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**AN ANALYSIS OF TECHNOLOGY ACCEPTANCE MODEL (TAM) IN
DEVELOPING PRE-SERVICE EFL TEACHERS' WEB PEDAGOGICAL CONTENT
KNOWLEDGE (WPACK) AND CRITICAL DIGITAL LITERACY (CDL)**

MASTER OF ARTS THESIS

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September, 2022

APPROVAL PAGE

This is to certify that the thesis entitled “**An Analysis of Technology Acceptance Model (TAM) in Developing Pre-service EFL Teachers’ Web Pedagogical Content Knowledge (WPACK) and Critical Digital Literacy (CDL)**” prepared by Rabia ÖLMEZ (Student ID: 1918116001) was submitted in fulfilment of the requirement for the degree of Master of Arts in Foreign Language Education complies with the regulation of the Izmir Democracy University, Institute of Social Sciences and meets the accepted standards with respect to originality.

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I hereby declare that all the information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all the material and results that are not original to this work.

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ÖZET

İngilizce Öğretmen Adaylarının Web Pedagojik İçerik Bilgilerinin ve Eleştirel Dijital Okuryazarlıklarının Geliştirilmesinde Teknoloji Kabul Modelinin İncelenmesi

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21. yüzyılda eğitim teknolojisinde köklü değişiklikler yaşanırken, öğretmen adaylarının eğitimi, eğitimcilerin ve öğretmenlerin dijital okuryazar, yeni teknolojileri kullanabilen ve kabul edebilen ve web araçlarını yetkin bir şekilde kullanabilen kişiler olarak aranmasıyla önem kazanmıştır. Bu bağlamda, mevcut nicel odaklı karma yöntem tezi, Teknoloji Kabul Modelinin (TAM) hizmet öncesi İngilizce öğretmenlerinin Eleştirel Dijital Okuryazarlığını (CDL) ve Web-Pedagojik İçerik Bilgilerini (WPACK) geliştirmedeki rolünü araştırmıştır. Araştırma, 2020-2021 eğitim-öğretim yılında Türkiye'de bir devlet üniversitesinin İngilizce Öğretmenliği Bölümü'nde 94 katılımcı ile gerçekleştirilmiştir. Ayrıca, bu araştırma yukarıda bahsedilen çerçeveler ve yapılar arasında birtakım değişkenler açısından statik olarak anlamlı farklılıklar olup olmadığını da analiz etmiştir. Veri toplamak için, sonunda üç açık uçlu soru bulunan üç çevrimiçi anket uygulanmıştır. Analiz sonuçları SPSS 27.0 yardımıyla hesaplanmış, ANOVA ve T-testi analizleri yapılmıştır. Öte yandan, pandemi kısıtlamaları nedeniyle niteliksel veriler beklenen düzeyde toplanamamıştır. Mevcut tez, Türkiye'deki İngilizce öğretmen adaylarının teknoloji kabulü ve eleştirel dijital okuryazarlık düzeylerinin orta düzeyde, web pedagojik içerik bilgi düzeylerinin ise yüksek olduğunu ortaya koymuştur. Ek olarak, T-test analiz sonuçları, katılımcıların teknoloji kabulü, web pedagojik içerik bilgisi ve eleştirel dijital okuryazarlık düzeyleri arasında yaş, cinsiyet ve kişisel bilgisayar sahipliği açısından anlamlı bir farklılık olmadığını göstermiştir. Nitel veri sonuçları, teknoloji ve web ile tanışmanın, öğretmen eğitim programlarında ve müfredatlarında farkındalıklarını artırmaya yardımcı olacak değişikliklerin, gelecekteki öğretimlerini bu yönde geliştirebileceğini ortaya koyarak, katılımcıların yukarıda belirtilen kavramlara ilişkin algılarına daha derin bir bakış açısı sağlamıştır.

Anahtar kelimeler: öğretmen eğitimi, İngilizce öğretmen adayları, teknoloji kabulü, web pedagojik içerik bilgisi, eleştirel dijital okuryazarlık

ABSTRACT

An Analysis of Technology Acceptance Model (TAM) in Developing Pre-service EFL Teachers' Web Pedagogical Content Knowledge (WPACK) and Critical Digital Literacy

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As 21st century has witnessed drastic changes in educational technology, the education of pre-service teachers has gained significance in that educators and teachers are sought to be digitally literate, capable of using and accepting new technologies and utilizing web tools competently. In this vein, the current quantitative driven-mix method master thesis investigated the role of Technology Acceptance Model (TAM) in developing pre-service EFL teachers' Critical Digital Literacy (CDL) and their Web-Pedagogical Content Knowledge (WPACK). The research was conducted at the department of English Language Teaching of a state university in Turkey with 94 participants during 2020-2021 academic year. Additionally, this research also analyzed the statistically significant differences among frameworks and constructs regarding several variables. Three online questionnaires with three open-ended questions in the end were operated for data collection. The results were calculated through SPSS 27.0, and analyses by ANOVA and T-tests were conducted. However, due to the restrictions of the pandemic, qualitative data was not collected at an expected level. As a result, this thesis revealed that the Turkish pre-service EFL teachers' levels of technology acceptance and critical digital literacy were moderately high whereas their web pedagogical content knowledge levels were detected to be high. Additionally, T-test results highlighted that there was no significance difference in terms of participants' technology acceptance, WPACK and CDL levels regarding age, gender, and personal computer ownership. Qualitative data results provided a deeper insight onto participants' perceptions on related concepts by revealing that familiarization with technology and web, modifications in teacher education programs and their curricula to help raise their awareness could improve their future teaching in this vein.

Key words: teacher education, EFL pre-service teachers, technology acceptance, web pedagogical content knowledge, critical digital literacy

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LIST OF ABBREVIATIONS

ATU:	Attitudes Towards Use
AWBT:	Attitudes Toward Web-based Teaching
BI:	Behavioral Intention
CA:	Computer Attitudes
CAE:	Computer Assisted Education
CALL:	Computer Assisted Language Learning
CDL:	Critical Digital Literacy
CWK:	Content Web Knowledge
EDTECH(s):	Educational Technologies
EFL:	English as a Foreign Language
ESL:	English as a Second Language
FC:	Facilitating Conditions
GWK:	General Web Knowledge
ICT:	Information and Communication Technologies
ICT-TPCK:	Information and Communication Technologies- Technological Pedagogical Content Knowledge
IoT:	Internet of Things
IT:	Information Technologies
PCK:	Pedagogical Content Knowledge
PCKg:	Pedagogical Content Knowing
PEU:	Perceived Ease of Use
PU:	Perceived Usefulness
PWK:	Pedagogical Web Knowledge
SN:	Subjective Norm
TAM:	Technology Acceptance Model

TAM2:	Technology Acceptance Model 2
TAM3:	Technology Acceptance Model 3
TCK:	Technological Content Knowledge
TPACK:	Technological Pedagogical Content Knowledge
TPK:	Technological Pedagogical Knowledge
TRA:	Theory of Reasoned Action
UTAUT:	Unified Theory of Acceptance and Use of Technologies
UTAUT2:	Unified Theory of Acceptance and Use of Technologies 2
WCK:	Web Content Knowledge
WebPack:	Web Pedagogical Content Knowledge
WK:	Web Knowledge
WPACK:	Web Pedagogical Content Knowledge
WPK:	Web Pedagogical Knowledge

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CHAPTER ONE

1. INTRODUCTION

The influx of technological innovations since the beginning of the 20th century reformed people's lives enormously in various ways. One of the most remarkable reformations brought by technological developments included educational technologies (EdTechs), which necessitated the evaluation of former teaching methods, tools, teachers' professional development and teacher education. Thus, the transmission of information through technology became one of the most significant tasks to be accomplished by teachers. The requirements for teachers' successful technology integration in their teaching broadened day by day as more recent technological developments emerged. Consequently, the question of "*What makes a good teacher in the 20th century?*" originated in educational pedagogy.

Numerous frameworks, approaches, pedagogies, and theories were proposed to explain and build on the previous research and paradigms to seek the answers to this question. Even the ones emerged and utilized in other disciplines were revised and adapted into educational pedagogy because teachers were considered as a key for successful technology integration in teaching (Teo, 2011). Therefore, the research field on this subject matter diverged enormously. Some researchers focused on the qualifications and knowledge teachers ought to have for successful technology integration (Angeli & Valanides, 2008; Mishra & Koehler, 2006; Shulman, 1986), whereas some others sought for the answers of what led individuals to accept a specific technology (Davis, 1985; Davis et al., 1989; Davis, 1993; Venkatesh & Davis, 1996; Venkatesh & Davis, 2000; Venkatesh, 2000; Venkatesh et al., 2003, Venkatesh & Bala, 2008; Venkatesh et al., 2012).

As the spectrum of the research field in technology acceptance and teacher knowledge diversified within multiple contexts and disciplines, more recent research topics appeared constantly. However, there was a common agreement on the significance of technology in teaching among authorities and other institutions, such as it was reported that technology ought to be an inseparable part of teaching and learning; thus, it must be enhanced in every step of teacher training globally (ISTE, 2000). That is why, at the end of the 20th century, the world witnessed so many technological innovations leading to the basic premise that a life without technology became almost impossible. It, then, transformed the way people could behave, think, and live, along with all scientific areas and educational technologies (Rahimi & Pourshahbaz, 2018).

One of the most substantial opportunities offered by these technologies was to be able to access digital information on the Internet with several web tools by means of a single click. The Pew Internet and American Life Project (2009) reported that 93% of young people used Internet, and 68% of them utilized online instant messaging, while 54% read blogs and 14% regularly posted blogs. It was also reported that 55% used Wikipedia and 73% used social network sites to access information, above 25% downloaded podcasts, and 75% viewed videos on video-sharing sites. Consequently, the concept of “literacy” took on a new meaning in the 21st century, underlining the fact that being literate did not only correspond to read and write but also to be able to use new technologies (European Commission, 2007). As a result, the research field in education gravitated towards this subject matter thoroughly.

As the 21st century has become the era in which people cannot lead their lives without technology, areas of research have inclined towards the effective use of technologies in education in several disciplines. In 2008, the International Society for Technology in Education (ISTE, 2008) defined the standards for in- and pre-service teachers’ computer competence for technology integration which involved the potent use of technologies in teaching, and the promotion of digital citizenship to develop students’ creativeness and enhance recognition. Thus, the idea that teaching without technological resources is less effective (Ertmer & Ottenbreit-Leftwich, 2010) brought along the investigation of teachers’ knowledge, technology acceptance, and digital literacies.

One of the disciplines focusing on the significance of technology integration and effective use of it both by teachers and learners is language education. The term Computer Assisted Language Learning (hereafter: CALL), is defined as a language learning process in which learners use computers and improve their language proficiency, has emerged as a new research area (Beatty, 2004). The word computer in this definition does not only refer to electronic devices but also to all technology types that can be utilized in teaching and learning. Hence, the effective use of digital technologies in language education is acknowledged to have a facilitating impact on learners’ language learning processes by enhancing their critical thinking and problem-solving skills (Blake, 2013).

Since the way of preparing teachers for teaching in the era of technology has its roots in teacher education institutions, which “serve as key change agents in transforming education and society” (UNESCO, 2005, p. 12), there is a need for the investigation of pre-service language teachers’ technology acceptance, their knowledge levels for technology integration and their critical digital literacies so as to provide an insight for teacher educators and other

authorities on the accomplishment of effective use and implementation of digital and web technologies in language education.

1.1. Background of the Study

The background of the study comprises of three frameworks, namely, the Technology Acceptance Model (hereafter: TAM) by Davis (1986), Web Pedagogical Content Knowledge Framework (hereafter: WPACK) by Lee and Tsai (2010), and the framework named “*The five resources of critical digital literacy: a framework for curriculum integration*” by Hinrichsen and Coombs (2013). All these frameworks were first proposed in different disciplines separately with an attempt to explore different topics, yet they were adapted to the educational settings within different contexts by previous researchers. Thus, the scope of the frameworks could be regarded as interdisciplinary in nature.

Firstly, TAM was introduced by Davis in 1986 to reveal the major stimulating factors of acceptance of a technology by its users in information systems. Since 1970s, technology acceptance has been a research area drawing the attention of scholars in the business and information systems disciplines (Teo, 2014). Davis (1986) proposed that there were three main contributing factors of a technology acceptance, which were ‘*perceived usefulness*’, ‘*perceived ease of use*’, and ‘*attitudes towards use*’. These three factors were hypothesized to have a direct impact on the actual system usage. It was also highlighted in the model that the ‘*attitudes towards use*’ construct was affected by the other constructs, and ‘*perceived ease of use*’ had a direct influence on ‘*perceived usefulness*’. The first introduction of the TAM was followed by the development of several other TAM frameworks (Davis, 1993; Davis et al., 1989; Venkatesh, 2000; Venkatesh & Bala, 2008; Venkatesh & Davis, 1996; Venkatesh & Davis, 2000; Venkatesh et al., 2003; Venkatesh et al., 2012), adapted, developed, and revised with add-on constructs and their interrelationships over time. The name given to the model was revised and changed according to the inclusion and exclusion of certain constructs, too. For instance, it was named as TAM2 (Venkatesh & Davis, 2000), the model of Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), TAM3 (Venkatesh & Bala, 2008), and the model of UTAUT2 (Venkatesh et al., 2012).

