Rank</b> | <b>Kruskal-Wallis H</b> | <b>p-value</b> |
|------------------|----------------------------|----------|------------------|-------------------------|----------------|
| <b>TPACK-EFL</b> | 1-5 years                  | 15       | 83.77            | 18.510                  | .000           |
|                  | 6-10 years                 | 43       | 77.08            |                         |                |
|                  | 13-16 years                | 107      | 115.58           |                         |                |
|                  | 16+ years                  | 50       | 125.64           |                         |                |

As Table 4.25 indicates, the group with over 16 years of computer experience (N=50) has the highest mean rank score followed by the group with 13-16 years of experience (N=107), and surprisingly followed by the group with 1-5 years of experience (N=15), putting the group with 6-10 years of experience (N=43) to the last place. The results also reveal that there is a statistically significant difference between the groups ( $H(3)=18.510$ ,  $p=.000$ ). Therefore, computer experience plays an influential role in determining pre-service EFL teachers' TPACK-EFL competencies. However, to avoid overgeneralization, each TPACK component will be analyzed in detail under the related sub-headings.

#### **4.2.3.1. The Relationship Between Computer Experience and Perceived TK Competencies**

In an effort to investigate the relationship between pre-service EFL teachers' TK competencies and their computer experience, the Kruskal-Wallis test was utilized to provide the related statistical results, which are displayed in Table 4.26:

**Table 4.26.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TK scores and computer experience

|    | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|----|---------------------|-----|-----------|------------------|---------|
| TK | 1-5 years           | 15  | 52.03     | 34.762           | .000    |
|    | 6-10 years          | 43  | 77.81     |                  |         |
|    | 13-16 years         | 107 | 114.07    |                  |         |
|    | 16+ years           | 50  | 137.77    |                  |         |

The pre-service EFL teachers' TK appears to be exceedingly influenced by their computer experience as the statistical results ( $H(3)=34.762, p=.000$ ) reveal a strongly significant difference in TK scores in favor of the pre-service EFL teachers with more computer experience. Thus, the data indicate that pre-service EFL teachers' computer experience is an influential factor in determining their TK competency levels.

#### 4.2.3.2. The Relationship Between Computer Experience and Perceived CK Competencies

Moving forward, pre-service EFL teachers' CK competencies were also analyzed with respect to their computer experience. The statistical results are illustrated in Table 4.27:

**Table 4.27.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' CK scores and computer experience

|    | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|----|---------------------|-----|-----------|------------------|---------|
| CK | 1-5 years           | 15  | 86.20     | 11.158           | .011    |
|    | 6-10 years          | 43  | 84.64     |                  |         |
|    | 13-16 years         | 107 | 115.38    |                  |         |
|    | 16+ years           | 50  | 118.84    |                  |         |

Among the four groups, the group with 6-10 years of computer experience ( $N=43$ , mean rank=84.64) had the lowest mean rank closely followed by the group with 1-5 years of experience ( $N=15$ , mean rank=86.20), the group with 13-16 years

of experience (N=107, mean rank=115.38), and the group with over 16 years of computer experience (N=50, mean rank=118.84), indicating the highest score. The Kruskal-Wallis test results revealed a statistically significant difference in the distribution of the CK scores in favor of those with more computer experience ( $H(3)=11.158, p=.011$ ). Therefore, the results indicate that computer experience plays a meaningful role in determining pre-service EFL teachers' CK competency levels.

#### 4.2.3.3. The Relationship Between Computer Experience and Perceived PK Competencies

In a similar vein, the Kruskal-Wallis test results indicate a statistically meaningful relationship between pre-service teachers' computer experience and PK competencies, even though the relationship is not linear. The statistical data are displayed in Table 4.28 and further analyzed:

**Table 4.28.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' PK scores and computer experience

|           | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|-----------|---------------------|-----|-----------|------------------|---------|
| <b>PK</b> | 1-5 years           | 15  | 124.77    | 10.663           | .014    |
|           | 6-10 years          | 43  | 81.83     |                  |         |
|           | 13-16 years         | 107 | 116.36    |                  |         |
|           | 16+ years           | 50  | 107.60    |                  |         |

Interestingly, Table 4.28 reveals that the group with the least computer experience has the highest mean rank score (N=15, mean rank=124.77) followed by the group with 13-16 years of experience (N=107, mean rank=116.36), the group with more than 16 years of experience (N=50, mean rank=107.60), and the group with 6-10 years of experience (N=43, mean rank=81.83). This ordering is rather unusual and may be the result of the fact that the relationship between PK and computer experience may not be as straightforward. However, as displayed in Table 4.28, the Kruskal-Wallis test reveals a significant difference in pre-service EFL teachers' PK competencies in relation to their computer experience ( $H(3)=10.663, p=.014$ ).

#### 4.2.3.4. The Relationship Between Computer Experience and Perceived PCK Competencies

Moving on to pre-service EFL teachers' PCK, the Kruskal-Wallis test reveals statistically significant differences in PCK levels among the groups with different levels of computer experience. The statistical results of the Kruskal-Wallis test are shown in Table 4.29:

**Table 4.29.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' PCK scores and computer experience

|            | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|------------|---------------------|-----|-----------|------------------|---------|
| <b>PCK</b> | 1-5 years           | 15  | 120.57    | 8.115            | .044    |
|            | 6-10 years          | 43  | 84.53     |                  |         |
|            | 13-16 years         | 107 | 111.57    |                  |         |
|            | 16+ years           | 50  | 116.76    |                  |         |

As can be understood from Table 4.29, a similar pattern to the PK component is revealed as the group with the least computer experience has the highest mean rank score again (N=15, mean rank=120.57), followed by the group with over 16 years of experience (N=50, mean rank, 116.76), the group with 13-16 years (N=107, mean rank=111.57), and the group with 6-10 years of experience with the lowest score (N=43, mean rank=84.53). The findings suggest that there are statistically significant differences in pre-service EFL teachers' PCK across the different levels of computer experience ( $H(3)=8.115$ ,  $p=.044$ ), even though the ranking is not linear.

#### 4.2.3.5. The Relationship Between Computer Experience and Perceived TCK Competencies

The analysis shifts to the TCK component and the influence of the computer experience of pre-service EFL teachers. This time around, the analysis reveals a linear difference regarding TCK levels in favor of the groups with more computer experience. Table 4.30 illustrates the results drawn from the Kruskal-Wallis test followed by further explanations:

**Table 4.30.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TCK scores and computer experience

|            | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|------------|---------------------|-----|-----------|------------------|---------|
| <b>TCK</b> | 1-5 years           | 15  | 80.00     | 10.752           | .013    |
|            | 6-10 years          | 43  | 89.74     |                  |         |
|            | 13-16 years         | 107 | 111.48    |                  |         |
|            | 16+ years           | 50  | 124.66    |                  |         |

The mean ranks follow a linear pattern as the group with the highest mean rank is the pre-service EFL teachers with over 16 years of computer experience (N=50, mean rank=124.66) followed by those with 13-16 years of experience (N=107, mean rank=111.48), followed by those with 6-10 years of experience (N=43, mean rank=89.74), and the group with only 1-5 years of experience (N=15, mean rank=80.00). This order, along with the remaining statistical results ( $H(3)=10.752$ ,  $p=.013$ ) indicates statistically significant differences in pre-service EFL teachers' TCK across different levels of computer experience, favoring the ones with more experience.