The second framework, WPACK was first introduced by Lee et al. (2008) and developed by Lee and Tsai (2010) which originated from the combination of Pedagogical Content Knowledge (hereafter: PCK) framework of Shulman (1986) and Technological Pedagogical Content Knowledge (hereafter: TPACK) framework proposed by Mishra and Koehler (2006).

The PCK framework of Shulman referred to the relationships between content and pedagogical knowledge a teacher possessed and aimed at explaining the teachers' construction and adaptation of preliminary subjects or topics tailored to the learners' interests and abilities.

Following the reform of educational technology at the beginning of the 21st century, the knowledge types a teacher ought to possess was deemed to include '*technological knowledge*' too which gave rise to the proposal of TPACK by some scholars (Angeli & Valanides, 2009; Mishra & Koehler, 2006). As the inclusion of several web tools in education gained importance over time as a result of the emergence of multiple web tools and the proliferation of Internet in people's lives on a daily basis, Lee et al. (2008) asserted that the technological knowledge in the framework would be insufficient to represent the web knowledge itself, for the reason that the characteristics and attributes of web tools differed from the use of educational technologies, and the use of certain web tools necessitated the utilization of some technologies themselves. Hence, they proposed the WPACK framework which consisted of three areas of knowledge known as '*content*', '*pedagogy*' and '*web*' together with four knowledge bodies, Web Knowledge (WK), Web Pedagogical Knowledge (WPK), Web Content Knowledge (WCK) and Web Pedagogical Content Knowledge (WPACK).

Finally, the emergence of the Critical Digital Literacy as a concept was prompted by the importance attached to digital literacies and the significance of the digital tools' critical evaluation in the 21st century. Thus, the concept of CDL arose from the 'digital literacy' concept of Gilster (1997) and had divergent definitions together with broadened explanations in different settings. The most outstanding and recent one of these definitions and frameworks was certified by Hinrichsen and Coombs (2013) who were inspired by the CDL model of Luke and Freebody (1990). Their framework suggested that there were four resources framed as CDL: '*decoding*', '*meaning making*', '*using*' and '*analyzing*', and amplified the model further with a fifth resource- '*persona*'. They also marked in the framework that it was not a new-born model which was not under the influence of previous frameworks and hypotheses, but a type of compilation and evaluation of previous studies in lieu of the revised and adapted concepts.

Regarding the educational context, the U. S. Department of Education (USDOE, 2003) stated that "technology is now considered by most educators and parents to be an integral part of providing a high-quality education" (p. 3), and the technology integration in teaching was deemed to be mainly determined by teachers as being the key transmitters (Teo, 2014). Thus, the technology acceptance of both in- and pre-service teachers was regarded as a prominent research field for the promotion of successful technology integration in teaching. Additionally,

it was underlined in literature that teachers' former knowledge directed their future teaching (Bransford & Schwartz, 1999); hence, developing the knowledge of teachers for technology integration was opted by pre-service teacher education programs so that they could be potent at technology integration into their teaching (Mishra & Koehler, 2006). What's more, in terms of language education, the significance of interaction with native speakers of the target language was asserted to be a key component in that it provided authentic language interaction; thus, the sufficient and appropriate utilization of web tools by the teachers was recognized as a paramount research field (Hew & Brush, 2007). Apparently, the aforementioned concepts in teacher education has become a prominent research area with a great attention, which composes the offspring of this thesis together with the significance of the study.

1.2. Statement of the Problem

The diversity of the educational technologies might provide numerous opportunities for teachers' professional development and support teaching and learning process, as it is pointed that learners are more motivated when the lessons are embellished with some technological tools (Granito & Chernobilsky, 2012), and expressing, collaborating, and sharing are reinforced by web-based digital technologies as Youtube or other social media platforms. As noted by Kavaklı and Ölmez (2021):

“The changes in our perspectives have also molded our expectations about learning. The role of inter-active media on learning is now clearer through the utilization of mobile, virtual, augmented, and computed nature of multimodal learning environments. Besides, a myriad of Internet of Things (IoT) tools provides ubiquitous learning opportunities for learners of the twenty-first century.” (p. 284)

In addition, the use of web tools in language education may promote learning greatly since it contributes to the connection of people, which stimulates the interaction in the target language, and can support approaches based on interaction such as distance learning. Thus, the benefits and costs of technological innovation in education are not questionable as we live in a digital world (Instance & Kools, 2013).

Notwithstanding various favorable functions of educational technology and Internet, there are certain challenges they present which are noteworthy to discuss. First, an easy access to technological tools does not necessarily mean it will be used appropriately in teaching (Ertmer, 1999), and the utilization of these technologies appropriately and profitably hinges on some factors such as teachers' knowledge and expertise (Cowie & Jones, 2009). Moreover, the

diversity of the online available resources requires teachers to obtain critical thinking skills regarding online and digital sources to be able to decide on their credibility with pedagogic objective, which is pointed as an issue teachers struggle with (Lightfoot, 2019). Several studies in literature acknowledged that teachers' use of technologies revolved around their previous practices such as drills (Garrett, 2009; Lei, 2009; Teo et al., 2008), or there was hardly any use of it due to certain reasons such as not being familiar with the technology at a satisfactory level and fear of losing authority in class (Hixon & Buckenmeyer, 2009), anxiety (Ryan & Bagley, 2015) and fearfulness (Ertmer & Ottenbreit-Leftwich, 2010).

The second challenge opposed by innovative educational technologies is that there is no assurance of successful technology integration in pre-service teachers' future teaching. Even though today's teachers are regarded as "digital natives", they do not seem to discern the use of digital tools essentially (Heverly, 2007). In the same vein, it is also stated that there is a concern about effective integration of technologies in teaching even though pre-service teachers today are competent in communication and utilization of online interaction technologies (Lei, 2009; Ma et al., 2005). To confirm, pre-service teachers expressed that they did not feel ready for technology integration in their future teaching even after taking a methodology course (Tondeur et al., 2012), which highlighted the fact that effective use of digital and web tools in teaching context was not guaranteed by a stand-alone technology or methodology course in teacher education (Buss et al., 2015); henceforth, there has been a growing need for the investigation of what particularly promotes it.

In conclusion, the issue of what enhances pre-service teachers' potent and proper technology integration in their teaching is a growing concern in teacher education in the 21st century. Hence, there is a demand for such studies conducted on the explanation and analysis of these concepts, namely, technology acceptance, WPACK, and CDL of pre-service English as a Foreign Language (hereafter: EFL) teachers, in that it can provide a fresh insight into the factors having an impact on the reinforcement of future technology integration and appropriate use of digital technologies in future teaching. Thus, the main purpose of this thesis is to develop an understanding of TAM in developing Turkish pre-service EFL teachers' Web Pedagogical Content Knowledge (WPACK), Critical Digital Literacy (CDL), and the interplay among these three frameworks in relation to some certain variables which will be explained further.

1.3. Research Questions

This thesis addresses the following research questions:

1. What are the Turkish pre-service EFL teachers' levels of Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy?
 - 1.1. Is there a statistically significant difference of Technology Acceptance, WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of age?
 - 1.2. Is there a statistically significant difference of Technology Acceptance, WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of gender?
 - 1.3. Is there a statistically significant difference of Technology Acceptance and WPACK, and CDL levels Turkish pre-service EFL teachers in terms of owning a personal computer?
2. Is there a statistically significant relationship between Technology Acceptance and WPACK of Turkish pre-service EFL teachers?
3. Is there a statistically significant relationship between Technology Acceptance and CDL levels of Turkish pre-service EFL teachers?
4. Is there a statistically significant relationship between WPACK and CDL levels of Turkish pre-service EFL teachers?

1.4. Significance of the Study

The increase in the number of studies conducted on Web 2.0 technologies and teacher education in this regard has been quite intensive, mainly since teachers' role and capacity in the 21st century education has become significantly crucial for appropriate integration of technologies in developing countries (Zhang et al., 2016). The National Educational Technology Standards for Teachers (NETS-T) (2012) highlights the standards expected from teachers as they ought to "model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning" (Standard 3d). Thus, the quality of education is deemed to depend on the quality of the teacher (Waseka et al., 2016).

As the role of teacher is regarded to be critical for the competent use of educational technologies (Zhao et al., 2001), the way of overcoming the challenges encountered with technology integration is to train pre-service teachers during initial teacher education (Smarkola, 2008). The international educational organizations emphasize the significance of both in- and pre-service teacher training to meet the growing demands of technology integration in education (ISTE, 2008; Partnership for 21st Century Skills, 2010). Thus, preparation of pre-service teachers for future Internet and communication technology use in their teaching is essential (Funkhouser & Mouza, 2013). To accomplish this preparation, there is a need for

research on the concepts leading to effective and successful technology integration in education (Marcinkiewicz, 1993).

For the promotion of more desirable English language teaching, the expansion of digitization in teaching requires language teachers to be digitally literate (Miller, 2015) on the grounds that being a member of Internet generation does not necessarily induce the utilization of web technologies in teaching (Kennedy et al., 2008). Thus, the study of EFL teachers' technology integration in relation with other concepts having an impact on this process is a paramount requirement in the field of educational technologies and teacher education so that practitioners, teacher educators and authorities can make efforts for a better quality of teacher education.

To the very best knowledge of the researcher, no previous study in literature has investigated the role of TAM in developing EFL pre-service teachers in developing their WPACK and their CDL, neither globally nor in the Turkish context. However, there have been numerous studies investigating the role of the TAM in educational settings (Akar, 2019; Baturay et al., 2017; Çeçen, 2020; Hu et al., 2003; Kırmızı, 2014; Ma, 2005; Nah, 2009; Scherer et al., 2015; Scherer et al., 2018; Scherer et al., 2019; Smarkola, 2008; Teo et al., 2008; Teo, 2011; Teo, 2015; Teo et al., 2015; Teo, 2019; Teo & Schaik, 2009; Wong, 2013; Yih, 2009; Yih & Nah, 2009), and other studies conducted on TPACK and WPACK of in- and pre-service teachers in the Turkish context with different participants (Akgün, 2013; Arabacıoğlu & Dursun, 2014; Aydın et al., 2017; Bağcı & Atar, 2019; Basaran & Yalman, 2020; Birisci & Kul, 2019; Eren & Alkan, 2014; Gökçearsan et al., 2016; Gömleksiz, 2011; Gulten, 2013; Higde et al., 2014; Karalar & Altan, 2018; Korucu, 2017; Tuluk & Kepceoglu, 2019; Uysal & Gündoğdu, 2019; Yağcı, 2020; Yeşiltaş, 2016; Yurdakul, 2018). Still, there is no published data on the relationships of those three frameworks neither in EFL context nor in other Turkish educational settings. Thus, current thesis will generate a fresh insight into the development of pre-service EFL teachers who are more critically digital literate and competent in integrating technology and web-based tools in their teaching via developing high level of WPACK.

In conclusion, this thesis will contribute to the current literature and the practitioners specifically in the field of teaching English as a foreign language by providing an opportunity to advance our knowledge of the ways of effective technology integration in language education, factors contributing to the professional development of the EFL teachers, and their critical digital literacy levels. As this is preliminary to undertake an analysis of these three frameworks in the Turkish EFL context, it will make a major contribution to the growing

research field on teacher education by demonstrating the interrelations among the previously mentioned frameworks.



CHAPTER TWO

2. LITERATURE REVIEW

The overview of the aforementioned frameworks in the literature was provided under this section with sub-heading for each one of them.

2.1. Technology Acceptance Model (TAM)

The evolution of Technology Acceptance Model as a framework and modifications applied to the model in literature were discussed in this section.

2.1.1 The Original Technology Acceptance Model

There have been numerous frameworks and models in literature which were proposed to explain a user's acceptance of a computer system. The most prominent and phenomenal of these was the Technology Acceptance Model (TAM) introduced by Davis in 1985 in his doctoral thesis at the MIT Sloan School of Management. The core conception of this model was that a user's motivation to use a certain system was the main impetus of whether that system was going to be accepted or refused. The motivation to use a system was predicated to be influenced by the external stimulus corresponding to the features and capabilities of the system (Figure 1).

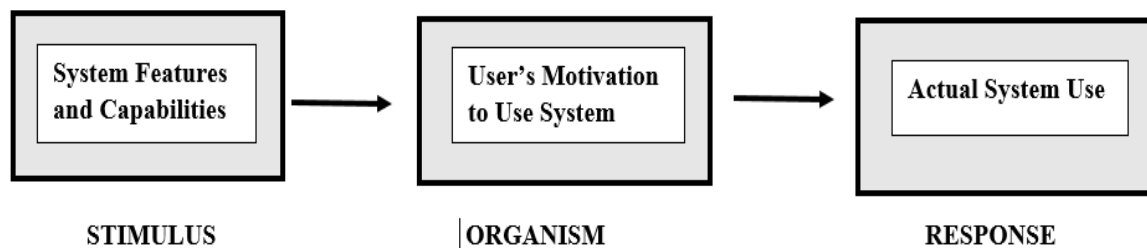


Figure 1: The conceptual model for technology acceptance, adapted from Davis (1985, p.10)

Following this conceptual framework, Davis built on his ideas and proposed the first Original TAM in 1986. He suggested that the user's attitude towards computer usage was mainly determined by three major constructs: '*perceived usefulness*' (hereafter: PU), '*perceived ease of use*' (hereafter: PEU) and '*attitude toward using*' (hereafter: ATU). The ATU construct was marked to be mainly affected by the PEU and PU constructs. Additionally, it was pointed that PEU was high likely to have a direct impact on PU whereas PU did not have that on PEU. Lastly, it was highlighted that these constructs were shaped according to system design characteristics shown in Figure 2 as X1, X2, and X3.

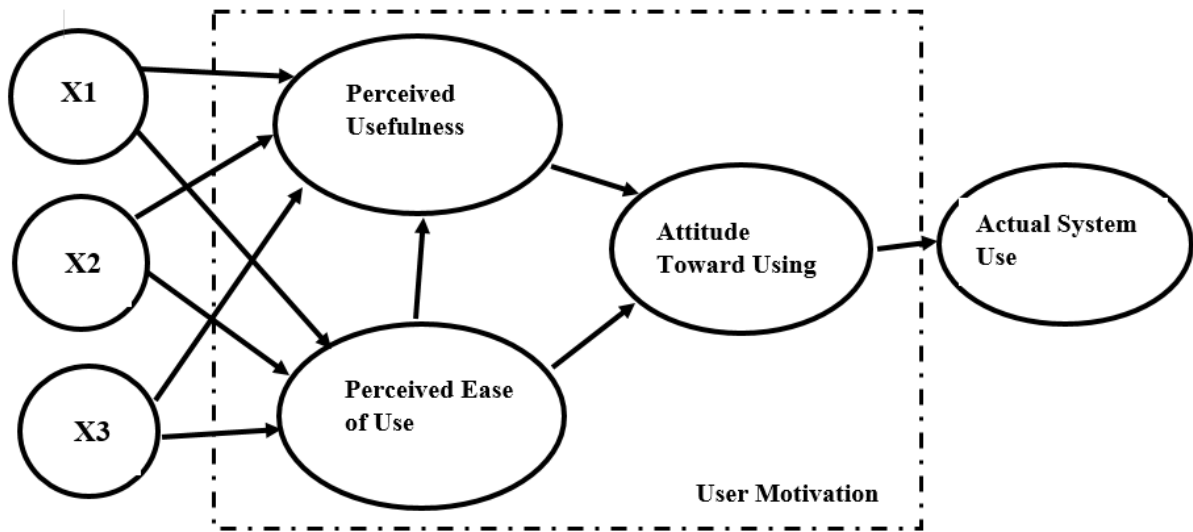


Figure 2: The original TAM, adapted from Davis (1986, p. 24)

According to Davis (1986), technology acceptance of persons is of critical importance in determining the failure or success of a given computer system and, the main determinant of this acceptance is the ATU of the individuals, and it is accompanied by PEU and PU. The origins of TAM have its roots in the Theory of Reasoned Action (hereafter: TRA) introduced by Fishbein and Ajzen (1975). Davis (1986) refined the essence of this theory and combined it with his own ideas leading to the emergence of this paradigm.

2.1.2. The Theory of Reasoned Action (TRA)

The original TAM originated from Fishbein and Ajzen's (1975) Theory of Reasoned Action. According to TRA, the behavioral intention of a user towards a system is mainly determined by their attitudes towards that system. Thus, it is hypothesized that intention is foreseen finest by behavior. The model asserts that volitional behaviors are influenced by behavioral intentions, and they are the outcomes of both the attitudes and the subjective norms linked with that behavior.

According to Fishbein and Ajzen (1975), '*attitude*' is defined as the feelings of an individual towards a specific behavior, and the '*attitudinal beliefs*' and '*outcome evaluations*' are substantive for the measurement of the attitudes. The second main construct "*subjective norm*" (hereafter: SN) is defined as the opinions of the individuals' significant others about whether they should perform that behavior. The TRA model in Figure 3 indicates that

‘*normative beliefs*’, which include the expectation of certain people or groups, and ‘*motivation to comply*’ are the factors constituting the SN construct.

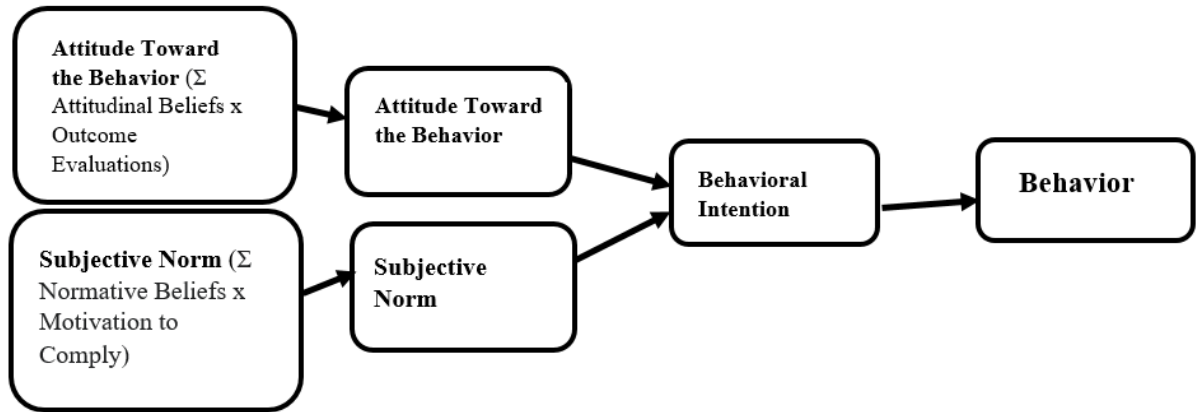


Figure 3: TRA, adapted from Fishbein & Ajzen (1975)

According to TRA, Fishbein and Ajzen (1975) proposed a formula to calculate the behavioral intention of an individual as follows:

$$BI = A_B(W_1) + SN(W_2)$$

In the formula, BI represents the behavioral intention to perform that behavior, A_B stands for the attitude towards the behavior, and SN corresponds to the subjective norm as indicated earlier. W_1 and W_2 represent the weights of these factors. Based on this formula, it is stipulated that the sum of the attitudes toward the behavior and the subjective norm comprises the behavioral intention of an individual which leads to the performance of actual behavior.

Davis (1986) also asserted that TRA would be applicable to illustrate that behavior but there were certain necessary adjustments to be made in TRA. In 1989, Davis argued that it could be possible the system could be perceived as useful leading to the intention to use that system without any attitudes. He added that attitude may not be crucial in the determination of intention since the usefulness as a factor might surpass the impact of attitudes on intention to use in several settings, such as workplace. Moreover, Davis et al. (1989) performed an analysis on the comparison of TRA and TAM and acknowledged that the implementation of TAM is much more effortless and less costly compared to TRA on the grounds that measurement of the ‘*beliefs*’ as a construct in TRA requires a range of salient belief to be formed, yet the construct is context-independent in TAM. On this wise, Davis added on the model by making changes and developed the first modified version of TAM.

2.1.3. The First Modified Version of TAM

Upgrading TRA with constructs, it was pointed that the system might be perceived as useful; however, when the system was too difficult to use, the usefulness of the system was outweighed by the factor of easiness (Davis, 1989). Thus, Davis eliminated the construct of SN from TRA model, and he centralized on determining two main constructs: PU, and PEU. Venkatesh and Davis (1996) asserted that “in order to be able to explain user acceptance and use, it is important to understand the antecedents of the key TAM constructs, perceived ease of use and usefulness.” (p. 743). These two factors, therefore, were remarked to be the most paramount constructs in explaining the technology acceptance (Chen & Chang, 2013), and described as follows:

- “Perceived usefulness; the degree to which a person believes that using that system will improve their performance or job.
- Perceived ease of use; the degree to which a person believes using that system will be easily performed both physically and mentally”. (Davis, 1985, p. 320)

The conception giving rise to the first modified version of TAM was that the PEU, PU and attitudes towards use (hereafter: ATU) affected behavioral intention (hereafter: BI) directly and indirectly. Besides, while both PEU and PU mutually affected ATU, PEU had a direct impact on PU implying that when the system was perceived as easy, it was likely to be perceived as useful, as well (Davis, 1989) which was also shown below in Figure 4.

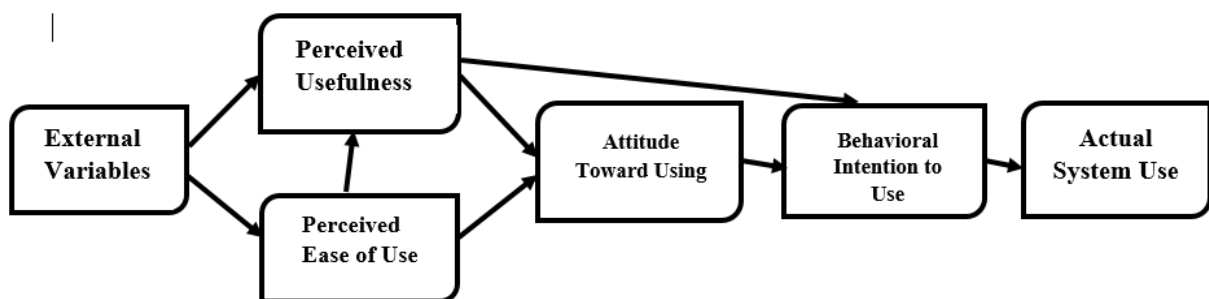


Figure 4: First modified version of TAM, adapted from Davis et al. (1989, p. 985)

Correlatively, Davis and Bagozzi (1992) conducted a study on the analysis of TAM in order to examine the conjoint direct and indirect effects of the two variables, namely PU and

PEU, and the regression analysis revealed that the relationship of actual system usage with PU was high whereas it remained low with PEU. This implied that users were able to handle with some difficulties they encountered while using the system if they perceived that the system's functionality was of critical importance. Yet, if there was no use or functionality in using that system, there was no amount of easiness that could compensate which emphasized the robustness of PU factor in the model (Davis & Bagozzi, 1992).

Following to this, Davis (1993) analyzed the direct and indirect effects of the PEU and PU variables retrospectively, and in contrast to what he presumed earlier, he concluded that PEU might have a direct impact on PU. He hypothesized that the main reason of this was PU was related to long term impact of a system's usage on a job performance (outcome). As an individual was likely to acquire while PEU was concerned with the process of using the system itself (process), it might have a greater impact on behavioral intention to use. Thus, it was speculated that a system's amount of usefulness fell short in explaining the behavioral intention of a user since the system was not used when it was perceived as difficult, which was also indicated in the model, as well.

Furthermore, the model underlines that individuals' PU and PEU were affected by certain external factors, such as training, computer self-efficacy, and system design characteristics (Davis, 1993). TAM with specified external factors foresaw utilization of technology and, also presented a justification of why a specific system might not be adopted in order that researchers might "pursue appropriate corrective steps" (Davis et al., 1989, p.985). Herein, Davis (1993) also suggested that there should be further studies conducted to detect the '*external variables*' affecting PU and PEU.

In search of external variables, the analysis of Davis et al. (1992) on the motivation factor within TAM uncovered that both extrinsic and intrinsic factors played a significant role in determining the behavioral intention to use a new technology. According to this analysis, when the individuals regarded a technology as useful, they had extrinsic motivation to use it, and when they had personal enjoyment using the system, they had intrinsic motivation to use it (Davis et al., 1992). On this basis, it might be suggested that when the system had a high level of perceived usefulness, it had more significant impact on behavioral intention than the ones with no enjoyment.

The significance of external variables was also acknowledged in literature. To illustrate, Mathieson (1991) claimed that TAM without external variables would solely illuminate on the

opinions of a user about a system but would not offer “specific information that can better guide system development” (p.173). Consequently, this version of TAM had been accepted as the final original TAM in literature and utilized as a framework within various contexts and disciplines.

2.1.4. Final Version of TAM

Prior to the development of final version of TAM, Davis (1993) asserted another claim contradictory to his previous estimations and pointed that PU might also be directly conducive to the actual system usage. In addition to this, he detected that system characteristics might directly impact the individuals’ ATU. Consequently, another formulation of TAM emerged as illustrated below by Figure 5.