#### 4.2.3.6. The Relationship Between Computer Experience and Perceived TPK Competencies

Table 4.31 summarizes the relationship between pre-service EFL teachers' computer experience and their perceived TPK competencies:

**Table 4.31.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPK scores and computer experience

|            | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|------------|---------------------|-----|-----------|------------------|---------|
| <b>TPK</b> | 1-5 years           | 15  | 98.87     | 8.495            | .037    |
|            | 6-10 years          | 43  | 84.81     |                  |         |
|            | 13-16 years         | 107 | 114.37    |                  |         |
|            | 16+ years           | 50  | 117.05    |                  |         |

The analysis illustrated in Table 4.31 reveals that the group with over 16 years of computer experience had the highest mean rank (N=50, mean

rank=117.05), followed closely by those with 13-15 years of experience (N=107, mean rank=114.37). However, the group with only 1-5 years of experience (N=15, mean rank=98.87) surpassed those with 6-10 years (N=43, mean rank=84.81). The Kruskal-Wallis H and p values in Table 4.31 ( $H(3)=8.495$ ,  $p=.037$ ) indicate that there are statistically significant differences in pre-service EFL teachers' TPK, influenced by their computer experience.

#### 4.2.3.7. The Relationship Between Computer Experience and Perceived TPACK Competencies

Finally, the relationship between pre-service EFL teachers' TPACK scores and computer experiences is also investigated. The statistical results drawn from the Kruskal-Wallis test are displayed in Table 4.32:

**Table 4.32.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPACK scores and computer experience

|       | Computer Experience | N   | Mean Rank | Kruskal-Wallis H | p-value |
|-------|---------------------|-----|-----------|------------------|---------|
| TPACK | 1-5 years           | 15  | 114.90    | 3.658            | .301    |
|       | 6-10 years          | 43  | 93.90     |                  |         |
|       | 13-16 years         | 107 | 108.12    |                  |         |
|       | 16+ years           | 50  | 117.80    |                  |         |

The statistical results in Table 4.32 indicate a rather unusual ordering as the pre-service EFL teachers with the most computer experience (N=50) hold the highest mean rank (117.80) followed by those with the least experience (N=15, mean rank=114.90), those with 13-16 years of experience (N=107, mean rank=108.12), and those with 6-10 years of experience (N=43, mean rank=93.90). However, the Kruskal-Wallis H and p-value ( $H(3)=3.658$ ,  $p=.301$ ) reveal that there is no statistically meaningful relationship between pre-service EFL teachers' computer experience and TPACK levels even though there are differences in the mean ranks.

In conclusion, the investigation on whether pre-service EFL teachers' computer experience influences their TPACK-EFL competency levels revealed a number of intriguing results. Firstly, the analysis suggests a generally strong relationship between computer experience and TPACK components, especially

regarding TK ( $p=.000$ ) and CK ( $p=.011$ ). However, the relationship becomes more complex when it comes to PK ( $p=.014$ ) and PCK ( $p=.044$ ) as participants with less computer experience scored higher. Regarding TCK ( $p=.013$ ) and TPK ( $p=.037$ ), higher computer experience levels seem to lead to higher scores in these components. In terms of the overall TPACK score, the p-value of .301 suggests that the differences in mean ranks are not statistically significant. The data shows that computer experience matters, but there might be other reasons to influence the pre-service EFL teachers' TPACK competencies. Finally, when it comes to examining the influence of computer experience on TPACK-EFL competency, a p-value of .000 suggests a strong correlation between the two.

While it appears that computer experience generally correlates with higher TPACK scores, there might be other factors in this regard as there are some complex findings that should not be attributed only to the participants' computer experience.

#### 4.2.4. What is the relationship between pre-service EFL teachers' year of education and their perceived TPACK-EFL competencies?

The influence of the year of education in the program on pre-service EFL teachers' TPACK levels is examined through the Kruskal-Wallis test and analyzed in this section. Table 4.33 illustrates the statistical results obtained by the Kruskal-Wallis test regarding the overall TPACK-EFL scores:

**Table 4.33.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPACK-EFL scores and the year of education

|           | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|-----------|-------------------|----|-----------|------------------|---------|
| TPACK-EFL | 1                 | 59 | 91.14     | 7.391            | .060    |
|           | 2                 | 54 | 106.24    |                  |         |
|           | 3                 | 40 | 118.60    |                  |         |
|           | 4                 | 62 | 118.74    |                  |         |

The statistical results illustrated in Table 4.33 reveal a rather relatable picture as the mean rank scores improve year by year, which indicates that the program is consistent in terms of improving pre-service EFL teachers' professional

development as future English teachers. The pre-service teachers in their first year scored 91.14, while those in their second year significantly increased their scores to 106.24. Another significant jump in the mean rank is observed for those in their third year with 118.60. However, the fourth graders revealed nearly identical mean rank scores (118.74), which indicates almost no improvement.

This pattern indicates a consistent improvement in TPACK-EFL scores through the years and aligns with the expectation that pre-service EFL teachers' skills would improve in the field as they gain more exposure and experience over their academic journey.

Despite the consistent improvement, the Kruskal-Wallis test results ( $H(3)=7.391, p=.060$ ) indicate that it would not be possible to confidently indicate that the differences in the mean scores are not just due to random variation. Therefore, the consistently increasing TPACK-EFL scores may indicate a strong relationship between the two, but statistical results call for a more cautious approach.

#### 4.2.4.1. The Relationship Between Year of Education and Perceived TK Competencies

Transitioning to the exploration of how TK scores are influenced by pre-service EFL teachers' years of education in the program, the Kruskal-Wallis test reveals a statistically significant difference in TK scores among the four years in the program. Table 4.34 illustrates the statistical results drawn through the Kruskal-Wallis test:

**Table 4.34.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TK scores and the year of education

|    | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|----|-------------------|----|-----------|------------------|---------|
| TK | 1                 | 59 | 87.08     | 10.289           | .016    |
|    | 2                 | 54 | 116.24    |                  |         |
|    | 3                 | 40 | 107.78    |                  |         |
|    | 4                 | 62 | 120.88    |                  |         |

The mean rank scores displayed in Table 4.34 suggest a trend where the pre-service EFL teachers' TK improves each year in the program. The Kruskal-Wallis test also indicates a statistically significant difference regarding pre-service EFL teachers' TK and their year of education ( $H(3) = 10.289, p=.016$ ). All the findings combined, year of education seems to play an influential role in determining pre-service EFL teachers' TK competency levels.

#### 4.2.4.2. The Relationship Between Year of Education and Perceived CK Competencies

The analysis continues with the investigation of how pre-service EFL teachers' CK levels are affected by the years of education in the department. The results of the Kruskal-Wallis test are displayed in Table 4.35:

**Table 4.35.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TK scores and the year of education

|    | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|----|-------------------|----|-----------|------------------|---------|
| CK | 1                 | 59 | 101.53    | 2.940            | .401    |
|    | 2                 | 54 | 101.05    |                  |         |
|    | 3                 | 40 | 118.00    |                  |         |
|    | 4                 | 62 | 113.77    |                  |         |

The Kruskal-Wallis test results demonstrated on Table 4.35 indicates that there is no statistically significant difference in pre-service EFL teachers' CK across the four years of education ( $H(3)=2.940, p=.401$ ). While first and second-year students have nearly identical mean ranks (mean rank = 99.65 and 97.21, respectively), there is a considerable improvement observed in third and fourth-year students' CK levels (mean rank = 118.00 and 113.77, respectively). However, the lack of statistical significance suggests that the differences in pre-service EFL teachers' CK across years of education may be a result of random variation; therefore, it cannot be implied that the year of education is significantly influential in determining pre-service EFL teachers' CK.