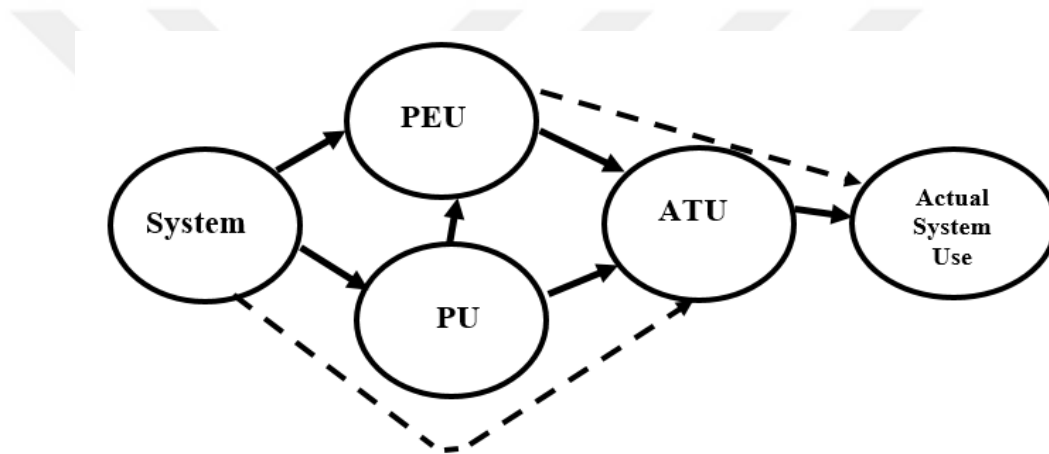


Figure 5: New relationship formulation of TAM, adapted from Davis (1993, p.481)

Davis et al. (1989) conducted a longitudinal study taking the first modified version of TAM as framework to examine the participants’ intention to use a system right after an hour of introduction and after the following 14 weeks. They concluded that the most influential and significant factor affecting the intentions of participants was PU. Nonetheless, their examination also indicated that the impact of PEU was small, yet it had a substantial effect on BI which decreased over time. The crux of this study was that both PU and PEU could have a direct impact on BI which necessitated the exclusion of the ATU construct from the model contributing to the development of final version of TAM (Venkatesh & Davis, 1996) as illustrated by the figure given below:

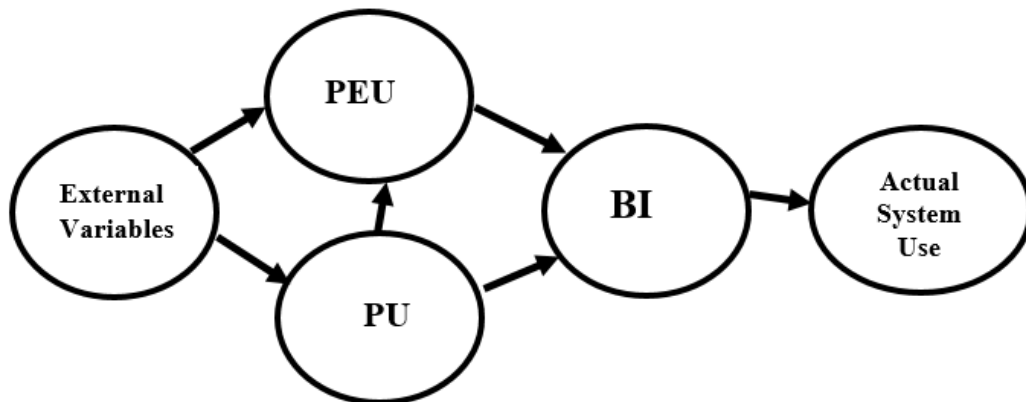


Figure 6: Final version of TAM, adapted from Venkatesh and Davis (1996, p. 453)

The exclusion of ATU construct from the model provided a justification of the direct influence of PU on the actual system usage, and probably, the unknown impact of system characteristics on ATU. In addition to this, the external variables were highlighted to be crucial determinants of both PEU and PU since they might affect the beliefs of individuals about the system. In the model, external variables consisted of user training, user participation in design, the features of implementation process, and system characteristics. Thus, the change in the model was the inclusion of system characteristics factor under the category of external variables construct contrary to its former position as a single construct per se.

A myriad of studies in literature focused on the two main constructs, namely PEU and PU, and their relationships with external factors. Firstly, 69% of the variance in attitude towards computer use among pre-service teachers studying at the National Institute of Education in Singapore was revealed to be defined by PU construct (Teo & Schaik, 2009). It was also demonstrated that PU affected the Singaporean and Malaysian pre-service teachers' intention to use technology directly (Teo et al., 2008). As PU, the PEU construct was spotted to be the main determinant of attitudes and intentions to use technology (Teo, 2009; Šumak et al., 2011). On the contrary to these findings, a meta-analysis of 1826 publications on technology acceptance of pre- and in-service teachers discovered that the impact of BI construct was weightier than PU and PEU due to its direct and indirect impact on the actual use. This meta-analysis also highlighted that TAM was evenly applicable to various sub-groups involving pre-

and in-service teachers, and teachers from different educational levels and backgrounds (Scherer et al., 2019).

The research on the relationship of the two main constructs, namely PU and PEU was diverse in literature. For instance, the relationship of PU and PEU with five individual user differences; division in an organization, level of education age, participation in training and prior experience were analyzed, and asserted that all these factors were entirely interceded by PEU and PU (Agarwal & Prasad, 1999). Additionally, Venkatesh (2000) detected that PEU affected six external variables positively and argued that the discovery of the mediating effects of external variables on the two main constructs PU and PEU was a momentous contribution since the research on this matter had been limited in literature. Even though the researchers aiming at extending TAM were mostly interested in the relationships amidst external variables and the two main constructs PU and PEU, there were many other factors implemented to TAM in literature.

It was reported in literature by a meta-analysis covering the years from 1998 up to 2003 that variables applied to TAM were marked as relative advantage, voluntariness, complexity, compatibility, trial ability, observability, self-efficacy, image, objective usability, end user support, computer playfulness, personal innovativeness, subjective norms/ social influence, social presence, job relevance, visibility, accessibility (physical accessibility and information accessibility), computer attitude, result demonstrability, computer anxiety, perceived enjoyment, management support, system (output or information) quality, prior experience, facilitating conditions (Lee et al., 2003). Another meta-analysis of 107 studies revealed that 152 external factors were utilized within TAM; however, it was identified that only five of them (i.e., subjective norm, self-efficacy, computer anxiety, prior experience, and enjoyment) were detected to be related to TAM in more than ten studies. Additionally, it was pointed that PEU was predicted at most by regarding the e-learning systems was self-efficacy, and subsequently, enjoyment experience, computer anxiety and subjective norm while it was enjoyment, followed by subjective norm, self-efficacy, and experience for PU (Abdullah & Ward, 2016). The experience variable was viewed as “the best-studied moderator variable in TAM” for King and He (2006, p. 747). Additionally, it was argued that education level (Zmud, 1979) and system experience might be also reflected on the internal abilities of users which could be mediated by the PEU construct (Mathieson et al., 2001).

Along with various adaptations and inclusion of several variables and constructs, TAM has been an exploratory framework in literature having more than 700 citations, cited by the

scholars from more than 15 different countries, being utilized for the measurement of more than 20 applications' acceptance, and being applied to more than 14 different participant groups (Chuttur, 2009), leading it to be the most preferred model in literature for technology acceptance (Straub, 2009) with its principle of parsimony and explicatory potential (Liu, 2010). Besides, TAM was remarked to be capable of explaining about 40% of a system use (Legris et al. 2003) and predicting the behavior of information systems' acceptance within different technologies and uses (Lee et al., 2003). It was also asserted in a meta-analysis of 42 papers that TAM was an appropriate model for investigating e-learning technology acceptance due to the similarity of PEU and PU on ATU with distinct e-learning technology and user types (Šumak et al., 2011).

The application of the TAM in various disciplines, contexts and participant groups with myriad variables necessitated the extension of the model so that it could be implicated more extensively. Schepers and Wetzels (2006) acknowledged in their meta-analysis of 63 studies published between 1989 and 2006 that the SN's effect on BI was found to be larger and the PU construct to be more influential in Western studies, whereas PEU construct was detected to be more extensive in non-Western studies. To conclude, the number of studies using the TAM as a theoretical framework without extending it had been scarce in literature (Imtiaz & Maarop, 2014). One of the most substantial developments of TAM was brought by Venkatesh and Davis (2000) proposing the further model, TAM2.

2.1.5. Technology Acceptance Model 2 (TAM2)

The primary objective of TAM2 was to retain the original constructs of TAM and “to include additional key determinants of the TAM's PU and BI constructs, and to understand how the effect of these determinants changed with increasing users' experience over time with the target system” (Venkatesh & Davis, 2000, p.187). Thus, it was introduced in the model that the main reason of an individual's perceiving a system as useful could not be explained in TAM which was a critical limitation to be handled. Hence, TAM2 aimed at investigating the probable reasons affecting PU.

The variables that had an impact on PU in TAM2 were consisted of subjective norm, image, job relevance, output quality, and result demonstrability. The '*image*' construct in the model referred to the aspiration of a user to maintain behaviors approved by his significant others, '*job relevance*' to the applicability extent of a technology, '*output quality*' to the degree of a technology's satisfactory accomplishment of the demanded tasks and lastly, '*result demonstrability*' to the production of evident results (Venkatesh & Davis, 2000). Additionally,

the ‘voluntariness’ and ‘experience’ constructs were pointed as moderating factors of the subjective norm as demonstrated in Figure 7 below.

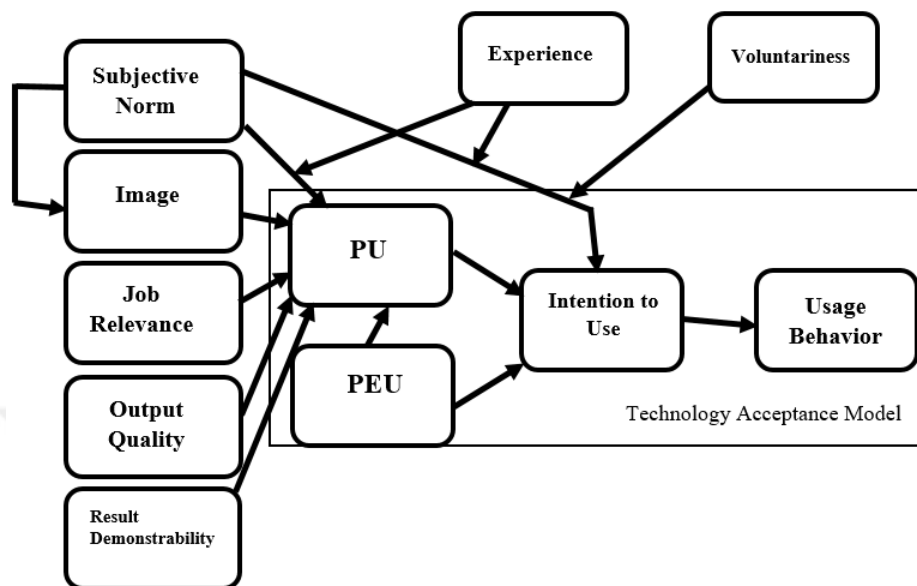


Figure 7: TAM2, adapted from Venkatesh and Davis (2000, p.188)

As affirmed in the figure above, SN construct had an influence on the image construct, suggesting that when people around the individuals approved or disapproved certain behaviors regarding the technology, the image portrayed by the individuals was impacted, as well. In TAM2, the additional constructs were categorized into two as *social influence processes* and *cognitive instrumental processes*. Accordingly, it was claimed that four cognitive factors, namely job relevance, result demonstrability, output quality, and PEU could affect PU while other three social drives having an impact on PU were subjective norm, image, and voluntariness.

Following the proposal of TAM2, Venkatesh and Davis (2000) attempted to test the performance of TAM2 in mandatory settings due to the fact that the construct of PU and PEU might fall under the influence of obligatory usage of a technology at certain settings. Thus, they conducted a field study with 156 knowledge workers. The participants used four different systems and, two of these systems were voluntary use whereas the other two were mandatory. Moreover, the data were collected from the participants at three points in time: pre-implementation, one-month post-implementation and three-month post-implementation. The study results revealed that

TAM2 was observed to operate well in both two environments. Yet, it was detected that the impact of SN in voluntary settings was non-existent while it was evident in mandatory settings.

The development of TAM2 was a significant extension of the original TAM in the field. Subsequently, a second extension of TAM2 by Venkatesh (2000) arose. Venkatesh pursued to analyze the antecedents of PEU which was not the focus of TAM2. Accordingly, he determined two main antecedent groups of PEU: anchors and adjustments. ‘*Anchors*’ were viewed as common ideas about computers and computers usage and, ‘*adjustments*’ referred to the beliefs that emerged according to the accustomedness with the target system. Various determinants formulated from the previous research on the PEU’s antecedents of Davis et al. (1992), and Venkatesh and Davis (1996) were included. As shown in Figure 8, the anchors were consisted of four variables (i.e., computer self-efficacy, perceptions of external control, computer anxiety and computer playfulness) and adjustments involved two variables (i.e., perceived enjoyment and objective usability). Venkatesh (2000) hypothesized that all these variables in both groups had a direct impact on PEU, and thus, an indirect impact on PU and BI.