#### 4.2.4.3. The Relationship Between Year of Education and Perceived PK Competencies

Addressing the investigation of the relationship between pre-service EFL teachers' years of education in the program and their PK levels, the Kruskal-Wallis test revealed no significant difference. Table 4.36 illustrates the findings drawn from the Kruskal-Wallis test:

**Table 4.36.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' PK scores and the year of education

|    | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|----|-------------------|----|-----------|------------------|---------|
| PK | 1                 | 59 | 99.65     | 5.629            | .131    |
|    | 2                 | 54 | 97.21     |                  |         |
|    | 3                 | 40 | 118.55    |                  |         |
|    | 4                 | 62 | 118.53    |                  |         |

As can be realized from Table 4.36, the mean ranks for the first and second years turned out to be relatively stable (mean rank = 99.65 and 97.21, respectively). However, there is a significant increase in pre-service EFL teachers' PK levels as they progress into their third and fourth years in the program, with mean ranks of 118.55 and 118.53, respectively. Such an increase aligns with the expectations as pre-service EFL teachers are generally exposed to more teaching-oriented content in the later years of their education. Regardless of the year-by-year progress, the Kruskal-Wallis test indicates that these differences are not statistically significant ( $H(3)=5.629, p=.131$ ). This result, in turn, suggests that the noticeable year-by-year increase in pre-service EFL teachers' PK is not substantial enough to rule out the possibility of random variation. The results are also counter-intuitive to some degree as first-year students cannot be expected to have any pedagogical knowledge yet considering that they are yet to take pedagogical courses. This may be due to students' over-reporting.

#### 4.2.4.4. The Relationship Between Year of Education and Perceived PCK Competencies

The examination of pre-service EFL teachers' PCK levels and the influence of the pre-service EFL teachers' year of education reveals a relatively similar

pattern to that of the PK component. Table 4.37 displays the related findings obtained by the Kruskal-Wallis test:

**Table 4.37.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' PCK scores and the year of education

|            | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|------------|-------------------|----|-----------|------------------|---------|
| <b>PCK</b> | 1                 | 59 | 99.71     | 5.047            | .168    |
|            | 2                 | 54 | 99.60     |                  |         |
|            | 3                 | 40 | 123.84    |                  |         |
|            | 4                 | 62 | 112.98    |                  |         |

The mean ranks for the first and second years in Table 4.37 seem to be nearly identical (mean rank = 99.71 and 99.60, respectively). Similar to the PK component, there is a significant increase in pre-service EFL teachers' PCK scores as they start their third year in the program (mean rank = 123.84), even though this score seems to decrease to some degree in the fourth year (mean rank = 112.98). The increased score in the third year is expected as the pre-service teachers generally get exposed to more pedagogy-oriented content. Even though the pre-service EFL teachers' year of education seems to be influential to some degree regarding their PCK, the Kruskal-Wallis tests indicate that the differences across different educational years are not statistically significant ( $H(3)=5.047$ ,  $p=.168$ ) as the p-value exceeds the standard 0.05 threshold for statistical significance. This result suggests that the increase in pre-service EFL teachers' PCK over the years is not substantial enough to eliminate the probability of random variance.

#### **4.2.4.5. The Relationship Between Year of Education and Perceived TCK Competencies**

Moving forward, another year-by-year improvement is observed in pre-service EFL teachers' TCK competency levels. Table 4.38 illustrates the findings drawn from the Kruskal-Wallis test:

**Table 4.38.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TCK scores and the year of education

|     | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|-----|-------------------|----|-----------|------------------|---------|
| TCK | 1                 | 59 | 98.81     | 4.161            | .245    |
|     | 2                 | 54 | 101.01    |                  |         |
|     | 3                 | 40 | 116.21    |                  |         |
|     | 4                 | 62 | 117.54    |                  |         |

The mean rank scores on Table 4.38 paint a similar pattern to those in the previous components, revealing a consistent improvement in pre-service teachers' TCK levels. While the participants indicate almost identical scores in the first and second years (mean rank = 98.81 and 101.01, respectively), a substantial increase is observed in the third year, which then remains almost identical in the fourth year (mean rank = 116.21 and 117.54, respectively) in line with the previous findings. Even though these findings indicate that pre-service EFL teachers' TCK levels improve as they progress through the years of education, the Kruskal-Wallis test suggests that these differences are not statistically significant ( $H(3)=4.161, p=.245$ ). Since the p-value is exceeding the standard 0.05 threshold for statistical significance, it is not viable to attribute the improvement in TCK scores to pre-service teachers' years of education.

#### 4.2.4.6. The Relationship Between Year of Education and Perceived TPK Competencies

Transitioning to the exploration of the influence of pre-service EFL teachers' years of education in the undergraduate program on their TPK levels, a similar yet slightly different pattern is observed. The results of the Kruskal-Wallis test are displayed in Table 4.39:

**Table 4.39.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPK scores and the year of education

|            | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|------------|-------------------|----|-----------|------------------|---------|
| <b>TPK</b> | 1                 | 59 | 92.44     | 6.136            | .105    |
|            | 2                 | 54 | 107.51    |                  |         |
|            | 3                 | 40 | 120.40    |                  |         |
|            | 4                 | 62 | 115.23    |                  |         |

As can be understood from Table 4.39, the first-year students scored a mean rank of 92.44, which then rises significantly for the second-year students to 107.51. The rising trend continues as the third-year students reveal a mean rank of 120.40, though, it slightly drops to 115.23 for the fourth-year students. Despite the pattern showing year-by-year improvement, the Kruskal-Wallis test ( $H(3)=6.136$ ) provides a p-value of .105, which reveals no statistically significant difference, being above the conventional .05 threshold for statistical significance.

#### 4.2.4.7. The Relationship Between Year of Education and Perceived TPACK Competencies

For the final remarks on the influence of pre-service EFL teachers' years of education in the undergraduate program on their TPACK scores, the Kruskal-Wallis test results are displayed in Table 4.40 and further analyzed in detail:

**Table 4.40.** The results of the Kruskal-Wallis test comparing the pre-service EFL teachers' TPACK scores and the year of education

|              | Year of Education | N  | Mean Rank | Kruskal-Wallis H | p-value |
|--------------|-------------------|----|-----------|------------------|---------|
| <b>TPACK</b> | 1                 | 59 | 104.42    | 2.168            | .538    |
|              | 2                 | 54 | 106.24    |                  |         |
|              | 3                 | 40 | 120.94    |                  |         |
|              | 4                 | 62 | 104.60    |                  |         |

As shown in Table 4.40, the mean rank scores for pre-service teachers in their first year stand at 104.42, which then slightly increases for second-year

students to 106.24. Moving forward, a significant increase in TPACK levels for those in their third year is observed (mean rank = 120.94). However, a relatively significant decrease in the mean rank scores of the fourth-year students is found (mean rank = 104.60). Even though there is an observed year-by-year increase in pre-service EFL teachers' TPACK levels except in the fourth grade, the Kruskal-Wallis test ( $H(3)=2.168$ ) suggests the differences among the four educational years' mean ranks are not statistically significant as the p-value is way above the statistical significance threshold of 0.05 ( $p=.538$ ). Therefore, it is indicated that the increase in pre-service EFL teachers' TPACK over the years is not statistically significant enough to dismiss the probability of random variance.



## 5. DISCUSSION

This chapter, in turn, discusses the results of the study while referring to the relevant literature. As mentioned earlier, the study at hand is aimed at examining pre-service EFL teachers' perceived TPACK competency levels as well as investigating whether there is a relationship between pre-service EFL teachers' TPACK competency levels and their demographic characteristics, specifically age, gender, computer experience, and year of education in the program.

The discussion based on the literature will first address the overall TPACK competency levels of pre-service EFL teachers, providing an in-depth analysis of both the quantitative and qualitative data. Then, the influence of demographic variables on pre-service EFL teachers' TPACK levels will be dwelled on.