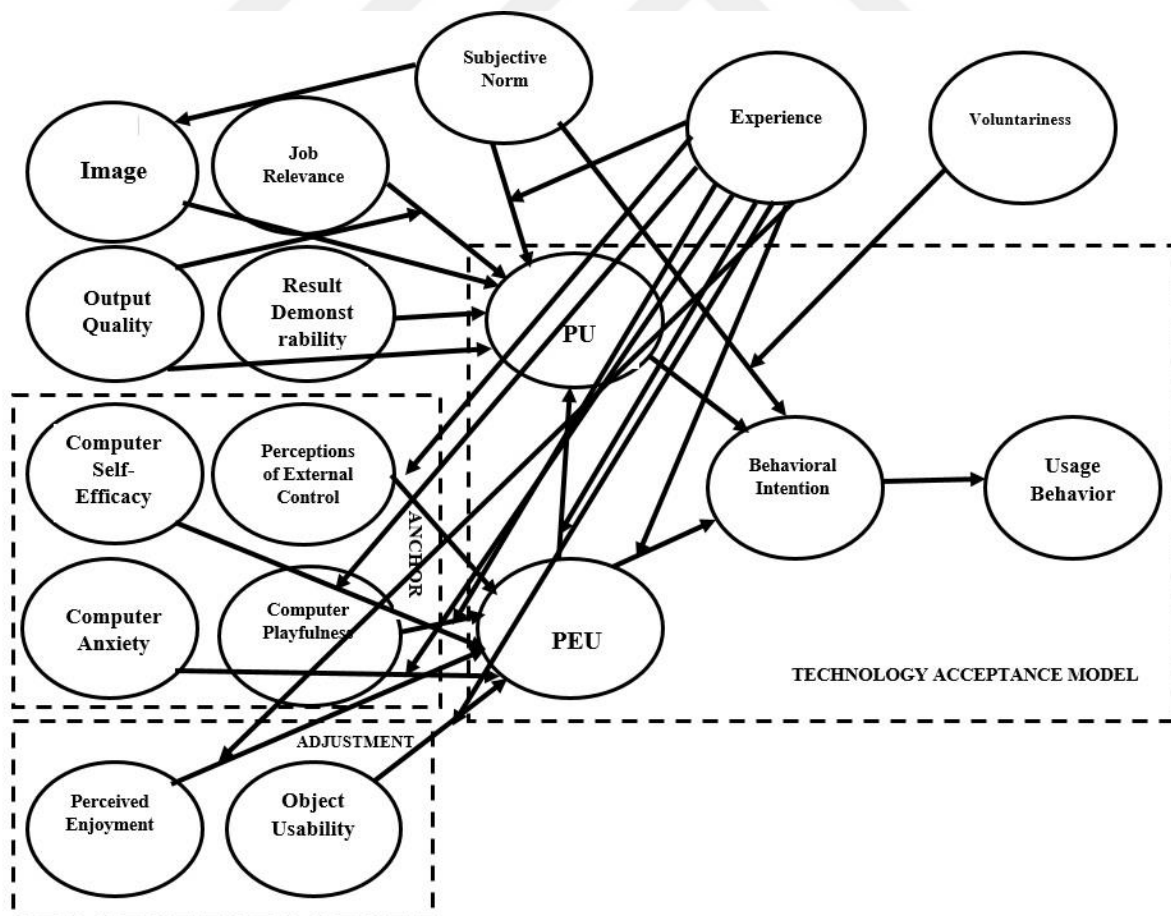


Figure 8: Extending TAM to include determinants of PEU (Venkatesh, 2000, p. 357)

For the confirmation of his hypothesis, Venkatesh (2000) conducted an analysis in three different settings with 246 participants over a three-month period by utilizing three different measures and, the results acknowledged that the extended variables in the model were robust in explaining PEU for a certain system. Even though the robustness of TAM was proven in literature, it was criticized in literature from three aspects: methodology used in the assessment of TAM, the variables and their relationships, and the core theoretical background of TAM (Chuttur, 2009). Hence, the development of the model continued perpetually in literature. Another novelty in the development of TAM was the development of the Unified Theory of Acceptance and the Use of Technology Model (UTAUT) by Venkatesh et al. developed in 2003.

2.1.6. Unified Theory of Acceptance and Use of Technology (UTAUT)

The model, UTAUT, proposed by Venkatesh et al. (2003) was distinct from the other models of TAM introduced previously due to the fact that it was not one of the models which was developed through add-on variables; yet, it emerged as a result of the review and integration of eight dominant theories related to the technology acceptance and usage, which were: the Theory of Reasoned Action (TRA), Motivational Model, Technology Acceptance Model (TAM), a combined TBP/TAM, Model of PC Utilization, Theory of Planned Behavior (TPB), Social Cognitive Theory (SCT) and Innovation Diffusion Theory (IDT). The primary focus of this model was to explain the users' intentions to use technology and consequent usage behavior.

There were seven comprising factors in the UTAUT model having an impact on the technology acceptance. Five of these factors were already existent in previous models, and they were performance expectancy (hereafter: PE), effort expectancy (hereafter: EE), social influence (hereafter: SI), and facilitating conditions (hereafter: FC). The fifth factor, '*attitude*' was eliminated from the model due to the hypothesis that only four components were the predictors of behavioral intention. The other two factors, self-efficacy and anxiety were retrieved from Social Cognitive Theory proposed by Bandura (1986).

It was also highlighted in the model that EE was more notable in women than men; thus, in addition to these variables, four other moderating variables were included in the model: age, gender, perceived voluntariness to use it and experience with the technology. It was hypothesized that the mediator impact of these variables was the determinant of four main

predictors of behavioral intention, and FC would have a substantial impact on users when moderated by experience and age as shown in Figure 9. Lastly, Venkatesh and Davis (2000) alleged that SI had an influence on individuals through three mechanisms: compliance, internalization, and identification.

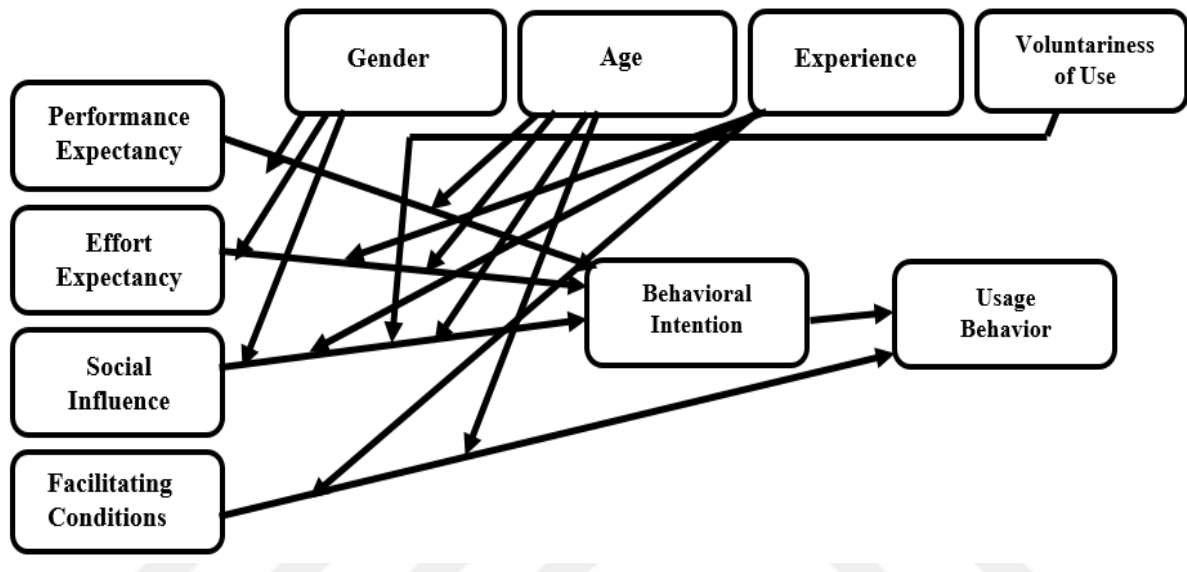


Figure 9: The UTAUT Model, adapted from Venkatesh et al. (2003, p. 447)

Even though the significance of intrinsic motivation, also defined as perceived enjoyment, in technology acceptance was formerly regarded as prominent (Davis et al., 1992), it was excluded from the framework in the UTAUT model since it was argued that its impact on the acceptance was surpassed by the mediator factors in the model. On the contrary to this argument, Sun and Zhang (2008) provided empirical data on the intrinsic motivation being the predictor of performance expectancy, interceded by effort expectancy, and subsequently having an indirect impact on acceptance outcomes. According to Bagozzi (2007), the UTAUT model may be potent in explaining technology acceptance while it did not investigate the new relationships of other subsuming variables. Yet, behavioral intention to use a technology was detected to be explained with around 70 percent of the variance and about 50% of technology use was highlighted to be explained by the UTAUT model (Venkatesh et al., 2012)

The application of UTAUT was more in industrial settings regarding consumers' acceptance of a technology or a computer system; nonetheless, there were recent research on the application of UTAUT into educational settings that inspect on the schoolteachers' technology use and acceptance (e.g., Teo, 2011; Teo, 2012; Teo & Wong, 2013). According to Venkatesh and Bala (2008), the necessity of the applicability of the model in different settings with various participant groups required the addition of TAM's PEU and 'usage intention' constructs to the framework. Based on this claim, they proposed a new model: TAM3.

2.1.7. Technology Acceptance Model 3 (TAM3)

Venkatesh and Bala (2008) integrated TAM2 (Venkatesh & Davis, 2000) with the PEU's determinants (Venkatesh, 2000) by suggesting that determinants of PEU did not have any impact on the determinants of PU. TAM3 included four major constructs that had an influence on the determinants of both PEU and PU, which were: *social influence*, *facilitating conditions*, *the individual differences*, and *system characteristics*. The main hypothesis of this model was that experiences were the moderators of the relationships between PEU and PU, PEU and computer anxiety and, PEU and BI as demonstrated in Figure 10. The core idea of these relationships originated from the Action Identification Theory (Vallacher & Kaufman, 1996) hinting those high-level identities that could be ascribed to the goals and plans of an individual and, low level identities to the actualization of these goals.

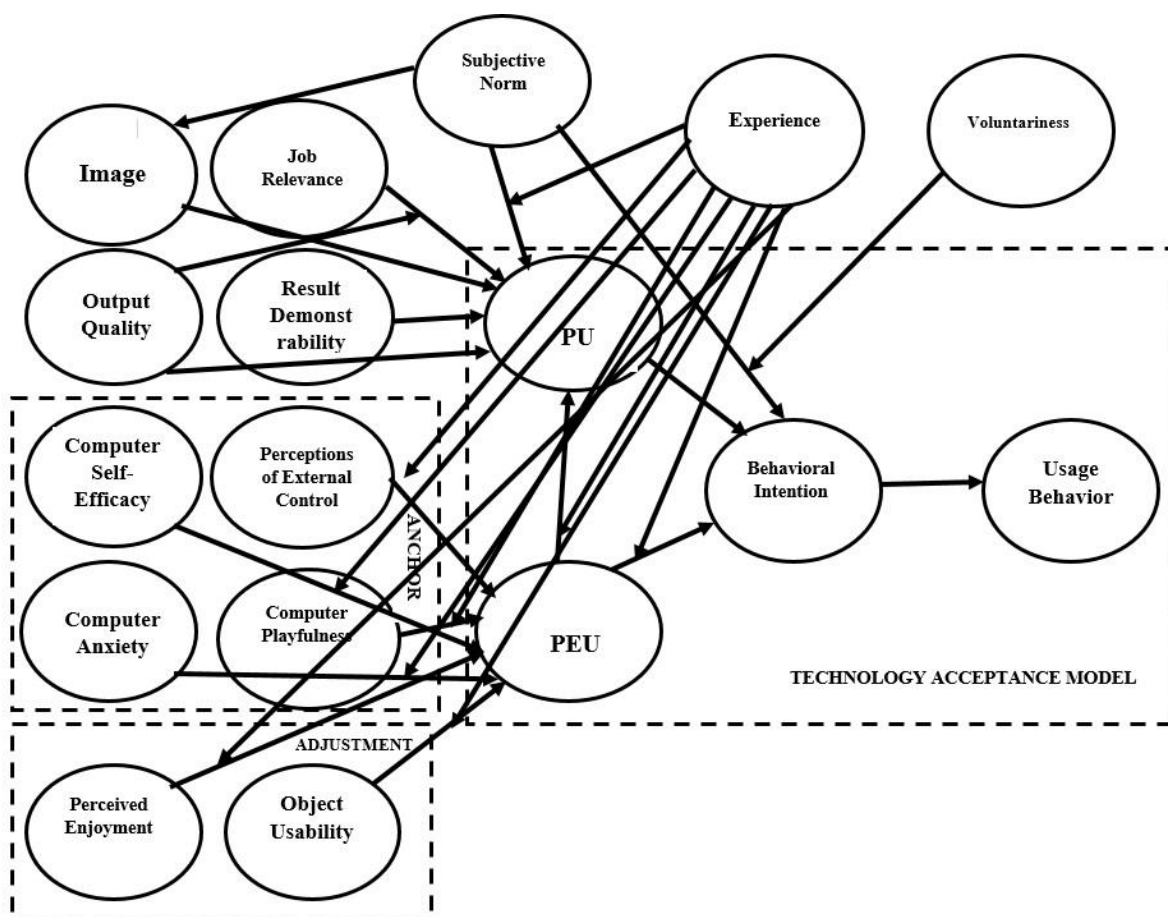


Figure 10: TAM3, adapted from Venkatesh and Bala (2008, p. 280)

The relationship of PEU and PU in TAM3 was explained as:

“... with increasing experience, the influence of PEU (low-level identity) on PU (high-level identity) will be stronger as users will be able to perform stronger as users will be able to form an assessment of their likelihood of attaining high-level goals (i.e., perceived usefulness) based on information gained from experience of the low-level actions (i.e., perceived ease of use)” (Venkatesh & Bala, 2008, p. 281).

The authors, thereby, conducted a longitudinal field study at four different organizations for the validation of the framework and provided empirical evidence on the relationships and cross-effect of the constructs' determinants on one another (Venkatesh & Bala, 2008). They concluded that “the key strength of the TAM3 is *comprehensiveness* and potential for *actionable guidance*” (p. 301). Yet, the application of this framework was context-based; thus, it was applicable to the workplace settings mostly. In this vein, the follow-up research on the model did not cease in literature. The last development and extension of the framework was the UTAUT2 Model proposed by Venkatesh et al. in 2012.

2.1.8. Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

Following the development of several hypotheses and the introduction of new frameworks based on the previous research in the field, the researchers kept seeking for the improvement of TAM and they aimed at adapting it into certain contexts. Bearing these in mind, the primary objective of the UTAUT2 Model was to address consumer use context. With this objective, Venkatesh et al. (2012) proposed the UTAUT2 Model by adapting the constructs and their definitions to the consumer technology acceptance and use. Apart from these constructs, they added three more constructs to the model which were ‘*hedonic motivation*’, ‘*price value*’, and ‘*habit*’. As promoted earlier, they hypothesized that all the other constructs of UTAUT and the latterly added ones had a direct impact on BI and usage, and the variables such as age, gender and experience affected the three newly promoted variables, and the facilitating conditions construct as illustrated in Figure 11.

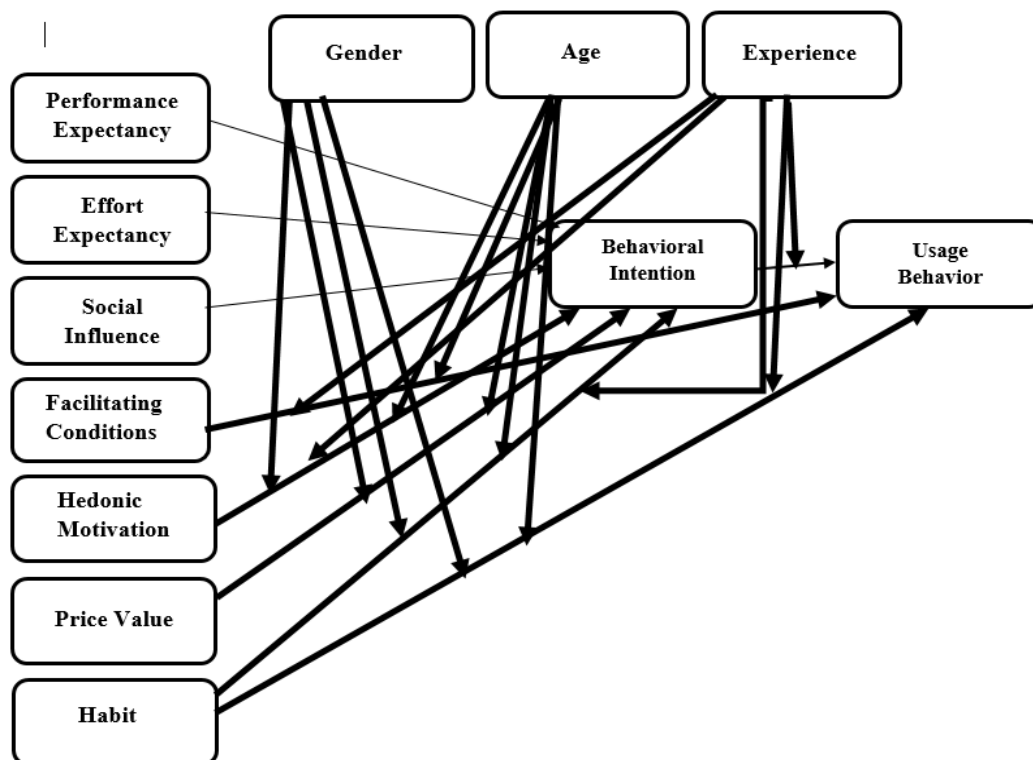


Figure 11: The UTAUT2 Model, adapted from Venkatesh et al. (2012, p. 160)

The adaptation of the former UTAUT constructs to the consumer use context brought new adapted definitions to the constructs, as well. Accordingly, the former constructs with new definitions were pointed as follows:

- *“Performance Expectancy; the degree to which using a technology will provide benefits to consumers in performing certain activities,*
- *Effort Expectancy; the degree of ease associated with consumers' use of technology,*
- *Social Influence; the extent to which consumers perceive those important others (e.g., family and friends) believe they should use a particular technology,*
- *Facilitating Conditions; consumers' perceptions of the resources and support available to perform a behavior” (Venkatesh et al., 2012, p. 159).*

To conclude, there have been a great body of research and investigation in literature which were dedicated to the development and extension of TAM by analyzing the relationships of the constructs with one another, validating, and justifying the proposed frameworks or add-on

constructs, and hypothesizing new relations or formulas in the model. Several scholars have attempted to extend the application of TAM into different settings, various participants groups, and numerous context which have led to the TAM being the most parsimonious framework being utilized in technology acceptance and usage studies worldwide.

2.2. Teacher Knowledge

As the research focus in educational technologies has gravitated towards the use of effective technological tools by teachers, the question of “*What constitutes teacher knowledge?*” has come into the forefront so much so that an effective technology integration in education could be initiated by it. Thus, the knowledge a teacher possesses has become the focus of the studies since the end of 19th century.

The origins of Web Pedagogical Content Knowledge (WPACK) have its roots in the Technological Pedagogical Content Knowledge (TPACK) framework (Angeli & Valanides, 2008; Mishra & Koehler, 2006) which is originated from the framework of Pedagogical Content Knowledge (PCK) introduced by Shulman (1986). The discussion of these frameworks is presented in the following sub-parts.

2.2.1. Pedagogical Content Knowledge (PCK)

Shulman (1986) introduced Pedagogical Content Knowledge (PCK) which integrates content and pedagogy to be able to uncover how peculiar subjects, topics or problems are constructed, and adapted to learners’ divergent interests and abilities in depth (Figure 12). He explained this dichotomy as “the ways of representing and formulating the subject that make it comprehensible to others.” (p. 9).

PCK basically represents an admixture of Content Knowledge (hereafter: CK) and Pedagogical Knowledge (hereafter: PK). The main objective of Shulman (1987) was to understand how teachers are “being able to comprehend subject matter for themselves, become able to elucidate subject matter in new ways, reorganize and partition it, clothe it in activities and emotions, in metaphors and exercises, and in examples and demonstrations so that it can be grasped by the students” (p. 13).

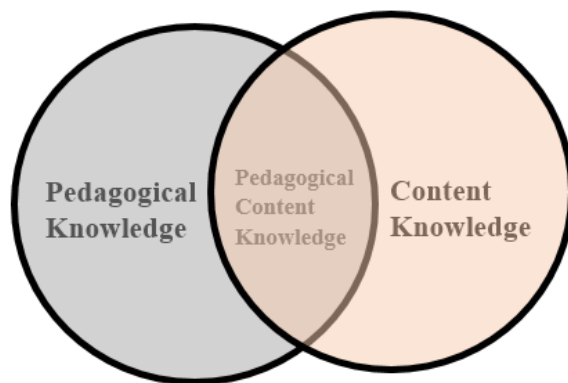


Figure 12: Pedagogical Content Knowledge, adapted from Shulman (1986, p. 9)

Shulman (1986) categorized the professional knowledge bases of a teacher as ‘*content knowledge*’, ‘*general pedagogical knowledge*’, ‘*curriculum knowledge*’, and ‘*pedagogical content knowledge*’. According to this categorization, a teacher’s CK consisted of ‘*subject matter content knowledge*’, ‘*pedagogical content knowledge*’, and ‘*curricular knowledge*’. The curricular knowledge included two types of knowledge, namely, ‘*lateral curriculum knowledge*’ and ‘*vertical curriculum knowledge*’. The definitions of these knowledge bodies are as follows:

- “*Subject Matter Content Knowledge; the amount and organization of knowledge per se in the mind of the teacher which requires going beyond knowledge of the facts or concepts of a domain,*
- *Pedagogical Content Knowledge; the form of content knowledge that embodies the aspects of content most germane to its teachability which goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching,*
- *Curricular Knowledge; the curriculum and its associated materials are the materia medica of pedagogy, the pharmacopeia from which the teacher draws those tools of teaching that present or exemplify content and remediate or evaluate the adequacy of student accomplishment,*
- *Lateral Curriculum Knowledge; the teacher's ability to relate the content of a given course or lesson to topics or issues being discussed simultaneously in other classes,*

- *Vertical Curriculum Knowledge; familiarity with the topics and issues that have been and will be taught in the same subject area during the preceding and later years in school, and the materials that embody them*” (Shulman, 1986, p. 9-11).

In addition to this conceptualization, Shulman (1987) added three more types of knowledge to the teacher knowledge base, which were ‘*knowledge of learners and their characteristics*’, ‘*knowledge of educational context*’, and ‘*knowledge of educational ends, purposes and values and their philosophical and historical grounds*’. Regarding these three types of knowledge forming the base of a teacher’s knowledge, Shulman (1987) proposed the term ‘*case knowledge*’ which came into play when teacher was dealing with these types of knowledge in several contexts. Case knowledge referred to knowledge of the specific events occurring in educational contexts and included three subcategories of cases:

- “*Prototypes; examples of theoretical principles,*
- *Precedents; communication of principles of practice or maxims,*
- *Parables; transmission of norms or values*” (Schulman, 1987, p. 11)

Lastly, Shulman (1987) added ‘*strategic knowledge*’ to the framework as a third body of knowledge which he referred as the type of knowledge necessary for teachers to deal with problems in relation with the crash of moral values, principles, or other situations. The definitions of teachers’ knowledge, especially PCK, had numerous extensions and re-categorizations in literature on the grounds that it was too narrow to be applied and adapted.

For instance, Grossman (1990) commented on PCK as the representations of six subject matters and the ways of teachers’ dealing with the content-related difficulties faced in the teaching environment in addition to the knowledge of specific curriculum and content related areas. Marks (1990) extended the framework of Shulman (1986) and introduced the ‘*knowledge of media*’ which went beyond subject matter knowledge per se by asserting that the development of PCK was actualized through the integration of subject matter knowledge and general pedagogical knowledge. Cochran et al., (1993) suggested an extension of Shulman’s (1986) PCK framework from a constructivist perspective, and they renamed the construct as ‘*Pedagogical Content Knowing*’ (PCKg) emphasizing the dynamic essence of the construct. They defined PCKg as “a teacher’s integrated understanding of four components of pedagogy, subject matter content, student characteristics, and the environmental context of learning” (Cochran et al., 1993, p. 266). Following this, Fernandez-Balboa and Stiehl (1995) introduced the knowledge of a teacher consisting of five knowledge components which were ‘*subject*

matter knowledge, *knowledge of students*, *knowledge of instructional strategies*, *knowledge of teaching context*, and *purposes of teaching*.

In 1999, a distinction of transformative and integrative view of teacher knowledge was represented by Gess-Newsome. The Shulman's (1986) PCK was claimed to be a transformative claiming that it was a unique body of knowledge possessed by teachers while integrative view presenting PCK as an amalgam of subject matter knowledge, pedagogical knowledge, and context knowledge rather than viewing PCK as an independent construct. Consequently, the extension of the Shulman's (1986) framework and addition of new categories of knowledge types were mostly under the influence of his original framework. The classification system of Borko and Putnam (1996) was an example of this. They renamed the Shulman's (1986) original categories and proposed them as *'general pedagogical knowledge'*, *'knowledge and beliefs about subject matter'*, and *'pedagogical content knowledge and beliefs'*. The PCK view of Margerum-Leys and Marx (2002) was prominent in literature in that it stressed the significance of pedagogical knowledge being not specific solely to the use of technologies but encompassing broader strategies to scaffold, monitor and motivate learners. They also claimed that PCK was a body of knowledge derived from educational technologies yet it could be employed for teaching and learning via educational technology.

The numerous and various conceptualizations of PCK reveals the principle of 'fit for purpose' implying that it is suitable to be modified and adapted (Mavhunga & Rollnik, 2017). The formulation of PCK has paved the way for future research on teacher knowledge in literature. The advancements in technology in the beginning of the 21st century have altered the way of teaching; thus, leading to scrutiny of how teachers have dealt with educational technologies. Consequently, knowledge of technologies has come into prominence since technological innovations and advancements have ruled educational settings including the ways teachers teach and students learn. On this regard, the scholars have proposed that the knowledge a teacher possesses should include *'technological knowledge'* as well giving rise to the emergence of 'Technological Pedagogical Content Knowledge' (TPACK) paradigm (Angeli & Valanides, 2008; Mishra & Koehler, 2006).

2.2.2 Technological Pedagogical Content Knowledge (TPACK)

Various innovations and development of several educational technologies brought many opportunities to learners, and new challenges to teachers. Mishra and Koehler (2006) argued that being competent in technology did not necessarily mean the effective usage of it in the

classroom by teachers. Thus, they operated a study for 5 years on a program targeting the teachers' professional progress and faculty in higher education, then they proposed the TPACK framework which diverged from the Margerum-Lays and Marx's (2002) notion of educational technology' PCK view.

The mindset of Mishra and Koehler (2005) was that they considered technology as a knowledge system of several biases and facilities pointing the changing applicability of it in some cases. They summarized what they aimed at proposing this framework as followed (Mishra & Koehler, 2005):

“Good teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts and requires developing a sensitivity to the dynamic, transactional relationship between all three components suggested by the TPACK framework” (p. 134).