### 5.1. Pre-service EFL Teachers' Perceived TPACK Competency Levels

In the rapidly evolving digital era, the integration of technology into teaching and learning processes has become a critical aspect of the English Language Teaching field. As Mishra and Koehler (2006) pointed out, the integration of technology in teaching requires a complex interplay of knowledge about content, pedagogy, and technology. Thus, the TPACK framework (Mishra & Koehler, 2006) has been recognized as an effective tool for outlining the objectives for the incorporation of technology in pre-service teacher education (Schmidt et al., 2009). Accordingly, the TPACK competency levels of pre-service EFL teachers were investigated in the current study. The findings outlined in the results section offer a comprehensive understanding of the TPACK competency levels among pre-service EFL teachers. The preliminary analysis of quantitative data revealed a moderate to high level of overall TPACK competency. This finding is in accord with several studies conducted on pre-service English language teachers' TPACK competency levels (Atar et al., 2019; Öz, 2015; Sarıçoban et al., 2019; Solak & Çakır, 2014; Uludağ, 2022).

The pre-service teachers in the present study felt the most confident when it comes to their command of the English language, which is of great importance for both pre- and in-service EFL teachers since this proficiency in English language use is not only crucial for effective communication in the classroom but also significant in the integration of technology as many of the digital resources used in education are predominantly in English. There are other studies in the literature in

which pre-service teachers reported the most competency in CK. For instance, Schmid et al. (2021) examined the link between the use of digital technologies in lesson plans and teachers' self-reported TPACK and revealed that pre-service teachers exhibited the strongest capabilities in the CK area, while their skills were least developed in TCK. However, the findings of the current study in this regard contradict several other studies as well. For instance, Hsu (2016) carried out an investigation into the TPACK levels of EFL teachers and the impact of TPACK on the adoption of Mobile-Assisted Language Learning. The findings indicated that the TPK sub-component received the highest average score, trailed by TPACK and TCK sub-domains, while PK scored the lowest. In another study by Graham et al. (2009), the TPACK competencies of in-service science teachers were scrutinized, and the results revealed that the highest score was achieved in the TK sub-component, followed by TPK, TPACK, and TCK. Moreover, Cheng (2017) carried out a study to examine the TPACK perceptions of in-service language teachers in Taiwan. The findings indicated that while the teachers generally felt confident about their overall TPACK competencies, they reported lower scores in CK, TK, and TPK. Similarly, some other studies found that PK received the highest scores among their participants (Hosseini & Kamal, 2013; Valtonen et al., 2020).

Even though the participants scored the best on CK in the current study, the semi-structured interviews highlighted a number of problematic areas regarding pre-service EFL teachers' CK. Firstly, the instructors mentioned that pre-service EFL teachers tend to have an exam-oriented mentality because of their high school English language education. Thus, they tend to translate everything instead of thinking directly in English. In this vein, Hatipoğlu (2016) points out the influence of examination-oriented English teaching in high schools on pre-service EFL teachers' language learning perceptions. The exam-oriented approach is found to be affecting students' language learning approach, as they prioritize grammar, vocabulary, and reading skills while neglecting listening, speaking, and writing, which are not assessed in the university entrance exam. Therefore, pre-service teachers tend to lack production skills. Moreover, the instructors in the current study highlighted the challenge of assessing pre-service teachers' production skills. This difficulty is largely attributed to the constraints imposed by large class sizes and a limited number of teaching staff, which inherently limit the amount of individual attention each student can receive. In this regard, Díaz et al. (2021) pointed out the

challenging nature of assessing productive language skills as they necessitate incorporating authentic tasks such as conducting interviews, creating videos, and designing poster presentations, which would only be possible with a lower student-teacher ratio. Therefore, an increase in the number of teacher educators is recommended to ensure that pre-service English teachers receive sufficient attention and guidance to effectively develop their production skills.

Furthermore, the value of preparatory classes is also underscored in the context of the current study since the teacher education program does not have a specific objective to improve pre-service teachers' English language skills. In a similar vein as Hatipoğlu (2016), Uztosun (2017) also highlighted the insufficiency of high school English language education in the matter of teaching productive skills while pointing out pre-service EFL teachers' lack of listening and speaking proficiencies. These findings underline the importance of English preparatory classes since the students are expected to have a certain English language proficiency before attending the English Language Teaching program.

On the other hand, the lowest mean score was observed in TK, suggesting that pre-service teachers felt less confident in their technological competencies. There are other studies in the literature contradicting this finding. For instance, Öz (2015) found that pre-service EFL teachers scored highest in TK and PK sub-domains. However, it is important to note that the mean score for TK was still relatively high in the current study, indicating a moderate level of competency. In addition, the item-by-item analysis in the present study revealed that pre-service EFL teachers generally reported lower scores in items that are related to the basics such as being able to troubleshoot common computer problems or using basic terms such as "operation system", "virtual memory", and so on. A similar finding was reported by Solak and Çakır (2014), who revealed that the pre-service teachers had difficulties troubleshooting technical problems even though they reported higher scores in terms of being able to integrate technology into their teaching. In this regard, a study conducted by Uzun (2016) revealed that the courses in the ELT program did not adequately enhance the basic ICT competencies of the pre-service teachers. This discrepancy suggests a lack of alignment between the pedagogical knowledge imparted to pre-service EFL teachers and the technical knowledge necessary for leveraging technology in contemporary education. The study further hypothesized that this deficiency in technology knowledge may negatively

influence the adoption of technology in education. This indicates a need for additional focus on fundamental technological literacy in teacher education programs. It is crucial to ensure that pre-service EFL teachers are not only comfortable with advanced educational technologies but also possess a strong understanding of basic computer terminology. This foundational knowledge will enable them to navigate any technology-related issues they may face in their teaching practice and will provide a solid base upon which they can continue to expand their technological competencies (Altun, 2007; Aslan and Zhu, 2015; Uzun, 2016).

Regarding pre-service EFL teachers' PK competencies, a notable discrepancy between theory and practice is observed. Both the pre-service EFL teachers and instructors pointed out that the undergraduate program is sufficient in terms of creating the theoretical foundation needed for English language teaching. However, the challenge lies in translating this theoretical knowledge into practice. This challenge is commonly attributed to the lack of practice opportunities in teacher education programs (Coşkun & Daloğlu, 2010; Karakaş, 2012; Seferoğlu, 2006; Uztosun, 2016). Thus, a significant number of pre-service teachers in the current study advocate for an earlier introduction of teaching practice courses in the curriculum. However, as Instructor 5 commented on pre-service EFL teachers' PK, it is of great importance to acknowledge the potential challenges and logistical issues that could arise from implementing such changes. For instance, initiating teaching practice courses earlier in the program would necessitate finding placement schools for hundreds of additional pre-service teachers. This could pose a significant challenge given the limited number of schools and the need to ensure quality placements that offer meaningful teaching experiences. Additionally, budgetary constraints must be taken into account. Expanding the scope of practical teaching experiences means additional costs, such as supervision, transportation, and resources for the placement schools. Given these challenges, initiating the practicum in the earlier years of the program seems impractical (Seferoğlu, 2006).

However, as some participants mentioned, this gap between theory and practice could potentially be bridged through the incorporation of more micro-teaching sessions, as they do not necessitate the same logistical arrangements as a full-scale teaching practicum. In an effort to investigate the influence of micro-teaching sessions, Takkaç-Tulgar (2019) examined how these sessions affected the

self-efficacy levels of pre-service English teachers, and the study revealed that micro-teaching sessions provide pre-service teachers with effective practice opportunities as they contribute to their self-efficacy levels. This indicates that conducting micro-teaching sessions is a good alternative to teaching practicum for the sake of providing practice opportunities to pre-service English teachers (Takkaç-Tulgar, 2019). Nevertheless, the most effective solution may be addressing the instructor-student ratio as it can be ensured that each pre-service teacher receives more personalized instruction and mentorship. While this approach may require additional resources, such as hiring more instructors or reducing the program quota, the potential benefits to the quality of teacher education could be substantial.