Accordingly, the primary focus of the framework was the interactions and connections between knowledge about content (C), pedagogy (P), and technology (T) as shown in Figure 13. Even though the framework emphasized the compound interaction of these three bodies of knowledge instead of considering them separately; however, knowledge bases are treated in pairs in this model as follows:

- *“Content knowledge (CK); knowledge of subject matter,*
- *Technology knowledge (TK); knowledge of various technologies,*
- *Pedagogical knowledge (PK); knowledge of the processes or methods of teaching,*
- *Technological content knowledge (TCK); representation of subject matter with technology,*
- *Technological pedagogical knowledge (TPK); knowledge of technology usage implemented with appropriate teaching methods,*
- *Pedagogical content knowledge (PCK); knowledge of teaching methods or techniques for different types of subject matter,*
- *Technological pedagogical content knowledge (TPCK); technology usage knowledge with an appropriate implementation of various teaching methods for different types of subject matter” (Mishra & Koehler, 2006, p. 1017-1054).*

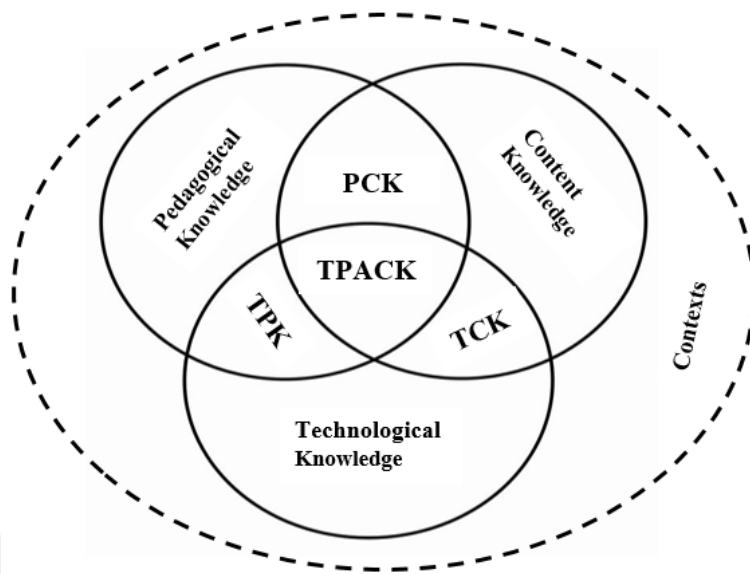


Figure 13: Technological Pedagogical Content Knowledge, adapted from Mishra and Koehler (2006, p. 1025)

Regarding the interaction among the components of the framework, Mishra and Koehler (2006) asserted that alterations occurring in one of these knowledge types needed to be compensated by the alterations in the other ones, underlining the dynamic relationships within the framework. They also suggested that there were some reasons of the competencies and knowledge bodies teachers were required to attain, albeit problematic. To illustrate, the constant technology changes in our era, a software's inappropriate design, the situated nature of learning, and the emphasis on what, not how in terms of technology use (Mishra & Koehler, 2006).

Koehler and Mishra (2009) also pointed out that teacher education in developing TPACK was of critical importance since raising teachers with high level of TPACK in the future in order to shape the TPACK framework representing a growing body of research in teacher education, professional progress of teachers, and technology use by teachers. Besides, they added that researchers, teachers, and teacher educators were supported by the TPACK to extend their approaches, run counter to the view of technology as an “add-on” construct in education and adapt more ecological view towards it.

The analysis of TPACK and delineation of consisting knowledge bodies' interaction with one another became the focal point of teacher knowledge and education in literature. Following the proposal of TPACK framework by Mishra and Koehler (2006), Angeli and Valanides (2005, 2008) proposed another framework suggesting that TPACK was a distinct and a unique body

of knowledge promoted by the interactions between its components, and they named their framework as Information and Communication Technologies-TPCK (hereafter: ICT-TPCK) signifying the importance of technology. They adopted a transformative view and asserted that the reason why the TPACK framework was required to be viewed from this perspective was that it necessitated the transformation of five knowledge bodies into a unique body of knowledge involving the component knowledge bodies' interactions (Angeli & Valanides, 2008).

On the other hand, the fundamental knowledge bases of ICT-TPCK's, as shown in Figure 14, comprised of three contributing knowledge bases of TPACK which were '*subject matter knowledge*', '*pedagogical knowledge*', and '*technology*' (narrowed to ICT in this case), and two other elements, namely, '*knowledge of students*' and '*knowledge of the context*' where learning occurred. These two affixed constructs were included according to research evidence from studies conducted with in-service teachers (Angeli & Valanides, 2008).

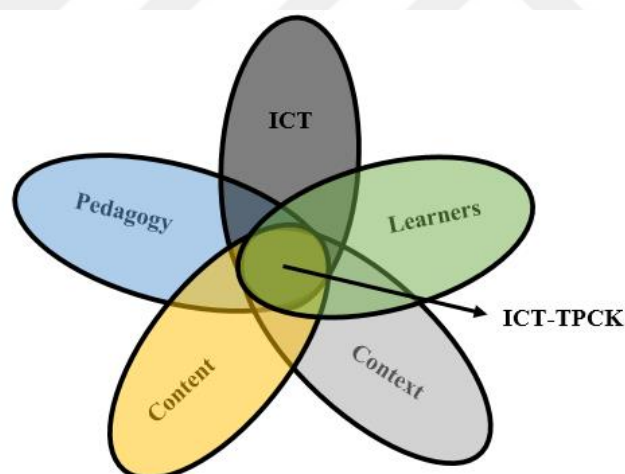


Figure 14: ICT-TPCK, adapted from Angeli and Valanides (2009, p. 159)

The knowledge bodies represented in the framework were defined as followed:

- “*Subject matter knowledge; the facts and structures of a content domain,*
- *Pedagogical knowledge; teaching strategies and principles aligned with classroom management and organization that can differentiate across subject-matter domains,*
- *Knowledge of learners; characteristics and predispositions brought by students to the learning context,*

- *Knowledge of context; educational values and goals, along with their philosophical bases including teachers' epistemic beliefs about teaching and learning,*
- *Technology knowledge; knowing how to run a computer and knowing how to use various tools in dubious situations"* (Angeli & Valanides, 2009, p. 159).

This conceptualization of Angeli and Valanides (2009) ran counter to the idea that technology was a vehicle to transmit information, and it foregrounded the significance of technology as a cognitive tool enhancing students' learning (Angeli & Valanides, 2008). The ICT-TPCK was at odds with Mishra and Koehler's TPCK (2006) framework in that ICT-TPCK highlighted the view that the growth and development of a knowledge body component per se did not guarantee the growth in the other knowledge bodies, and a change in one of these knowledge bodies might not be compensated by none of the others. This point of view pointed out the focus on TPCK as a unique knowledge body instead of treating it with its knowledge domains separately. Lastly, Angeli and Valanides (2008) stressed that ICT-TPCK development attempts must be built upon socio-cognitive constructivist ideas since constructing cognitive and socio-cognitive conflicts and stimulating meaning negotiation among students with different conceptions were the most effective transformations of the content. Among all these assertions, there were some other scholars (Cox & Graham, 2009; Niess, 2005) conforming the hypothesis of Angeli and Valanides (2008) which was regarded as a continued version of Shulman's (1987) PCK framework. Finally, the most prevalent one was Mishra and Koehler's (2009) view asserting that TPACK was the interaction and interjunction of three knowledge bodies within a specific context.

The influence of TPACK research, especially in teacher education, have prompted several scholars to probe into this paradigm within a myriad of settings. It became so widespread in literature that Cox (2008) identified ten definitions for TPK, thirteen definitions for TCK and eighty-nine definitions for TPACK. According to Koehler (2012), more than 500 publications and presentations on TPACK were discovered following to the introduction of the construct in 2005. It was also pointed that the target group of TPACK was the second largest group in the Society for Information Technology and Teacher Education (Hofer & Grandgenett, 2012). Lastly, TPACK was entitled as 'TPCK' in literature till 2008, when it was proposed to be used as 'TPACK' for easier use (Thompson & Mishra, 2007).

As the delivery of the content and the ubiquitous application of numerous web tools in educational technologies have gained prominence, the technology and web usage have differed

in time. Hereby, Lee and Tsai (2010) have expressed that web tools must be distinguished as a separate technology per se in modern education and TPACK would be inappropriate and insufficient to incorporate all the web technologies utilized in the educational technologies. Thus, they have suggested this new framework named “Web Pedagogical Content Knowledge” which has contravened the view that the web knowledge teachers possess can be subsumed under the category of technology knowledge.

2.2.3. Web Pedagogical Content Knowledge (WPACK)

Having a greater insight into the educational technologies and the role of teachers, new resources of information and communication have arisen, which also gives rise to various modes of teaching such as synchronous, asynchronous, collaborative, and autonomous learning making Internet and web-based tools the focal point of educational technologies (Neo, 2003). Yet, Internet has been regarded as a means rather than the essential point of education, or even sometimes as a toy (Tsai & Lin, 2004). However, the inclusion of web technology in teacher education programs has debunked the significance of web tools since TPACK is asserted not to be sufficient to provide an insight into teacher education on this matter (Lee et al., 2008).

It is also highlighted that web is a momentous requisite in modern education and the evaluation of teacher knowledge including web technologies under the TPACK framework will be incompetent in providing information that can reinforce the professional development of teachers and the teacher training programs (Lee & Tsai, 2010). Thus, Lee et al. (2008) and Lee and Tsai (2010) have introduced the WPACK framework, also named as TPCK-W, to examine teacher knowledge with respect to web-based instruction and have suggested that teachers need to combine their web knowledge with PCK for teaching with web. Their framework consists of three areas of knowledge, namely, ‘*content*’, ‘*pedagogy*’ and ‘*web*’ as illustrated on Figure 15, and is composed of four knowledge bodies, Web Knowledge (WK), Web Pedagogical Knowledge (WPK), Web Content Knowledge (WCK) and Web Pedagogical Content Knowledge (WPCK) (Lee & Tsai, 2010; Lee et al., 2008).

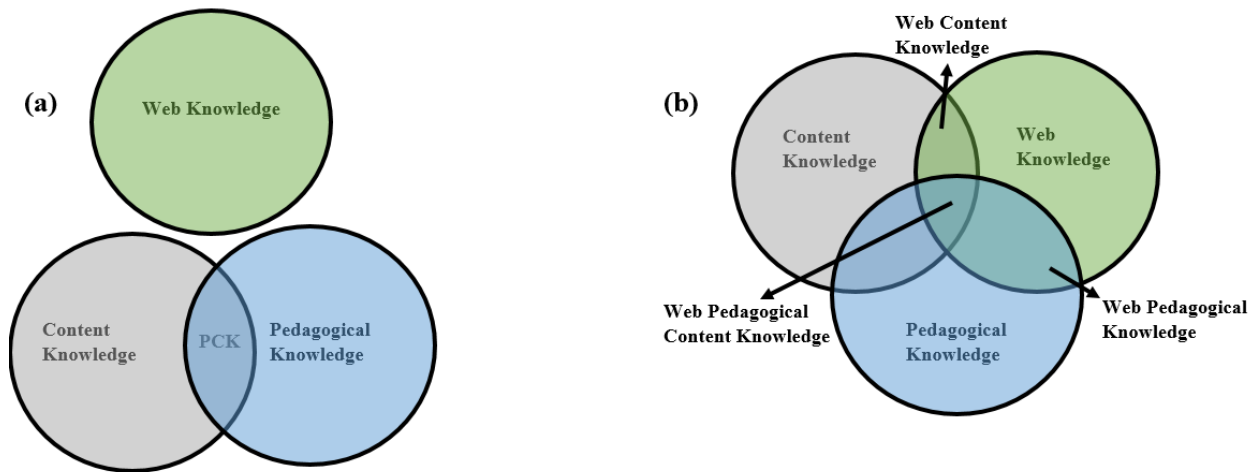


Figure 15: The WPACK Framework, adapted from Lee and Tsai (2010, p. 4)

In the framework, ‘web’ encompasses not only the knowledge about web tools but also the progressive knowledge required for web-based interaction and web-based communication. The conjunction of ‘web’ and ‘content’ generates WCK which refers to the system of connecting the benefits and attributes of web with content. Another conjunction of the framework, namely the overlap of ‘web’ and ‘pedagogy’ forms WPK which highlights the elements of web and the skills of teachers to be utilized in teaching with web (Akar, 2019). The framework also underlines the interaction amidst these knowledge areas, and WPACK requires teachers to develop pedagogical strategies for a specific subject matter within the web and raise an enriched awareness on the ways to reinforce learners while engaging in web-pedagogical practices and making use of web applications by integrating them with the content appropriately (Lee & Tsai, 2010).