The semi-structured interviews provided further insights into the pre-service EFL teachers' TPACK competency levels. While some interviewees expressed confidence in their ability to integrate technology into their teaching practices, others indicated a need for further support and training. This disparity suggests that while pre-service EFL teachers may feel generally competent in their TPACK abilities, there are certain areas where they highlighted a need for improvement. For instance, several interviewees revealed that their ability to access technology and their personal interest significantly influenced their TK competency, leading to lower TK scores for the ones with limited access to technology and less personal interest. In light of these findings, the need for ongoing support and professional development opportunities for pre-service teachers becomes even more apparent (Başer et al., 2021; Kopcha, 2012; Liu et al., 2015; Park & Son, 2020). These could include workshops on the latest educational technologies, mentoring programs, or online learning communities where pre-service teachers can share experiences and learn from each other (Daloğlu, 2006). In addition, considering the feedback from the interviews, it might be beneficial to explore ways to foster personal interest in technology among pre-service teachers. This could involve showcasing innovative uses of technology in teaching, providing opportunities for hands-on experience with different technologies, or integrating more technology-related topics into the curriculum (Akayoğlu, 2017). There are several studies revealing the benefits of introducing how different technologies can be used in teaching. In the research conducted by Koçoğlu (2009), every participant underscored the influential role of their educators showcasing the

application of technology for educational objectives, which served as a source of inspiration for them to integrate technology into their own instructional practices. In a similar vein, Kurt et al. (2013) further showcased the potential influence of a course designed around the TPACK framework in boosting the TPACK levels of pre-service teachers, augmenting their understanding of technology integration, and fostering their capacity to create their own lesson plans.

Additionally, a significant number of interviewees acknowledged the role of their undergraduate courses in introducing them to various Web 2.0 tools and enhancing their abilities to integrate technology into teaching while pointing out that the number of such courses should be increased. The importance of technology-oriented courses is also mentioned in a considerable number of studies. In a study conducted by Koçoğlu (2009), for instance, the Computer-Assisted Language Learning course was identified as an influential tool in improving the TPACK competencies of pre-service EFL teachers and aiding them in putting their TPACK into practice effectively. In a similar vein, Kurt et al. (2013) observed a notable improvement in the capabilities of pre-service EFL teachers to integrate technology following their participation in a technology-oriented course. This highlights the pivotal role such courses play in teacher education programs, emphasizing the need for teacher education programs to holistically approach technology, content, and pedagogy for effective technology integration. Moreover, İşler and Yıldırım (2018) advocated that pre-service teacher training programs should incorporate lessons with a combination of technology, content, and pedagogy. They also suggested that these programs should offer opportunities for pre-service teachers to create their own technology-based educational resources.

In addition, Graham et al. (2009) conducted a study that demonstrated significant enhancements in all TPACK sub-domains for in-service science teachers who participated in a professional development program, in which they were exposed to a diverse range of technologies, leading to noticeable improvements in their TPACK competencies. Furthermore, Dinçer (2018) conducted a study to evaluate the technological knowledge and attitudes of pre-service teachers and the results indicated that the pre-service teachers' competencies were not as advanced as they perceived, and this discrepancy was attributed to the lack of technology-related courses in their curriculum or the insufficiency of the existing ones by the researcher. Consequently, the researcher

suggested a comprehensive review and enhancement of technology-related courses in teacher education programs. Moreover, the role of technology use outside the classroom through various tools and platforms (e.g., YouTube, Instagram) was also mentioned by a number of interviewees, indicating a positive influence on pre-service EFL teachers' TPACK competencies. In this context, a number of studies in the literature also pointed out the importance of outside-the-classroom technology use (Lai et al., 2016; Lamb & Arisandy, 2020; Minalla, 2018; Sert & Boynueğri, 2017).

In conclusion, the findings of the current study revealed that pre-service EFL teachers exhibit a robust overall TPACK competency, with some variations across the sub-components and among individuals. The undergraduate program appears to be relatively effective in preparing pre-service EFL teachers not only to teach English effectively but also to integrate technology into their teaching practices. However, there is always a need for continuous improvement (Daloğlu, 2006; Koçoğlu, 2009; Kurt et al., 2013). This applies both to the performance of pre-service teachers and to the structure of the undergraduate program. While the program has been successful in laying a solid theoretical foundation, there is room for further enhancement, especially regarding the practice part of teaching. This potential for further enhancement is closely tied to several key factors (Richards, 2017). First and foremost is the student-instructor ratio. A lower ratio allows for more personalized instruction, which can significantly enhance the learning and teaching experience. Secondly, the content of technology-related courses seems to need attention as the findings suggest a need for a more comprehensive introduction to the basics of technology. This includes knowledge of basic computer terminology, troubleshooting common problems, and understanding the core principles of how different technologies work. Lastly, the provision of better practice opportunities is a critical area for improvement. While theoretical knowledge is unquestionably important, the ability to put this knowledge into practice is what truly prepares pre-service teachers for their future roles. This could involve more frequent micro-teaching sessions since increasing the number of practicums is rather inapplicable due to various constraints. In this regard, Takkaç-Tulgar (2019) underlined the positive influence of micro-teaching sessions on pre-service EFL teachers' teaching skills, indicating that conducting micro-teaching sessions provides a reliable and more applicable alternative to teaching practicums.

## **5.2. The Relationship Between Demographic Variables and Perceived TPACK Competencies**

While the TPACK competency levels of pre-service EFL teachers are undoubtedly influenced by their training and experiences, it is also crucial to investigate other factors that might play a role. Demographic variables, particularly gender, age, computer experience, and year of education in the program are among these factors.

Regarding the influence of gender on TPACK competency, the findings suggest that gender does not play a decisive role in determining overall TPACK competency, as suggested by several other studies in the literature (Delen, 2016; Erşanlı, 2016; Koh & Chai, 2011; Saraç, 2015; Şenen, 2019; Yüksel & Yasin, 2014). However, TK, PK, and PCK competencies were found to be influenced by their gender. In terms of TK, it was observed that male pre-service teachers scored higher than their female counterparts. This finding is in line with a considerable number of other studies in the literature (Baş & Şentürk, 2018; Gündoğmuş, 2013; Jang & Tsai, 2013; Kartal & Afacan, 2017; Öz, 2015; Özkara et al., 2018; Sarıçoban et al., 2019; Solak & Çakır, 2014; Uludağ, 2022). On the other hand, female participants exhibited higher competency levels in PK, which suggests that female teachers may have a better understanding or greater confidence in their pedagogical practices. This finding is consistent with the results of several studies (Altun, 2013; Altun & Akyıldız, 2017; Öz, 2015; Solak & Çakır, 2014). The female pre-service teachers also scored higher in PCK than their male counterparts, which may be the result of their strong overall PK competency alone, as there was no statistically significant relationship found between pre-service EFL teachers' CK levels and genders.

The influence of age on pre-service EFL teachers' TPACK competency is another interest in the study at hand. In the context of this study, it was found that age does not play a significant role in determining overall TPACK competency levels, suggesting that pre-service EFL teachers are capable of developing the necessary skills and knowledge for effective technology integration in English language teaching, regardless of their age. In contrast, Lee and Tsai (2010) found that older teachers revealed lower levels of TPACK competency. However, a considerable number of studies are in accord with the findings of the current study. For instance, Burmabıyık (2014) also found similar results in a study that examined

the impact of factors such as gender, age, seniority, academic major, level of education, proficiency in technology use, access to technology, and the number of in-service training sessions on the TPACK levels of in-service teachers. In addition, Hosseini and Kamal (2013) also discovered that TPACK competency levels of pre- and in-service teachers were not influenced by their ages. It is also important to note that this does not rule out the possibility of age-based differences in specific TPACK sub-components. For instance, in the current study, it was found that the pre-service EFL teachers older than 24 years of age reported lower scores in CK, suggesting that they have a weaker command of the English language than their younger counterparts. This finding could be attributed to various factors such as the fact that older pre-service teachers may have had fewer opportunities for exposure to the English language due to limited resources before the advent and widespread accessibility of the Internet. In addition, even though it is not statistically significant, a linear difference in PK scores was also found in this study in favor of older pre-service teachers. This trend suggests that age may play a role in the development of PK, potentially due to increased life experiences and maturity. However, the differences in PK scores are not statistically significant enough to eliminate the possibility of random variance. In conclusion, pre-service EFL teachers' age seems to have no significant influence on their overall TPACK competencies, with an exception on the CK sub-component. The influence of age on pre-service EFL teachers' PK may need further investigation. A number of other studies in the literature also found component-wise differences in accordance with the participants' ages (Cheng, 2017; Chuang & Ho, 2011; Koh & Chai, 2011).

The influence of computer experience on pre-service EFL teachers' TPACK competency is also investigated in the current study. The findings revealed that computer experience plays a decisive role in determining overall TPACK competency levels. The pre-service EFL teachers with more computer experience revealed remarkably higher scores, especially in TK. In a similar vein, Yavuz-Konokman et al. (2013) conducted a study with the goal of examining the TPACK perceptions of pre-service primary education teachers, specifically focusing on their use of technology, access to technology, and interest in new technologies. The findings from this study indicated that the teachers who reported high levels of technology usage, had good access to technology, and showed a keen interest in new technologies, tended to perceive higher TPACK scores than their counterparts.

In addition, Altun (2013) conducted a study to explore the TPACK competencies of in-service teachers and how these competencies were influenced by various factors, the usage of ICT resources and educational software being one of them. In Altun's (2013) study, it was found that access to the Internet and an ICT lab in the school, and the use of educational technologies positively influence the teachers' TPACK competencies. In a similar vein, Burmabıyık (2014) explored the impact of various factors, such as technology usage, on in-service teachers' TPACK competency levels. It was found that teachers who are proficient in using technologies had better TPACK scores, therefore, revealing a positive correlation between computer experience and TPACK. These findings indicate that computer experience seems to play an influential role in determining TPACK competency levels. However, the current study revealed that the relationship between pre-service teachers' computer experience and their PK and PCK competencies is not straightforward, and rather complex since the participants with the least computer experience revealed the highest PK and PCK scores. Hence, there might be a need for further investigation in this regard.

In addition to the influence of computer experience, the influence of pre-service EFL teachers' years of education in the program on their TPACK competency is also analyzed. The year of education can be associated with the accumulation of knowledge and skills over time, which may impact the development of TPACK competency notably. In terms of overall TPACK competency, it was found that pre-service teachers in their later years of education reported higher scores, revealing a relationship between pre-service EFL teachers' TPACK competency levels and their years of education in the program. Even though almost all components reveal a year-by-year difference in scores, the majority of these differences are not statistically significant. However, a rather noteworthy difference in scores was observed in the TK component, in favor of those in their later years. This finding implies that the undergraduate program is influential in terms of improving pre-service EFL teachers' TK competencies. This observation is further supported by the majority of the interviewees, who highlighted the substantial impact of technology-oriented courses such as Instructional Technologies and CALL on their TK development. Regarding the influence of the grade levels of pre-service teachers, similar results were found in other studies (Kartal & Afacan, 2017; Sancar-Tokmak et al., 2013). In these studies,

Sancar-Tokmak et al. (2013) found that pre-service teachers in their later years scored higher in TK while Kartal and Afacan (2017) investigated pre-service science teachers' TPACK competencies and how these competency levels were influenced by demographic variables, grade level being one of them. The study revealed higher TK, CK, and TPACK scores for those in higher grades, revealing a component-wise relationship between TPACK competency levels and participants' years of education in their program. The current study, in conclusion, indicates that there is a year-by-year improvement in TPACK competencies, but the differences in the scores are not statistically significant enough. Thus, there is a need for further investigation to eliminate the possibility of chance and random variance.

In conclusion, this section has illuminated the nuanced influences of demographic variables on pre-service EFL teachers' TPACK competency levels. While gender and age were found to impact specific sub-components of TPACK, they did not significantly influence overall competency. Computer experience, however, was a decisive factor in overall TPACK competency particularly in TK. The year of education in the program was also revealed to have an influence on overall TPACK competency of pre-service teachers, suggesting the cumulative effect of knowledge and skills over time. Despite these findings, the majority of differences in scores were not statistically significant, indicating a need for further investigation. These insights underscore the multifaceted nature of TPACK competency and highlight the importance of a holistic approach in teacher education that considers a range of demographic variables.

## 6. CONCLUSION

### 6.1. The Summary

This study aimed to investigate the Technological Pedagogical Content Knowledge (TPACK) of pre-service EFL teachers and the relationship between demographic variables and pre-service teachers' perceived TPACK competencies. The research was conducted using a mixed-methods approach, combining quantitative and qualitative data. The sample consisted of a total of 215 pre-service EFL teachers and five teacher educators in an undergraduate English Language Teaching program at a state university in Turkey. The TPACK-EFL scale (Başer et al., 2016) and a demographic background questionnaire were used to collect the quantitative data while semi-structured interviews were conducted to gather qualitative insights. The quantitative data were first analyzed through descriptive statistics to identify the participants' TPACK levels and demographic backgrounds. The Shapiro-Wilk test was used to analyze the distribution of the data, which revealed that the data were not distributed normally. Consequently, nonparametric tests, namely Mann-Whitney U for the gender variable and Kruskal-Wallis for the rest of the variables, were used to determine if demographic variables influence pre-service EFL teachers' TPACK levels. The qualitative data were collected through semi-structured interviews with five teacher educators and 14 pre-service teachers, excluding freshman-year students, as they had not yet received enough pedagogical training to properly answer the interview questions. The interview recordings were transcribed and used to explain the statistical results obtained through quantitative data with more in-depth comments.

The findings of the study indicated that pre-service EFL teachers generally have a strong overall TPACK competency, with some variations across the sub-components and among individuals. The undergraduate program was found to be relatively sufficient in terms of preparing pre-service EFL teachers not only to teach English effectively but also to integrate technology into their teaching practices.

The relationship between demographic variables and pre-service EFL teachers' perceived TPACK competencies was also investigated. The findings suggest that gender and age variables were found to influence only specific sub-components of TPACK while having no statistically significant influence on overall TPACK competency. Computer experience, on the other hand, was found

influential in determining pre-service EFL teachers' TPACK competencies. In addition, the year of education variable revealed linear differences in pre-service EFL teachers' TPACK levels, but such differences were not statistically significant.

## **6.2. Implications**

Based on the findings of this study, several implications can be drawn for the field of English Language Teaching, particularly in the context of pre-service teacher education:

### **6.2.1. Enhancing Personal Interest in Technology**

The study suggests that fostering personal interest in technology among pre-service teachers could be beneficial. This could involve showcasing innovative uses of technology in teaching, providing opportunities for hands-on experience with different technologies, or integrating more technology-related topics into the curriculum. Similarly, in Koçoğlu's (2009) study, all participants highlighted how their educators demonstrated the use of technology for educational purposes and how this inspired them to incorporate technology into their own teaching, which highlights the potential benefits of demonstrating the use of technology in education.

### **6.2.2. Providing More Practice Opportunities**

One of the main challenges highlighted in the undergraduate program was the limited number of opportunities to practice teaching. As stated by some of the pre-service teachers and teacher educators, the undergraduate program is sufficient when it comes to creating the theoretical foundation required for teaching English effectively. Nevertheless, the majority of the participants highlighted the lack of practice opportunities and advocated for more practice teaching courses in the earlier years. Therefore, more practice opportunities should be provided to the students (Daloğlu, 2006; Seferoğlu, 2006).

### **6.2.3. Revising Technology-Related Courses**

The content of technology-related courses seems to need attention as the findings suggest a need for a more comprehensive introduction to the basics of technology. This includes basic terminology, troubleshooting common problems,

and the basic principles of how digital technologies work. Several studies in the literature underlined the positive influence of technology-oriented courses in undergraduate programs in terms of enhancing pre-service teachers' technology-integration attitudes and capabilities (Dinçer, 2015; Graham et al., 2009; İşler & Yıldırım, 2018; Koçoğlu, 2009; Kurt et al., 2013).

In conclusion, the study underscores the pivotal role of teacher education programs in equipping pre-service teachers with the necessary skills for the digital era while emphasizing the necessity of continuous development. This concept of continuous improvement applies not only to the performance of pre-service teachers but also to the structure of undergraduate programs. It is crucial to regularly review and update these programs to ensure they are in line with the rapidly evolving technological era and the changing needs of learners (Coşgun-Ögeyik, 2009; Karakaş, 2012). This way, it can be ensured that future teachers are well-equipped and ready to face the challenges of the digital era.

### **6.3. Limitations and Recommendations for Further Research**

The study at hand had a number of limitations, therefore, recommendations for further research will be given in this section. First of all, the current study was conducted with a limited number of participants from a single university in Turkey. Future research could benefit from a larger and more diverse sample size, including pre-service EFL teachers from different universities, and even countries. This would provide a broader perspective on the TPACK competencies of pre-service EFL teachers and the influence of demographic variables.

Secondly, this study was cross-sectional, providing only the TPACK competencies of pre-service EFL teachers at a specific point in time. Future research could employ a longitudinal design to track the development of TPACK competencies over time, which would provide insights into how these competencies evolve throughout the teacher education program.

Moreover, while this study found that demographic variables do not significantly influence overall TPACK competency, they do affect certain TPACK sub-components. Additionally, some differences in scores were observed that are not straightforward and relatively complex. Future research could delve deeper into these relationships, investigating why and how specific demographic variables influence certain aspects of TPACK competency.

In addition, the current study focused only on pre-service EFL teachers. However, the role of teacher educators in shaping pre-service teachers' TPACK competencies is also crucial. Future research could explore this aspect, investigating how teacher educators' own TPACK competencies and teaching practices influence the development of pre-service teachers' TPACK.

The study also revealed that some pre-service teachers faced various challenges with online education during the COVID-19 pandemic, which may have affected their TPACK development. Future research could explore strategies for enhancing TPACK development in online learning environments, which is particularly relevant given the increasing use of technology in education.

Finally, some participants expressed a desire for more practice-oriented learning. Future research could investigate the impact of incorporating more practical experiences, such as developing lesson plans, or classroom management simulations on the development of pre-service EFL teachers' TPACK competencies.

These recommendations aim to address the limitations of the current study and provide directions for future research to further our understanding of pre-service EFL teachers' TPACK competencies and the factors influencing them.

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## 8. APPENDICES

### APPENDIX 1: DEMOGRAPHIC BACKGROUND QUESTIONNAIRE

#### DEMOGRAFİK BİLGİ ANKETİ

Değerli Öğretmen Adayı,

Bu ankete katılım tamamen gönüllülük esasına dayanmaktadır ve çalışmadan elde edilecek veriler sadece bilimsel amaçlı kullanılacaktır. Lütfen anketteki maddeleri dikkatli bir şekilde okuyup ilgili yerleri doldurunuz. Katkılarınız için şimdiden çok teşekkürler.

Yaşınız? \_\_\_\_\_

Cinsiyetiniz? \_\_\_\_\_

Öğrenim yılınız? ☐ 1 ☐ 2 ☐ 3 ☐ 4

Yaklaşık olarak kaç yıldır bilgisayar kullanıyorsunuz?

☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16 ve üzeri

Şu anda öğrenim görmekte olduğunuz döneme kadar eğitimde teknoloji kullanımı ile ilgili kaç ders aldınız?

\_\_\_\_\_

Aşağıdaki derslerden hangilerini aldınız? Lütfen işaretleyiniz.

- ☐ Bilişim Teknolojileri
- ☐ Öğretim Teknolojileri
- ☐ Açık ve Uzaktan Öğrenme
- ☐ Medya Okuryazarlığı

## APPENDIX 2: TPACK-EFL SCALE

|    |                                                                                                                                | Hiç uygun değil | Çok az uygun | Biraz uygun | Oldukça uygun | Çok uygun |   |   |   |   |
|----|--------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------------|---------------|-----------|---|---|---|---|
| 1. | Temel teknoloji terimlerini (işletim sistemi, hard disk, kablosuz ağ, sanal bellek, vb.) doğru bir şekilde kullanabilirim.     | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 2. | Program kurmak ve internet bağlantısı kurmak gibi ayarları yapabilirim.                                                        | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 3. | Bilgisayar çevre birimlerini (yazıcı, mikrofon, projeksiyon, vb.) kullanabilirim.                                              | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 4. | Olağan teknolojik sorunları (yazıcıdan çıktı alamama, internet bağlantısının kesilmesi, vb.) kendim çözebilirim.               | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 5. | Projektör, tepegöz ve akıllı tahta gibi dijital sınıf ekipmanlarını kullanabilirim.                                            | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 6. | Ofis uygulamalarını (Word, PowerPoint, vb.) ileri düzeyde kullanabilirim.                                                      | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 7. | Metin, resim, ses, video ve animasyon gibi bilgi kaynaklarını kullanarak çoklu ortam (video, web sitesi, vb.) oluşturabilirim. | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 8. | İşbirliği yapılabilecek sanal ortamları (wiki, edmodo, 3B sanal ortamlar, vb.) amaçlarım doğrultusunda kullanabilirim.         | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 9. | Amacıma uygun olabilecek programları ve dijital araçları kullanmayı öğrenebilirim.                                             | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |

## APPENDIX 2 (Continued)

|     |                                                                                                                                  | Hiç uygun değil | Çok az uygun | Biraz uygun | Oldukça uygun | Çok uygun |   |   |   |   |
|-----|----------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------------|---------------|-----------|---|---|---|---|
| 10. | Duygu ve düşüncelerimi İngilizce konuşarak ifade edebilirim.                                                                     | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 11. | Duygu ve düşüncelerimi İngilizce yazarak ifade edebilirim.                                                                       | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 12. | İngilizce yazılmış bir metni telaffuz kurallarına uyarak okuyabilirim.                                                           | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 13. | İngilizce yazılmış bir metinde ifade edileni anlayabilirim.                                                                      | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 14. | Ana dili İngilizce olan birini rahatlıkla anlayabilirim.                                                                         | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 15. | Öğrenme ortamına uygun öğretim yöntem ve teknikleri kullanabilirim.                                                              | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 16. | Öğrencilerin gelişim düzeylerine uygun öğrenme ortamları hazırlayabilirim.                                                       | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 17. | Öğrencilerin öğrenmelerini bedensel, zihinsel, duygusal, sosyal ve kültürel farklılıklarına uygun bir şekilde destekleyebilirim. | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 18. | Öğrencilerin öğrenmelerini desteklemek amacıyla okul paydaşları (öğrenci, veli, öğretmenler, vb.) ile işbirliği yapabilirim.     | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 19. | Mesleki gelişimim ile ilgili çalışmalarımın edindiğim deneyimi öğretim sürecine yansıtabilirim.                                  | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 20. | Öğrencilerin kendi başlarına öğrenmelerini desteklemek amacıyla ders dışında da öğrenmeye güdüleyebilirim.                       | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |

## APPENDIX 2 (Continued)

|     |                                                                                                                                                           | Hiç uygun değil | Çok az uygun | Biraz uygun | Oldukça uygun | Çok uygun |   |   |   |   |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------------|---------------|-----------|---|---|---|---|
| 21. | Ders esnasında sınıf yönetimine hâkim olabilirim.                                                                                                         | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 22. | Öğrencilerin öğrenme süreçlerini değerlendirebilirim.                                                                                                     | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 23. | Öğrencilerin İngilizce dil becerilerini geliştirmelerini, uygun pedagojik yöntem ve teknikler kullanarak destekleyebilirim.                               | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 24. | Öğrencilerin dil becerilerini geliştirecek nitelikte müfredata uygun etkinlikler hazırlayabilirim.                                                        | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 25. | Öğrencilerin İngilizce dil seviyelerine göre var olan ders planını uyarlayabilirim.                                                                       | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 26. | Farklı konularla ilgili bilgi ve düşüncelerimi çoklu ortamlardan (video, slayt gösterisi, vb.) yararlanarak İngilizce ifade edebilirim.                   | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 27. | Çok uluslu toplulukların yer aldığı ortamlara uzaktan katkıda bulunabilmek için bilişim teknolojilerinden (Web konferans yazılımı, vb.) yararlanabilirim. | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 28. | Yabancı uyruklu kişilerle sanal ortamlar (second life, wiki, vb.) aracılığı ile ortak çalışma yürütebilirim.                                              | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 29. | Öğrencilerin bireysel öğrenme ihtiyaçlarına öğretim teknolojilerini kullanarak yanıt verebilirim.                                                         | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 30. | Öğrencilerin yasal, etik, telif hakkına saygılı ve güvenli bir şekilde bilişim teknolojilerini kullanabilmeleri için onlara rehberlik edebilirim.         | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 31. | Öğretim teknolojilerini (sanal tartışma ortamları gibi) kullanarak öğrencilerin üst düzey düşünme becerilerini geliştirmelerini destekleyebilirim.        | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |

## APPENDIX 2 (Continued)

|                                                                                                                                                   | Hiç uygun değil | Çok az uygun | Biraz uygun | Oldukça uygun | Çok uygun |   |   |   |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------------|---------------|-----------|---|---|---|---|
| 32. Derslerimde öğretim teknolojilerini kullanırken sınıf yönetimine hâkim olabilirim.                                                            | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 33. Hangi kazanımları bilişim teknolojilerinden yararlanarak vereceğime karar verebilirim.                                                        | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 34. Bilişim teknolojilerini kullanarak öğrencilerin öğrenimlerini destekleyecek materyal geliştirebilirim.                                        | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 35. Öğrencilerin öğrenimlerini desteklemek amacıyla video, web sitesi gibi çoklu ortamlardan yararlanabilirim.                                    | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 36. Öğrencilerin İngilizce öğrenmelerini desteklemek için sanal işbirliği ortamlarından (wiki, 3B sanal ortamlar, vb.) yararlanabilirim.          | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 37. Öğrencilerin Bilişim teknolojilerini kullanarak (eğitim yazılımları vb.) kendi başlarına dil becerilerini geliştirmelerini destekleyebilirim. | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 38. Web 2.0 araçlarını (animasyon, dijital hikâye araçları, vb.) öğrencilerin dil becerilerini geliştirmek için kullanabilirim.                   | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |
| 39. İngilizce öğretim sürecini sürekli iyileştirmek için dijital araç ve kaynaklardan yararlanarak mesleki gelişimimi destekleyebilirim.          | 1               | 2            | 3           | 4             | 5         | 6 | 7 | 8 | 9 |

### APPENDIX 3: SEMI-STRUCTURED INTERVIEW QUESTIONS (PRE-SERVICE TEACHERS)

1. Genel anlamda **teknolojik bilginizi** nasıl değerlendiriyorsunuz (örn. projeksiyon cihazı gibi farklı dijital araçları kullanabilme)?
2. **Alan bilginizi** nasıl değerlendiriyorsunuz (örn. günlük konuşmalar yapmak için İngilizceyi kullanabilme, sözlü İngilizceyi kolayca anlayabilme)?
3. **Pedagojik bilginizi** nasıl değerlendiriyorsunuz (örn. bulunduğunuz öğrenme ortamına göre çeşitli öğretim tekniklerini kullanabilme, öğrencilerin bireysel farklılıklarına göre öğrenmelerini destekleme)?
4. **Pedagojik alan bilginizi** nasıl değerlendiriyorsunuz (örn. öğrencilerinizin dil yeterlilik düzeyine ve/veya dil ihtiyaçlarına göre bir ders planı geliştirebilme)?
5. **Teknolojik alan bilginizi** nasıl değerlendiriyorsunuz (örn. herhangi bir konuyu Reddit gibi platformlarda İngilizce kullanarak tartışabilme)?
6. **Teknolojik pedagojik bilginizi** nasıl değerlendiriyorsunuz (örn. Quizlet üzerinden bir kısa sınav gibi dijital öğrenme materyalleri tasarlayabilme)?
7. **Teknolojik pedagojik alan bilginizi** nasıl değerlendiriyorsunuz (örn. İngilizcede günlük rutinler konusunu öğretmek için Scratch kullanarak interaktif bir hikaye hazırlamak)?

#### APPENDIX 4: SEMI-STRUCTURED INTERVIEW QUESTIONS (TEACHER EDUCATORS)

1. Genel anlamda öğrencilerinizin **teknolojik bilgisini** nasıl değerlendiriyorsunuz (örn. projeksiyon cihazı gibi farklı dijital araçları kullanabilme)?
2. Öğrencilerinizin **alan bilgisini** nasıl değerlendiriyorsunuz (örn. günlük konuşmalar yapmak için İngilizceyi kullanabilme, sözlü İngilizceyi kolayca anlayabilme)?
3. Öğrencilerinizin **pedagojik bilgisini** nasıl değerlendiriyorsunuz (örn. bulunduğunuz öğrenme ortamına göre çeşitli öğretim tekniklerini kullanabilme, öğrencilerin bireysel farklılıklarına göre öğrenmelerini destekleme)?
4. Öğrencilerinizin **pedagojik alan bilgisini** nasıl değerlendiriyorsunuz (örn. öğrencilerinizin dil yeterlilik düzeyine ve/veya dil ihtiyaçlarına göre bir ders planı geliştirebilme)?
5. Öğrencilerinizin **teknolojik alan bilgisini** nasıl değerlendiriyorsunuz (örn. herhangi bir konuyu Reddit gibi platformlarda İngilizce kullanarak tartışabilme)?
6. Öğrencilerinizin **teknolojik pedagojik bilgisini** nasıl değerlendiriyorsunuz (örn. Quizlet üzerinden bir kısa sınav gibi dijital öğrenme materyalleri tasarlayabilme)?
7. Öğrencilerinizin **teknolojik pedagojik alan bilgisini** nasıl değerlendiriyorsunuz (örn. İngilizcede günlük rutinler konusunu öğretmek için Scratch kullanarak interaktif bir hikaye hazırlamak)?