The introduction of the WPACK framework was followed by the development of Technological Pedagogical Content Knowledge-Web Survey (TPCK-W) by Lee et al. (2008) and applied to assess Taiwanese teachers’ self-efficacy in their web-general knowledge, web-communicative knowledge, web content knowledge (WCK), and web pedagogical content knowledge (WPK) with Lee and Tsai’s (2010) confirmatory factor analysis. The description of each construct was argued as given below:

1. “Web-General; measuring teachers’ confidence in their knowledge about their use of the web in general, such as use of web-related tools, e.g., be able to click the hyperlink to connect to another website,

2. *Web-Communicative; assessing teachers' confidence in their knowledge relative to web-based communication or web-based interaction, e.g., be able to read others' messages in a chatroom,*
3. *Web-Pedagogical Knowledge (WPK); evaluating teachers' confidence in their knowledge about the existence, components and functions of the web as they are used in educational settings, e.g., be able to use the web to enhance students' learning motivation.*
4. *Web-Content Knowledge (WCK): measuring teachers' confidence in their knowledge about the manner in which the web and content can mutually reinforce each other, e.g., be able to search for various materials on the web to be integrated into course content.*
5. *Web-Pedagogical-Content Knowledge (WPCK): surveying teachers' confidence in their knowledge about how to identify appropriate online learning activities to fit the needs of a particular course and the practice of appropriate pedagogies to support online activities, e.g., be able to use web resources to guide students' learning activities for a certain course unit.*
6. *Attitudes toward web-based instruction (attitudes): measuring the extent of teachers' agreement regarding the usage of web-based instruction, e.g., web-based teaching can enhance students' learning motivation" (Lee & Tsai, 2010, p. 8)*

The subcategories of teacher knowledge in the scale were also re-described by Horzum (2011) as:

- *“General Web Knowledge (GWK); the general knowledge of using the Internet,*
- *Communicational Web Knowledge (CWK); the knowledge of communication and interaction based on Internet,*
- *Pedagogical Web Knowledge (PWK); the knowledge about the web processes and the components of these processes which are used in educational environments,*
- *Web Pedagogical Content Knowledge (WebPack); the appropriate pedagogical applications and special area learning activities which are related with web applications,*

- *Attitudes towards Web Based Teaching (AWBT); the items which are related with the attitudes towards web-based teaching*” (p. 5).

The development of a scale to assess WPACK levels of teachers, pre-service teachers and teacher educators has given rise to the performance of numerous studies in literature and underscored the significance knowledge and skills teachers must have in the 21st century classroom. As another digital age competency having emerged as a result of digitalized learning environments, evaluation, and comprehension of the digital sources in a critical way has gained importance in the modern education. This notion has provoked the inspection of the new paradigm ‘*Critical Digital Literacy*’ (hereafter: CDL) in terms of its association with effective use of web tools which is regarded as one of the essential skills of the 21st century (Partnership for 21st Century Skills, 2010).

2.3. Critical Digital Literacy (CDL)

The evolution and baseline of the CDL framework were discussed under this heading with an overview of previous studies.

2.3.1. The Origins of Critical Digital Literacy

As the orientation in educational contexts has verged towards the use of digital sources, the favorable utilization of these sources has become much more noteworthy. As a result, the term of ‘being literate’ has taken on new meanings which has become associated with the concept of ‘being digitally literate’ in the 21st century. Yet, the origins of digital literacy dates to 1980s when the first term ‘*computer literacy*’ and its variations such as ‘*Information Technologies* (hereafter: IT) *literacy*’, ‘*ICT literacy*’, and ‘*technology literacy*’ were introduced, all of which were related to the acquaintance and experience with the computers (Hawkins & Paris, 1997). ICT literacy was defined as “using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society” (ICT International Literacy Panel, 2002, p. 5).

Concomitantly, the term ‘*information literacy*’ emanated from this perspective in 1990s stressing the significance of the discovery, recognition, and the assessment of information (Bawden & Robinson, 2002). However, the term ‘*media literacy*’ was also associated with this concept that time which was regarded as a part of IT, and it dealt with the evaluation of mass media while choosing for the appropriate information by using digital tools. According to Jenkins (2006), learners are required to develop a critical understanding on how digital media

“... structure our perceptions of the world, the economic and cultural contexts within which mass media is produced and circulated, the motives and goals that shape the media they consume” (p. 31). The discussions on these terms were followed by the introduction of ‘digital competence’ by Gilster in 1997.

The idea of digital competence was put forward by Gilster (1997) and the definition of the concept in literature emerged from this assertion. Gilster (1997) described digital competence as:

“The concept of literacy goes beyond simply being able to read; it has always meant the ability to read with meaning, and to understand. It is the fundamental act of cognition. Digital literacy likewise extends the boundaries of definition. It is cognition of what you see on the computer screen when you use the networked medium. It places demands upon you that were always present, though less visible, in the analog media of newspaper and TV. At the same time, it conjures up a new set of challenges that require you to approach networked computers without preconceptions. Not only must you acquire the skill of finding things, but you must also acquire the ability to use these things in your life.” (p. 1-2).

Gilster (1997) additionally construed critical thinking as digital literacy’s origin skill rather than a mechanical skill and highlighted the analytical assessment’s importance of the information found on web with respect to proper usage of it in people’s lives. Consequently, it was a crystal-clear fact that developing critical thinking skills together with digital literacy competence in pre- and in-service teachers was paramount in educational contexts of the 21st century, as it would be unreasonable to expect from digital natives, or next generations to lead an isolated life from technology, or to receive education without digital sources, the Internet, and technology.

The importance given to this concept kept increasing in the 21st century. In 2006, the UNESCO’s report pointed that digital competence was one of eight core components for lifelong development of an individual, and the EU framework asserted that digital competence was as one of eight key competencies for all citizens (European Commission, 2006) and it was defined as follows:

“Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and

exchange information, and to communicate and participate in collaborative networks via the Internet” (p. 16).

The scope of digital literacy was considered as much broader than ICT literacy as it encompassed the aspects of information literacy, media literacy, computer literacy. Yet, its main background had its roots in ICT literacy- the fundamental skills to handle digital software or hardware; however, it would be wrong to assume that an individual with ICT skills was digitally literate, as well (Martin, 2005). A digitally literate person was suggested to have the knowledge of how to use technology to search for information, select and evaluate it, and make use of that information by exchanging with peers, and procreate on it by using distinct web tools (Silva, 2012). The matter of being digitally literate was linked with having critical thinking skills because the concept was related with critical thinking about the use of technologies, albeit not with its technical elements (Silva & Behar, 2019). Digital literacy was also described by Thorne (2013) as a “semiotic activity mediated by electronic media” (p. 192). This definition emphasizes the meaning making and the analysis of the information processing available in digital sources mentally and visually, pointing out the significance of critical thinking skills.

Lankshear and Knobel (2008) claimed that digital literacy was a mixture of multiple distinct social practices for interpreting the mediated texts including blogs, text messages, video games, memes, discussion forms etc. through digital codification. Besides, meaning making from the information presented via digital sources did not only comprise to being digitally literate as “being critical” with those sources was also of vital importance. The reason why being critical, or critical thinking played a significant role in digital learning was that there were several open networks such as Internet in which it was allowed to anyone to publish anything which decreased the reliability of these sources and increased the risk of being misled by that digital source. This aspect of Internet, or other open networks was one of the limitations presented by technological advancements on the grounds that the information presented available to everyone had a probability of being produced by people with a particular religious, political, or ideological viewpoint (Leu et al., 2017). To this respect, being critical with the digital information was regarded as a competence that should be acquired by the digital natives of our era.

According to Søby (2008), having digital competence arouse in three dimensions. The first one was about appraisal and values. Secondly, there was a compound duration among skills, knowledge, and formative education. Lastly, there was to be an acceptance which might generate disparate promising interpretations of the presented information, and the areas to

utilize it. In this manner, those dimensions were required to be the focal point in educational settings in order to be able to boost digital literacy of learners.

Beyond question, encouraging learners to be digitally literate, and to obtain that competence may include some specific strategies that can be incorporated by educators. Media education should be regarded as a fundamental precondition for education since educators are willing to implement the usage of digital media, or Internet into their teaching. Thus, it cannot be assumed that these digital sources are the only means of transmitting information, and they are to be analyzed and absorbed critically by learners themselves. They should be practiced actively in a functional way (Buckingham, 2016). Thus, in order to be able to fulfill all these requirements suggested by the experts in the field, having the competence of critical digital literacy, which emphasizes the notion of critical thinking, attracts attention.

2.3.2. The Critical Digital Literacy Framework

CDL is a newborn phenomenon originated from critical literacy and critical media literacy, and it underlines the readiness of individuals to live in a digital age (Castellví et al., 2020). The phrase of CDL has its roots in several disciplines involving media literacy, computer ICT literacy, literacy, e- and literacy information literacy (Lohnes Watulak, 2016). Since digital media stimulates critical thinking, analyzing, using meta-knowledge to evaluate sources, and interact with others, these concepts fall into the CDL's subcategories (Darvin, 2017). It also "... expands the notion of literacy to include different forms of mass communication and popular culture as well as deepens the potential of education to critically analyze relationships between media and audiences, information and power." (Kellner & Share, 2007, p. 4).

There have been several definitions of CDL in literature. For instance, Labbo et al. (1998) described it as "the ability to recognize, interpret, and evaluate underlying ideologies in various types of hyper textually linked information as it is presented in various data sources" (p. 282) highlighting the absorption and manipulation of the information available on digital sources by individuals. Poore (2011) has asserted that there are two layers of digital literacy- functional digital literacy and CDL. The former one is associated with the technical skills and altering the attitudes towards technology via training whereas the latter one is related to the evaluation of the digital contexts more culture-specifically and the development of necessary philosophical and ethical strategies to reflect on them. Besides, Avila and Pandya (2013) have described CDL as having two objectives "to investigate manifestations of power relations in texts, and to design, and in some cases redesign, texts in ways that serve other, less powerful interests" (p.

3), and the original definition of CDL is proposed by them as “those skills and practices that lead to the creation of digital texts that interrogate the world; they also allow and foster the interrogation of digital, multimedia texts” (p. 3). On the other hand, CDL is inspected from a socio-cultural perspective and defined as “a mastery of the wider socio-cultural and economic context in which text production in digital spaces occurs” (Dowdall, 2009, p. 51).

Another approach of CDL is originated from the evaluation of personal experiences focusing on the social and political ideologies imposed on individuals due to the dominance of certain ideologies on digital media and sources. Thus, CDL should be evaluated on the grounds that it provides potentials for individuals, yet it holds the structural constraints, too (Polizzi, 2020). To elaborate, Pangrazio (2016) has claimed that the understanding of CDL is required to be reshaped according to the dominant ideologies since the only way to be able to absorb and criticize the message available in these media and digital sources is to be aware of the ideologies behind them and to develop a critical disposition that can be transferred across multiple contexts rather than social, political, economic, and culture dependence. Additionally, it is also highlighted that CDL should be treated as a sum of critical skills and knowledge which are deemed to be vital in democratic participation and involvement in the society socially (Trültzsch-Wijnen et al., 2017).

On another hand, Dowdall (2009) has also highlighted CDL as “... a mastery of the wider socio-cultural and economic context in which text production in digital spaces occurs” (p. 51). Similarly, Luke (2003) has underlined that a critical ICT literacy should involve “a meta-knowledge, a critical and self-reflective analysis of the sociocultural and political contexts of ICTs at global and local levels” (p. 399). Lastly, Merchant (2007) has argued that “...it is important to examine and critique discourses that relate to wider social issues, power relationships, prejudices, or inequities, and indeed that it is part of the function of educational institutions to engage in this sort of work.” (p. 125). All these critical models are the reflections of Freire’s (1970) critical pedagogy, which has intended to nullify social and political inequalities through literacy education.

The integration of digital literacy and critical thinking skills in education, especially in teacher education, has become quite significant since teachers are regarded as the cornerstones of learners’ critical thinking progress and problem-solving skills in the digital age (Farrell & Marshall, 2020). Thus, it is underscored that CDL requires teachers to be adequately qualified to be able to comprehend digital cultures as they are considered as guiders of learners who assist them to make connections of the digital divides by accessing to information and divergent

networks (Poore, 2011). The CDL of the teachers is claimed to be an urgent need (McDougall et al., 2018; Meehan et al., 2015; Santisteban et al., 2020) because it can enable them to create educational mediations and promote curricular materials accordingly. Hence, the key to attain the digital age's critical citizenship is indicated to be established in education and appropriate teacher training at tertiary level (Castellví et al., 2020).

The framework proposed by Hinrichsen and Coombs (2013) has named "*the five resources of critical digital literacy: a framework for curriculum integration*" was quite influential in literature on the grounds that it has provided a framework for teachers, teacher educators, and policy makers for the integration of CDL in this domain. They have offered a framework for the integration of CDL in the curriculum developed from the CDL model of Freebody and Luke (1990). The main point of the framework is that it does not offer rigid categorization of the following resources, underlining that the resources are related to each other and there is an interrelation between them. The researchers have also pointed that their primary goal is not to change the previously proposed resources completely, but to expand their interpretation by stressing the fluidity of these resources. They, then, have reinterpreted the four resources framed as CDL- '*decoding*', '*meaning making*', '*using*' and '*analyzing*', and amplify the model further with a fifth resource- '*persona*'.

They have defined '*decoding*' as "... the familiarity with the structures and conventions of digital media, sensitivity to the different modes at work within digital artefacts and confident use of the operational frameworks within which they exist" (p. 8) and have suggested five characteristic dimensions of decoding: '*navigation*', '*conventions*', '*operations*', '*stylistics*', and '*modalities*.' In the framework, '*meaning making*' is described as an unintentional process where the content, style and the purpose of the text is associated with the reader's previous experience, knowledge and response, and the characteristics of meaning making process are highlighted as '*reading*', '*relating*', and '*expressing*'. The third resource of the framework, namely '*using*' attributes to the ability to the digital sources' usage conveniently and effectively for the tasks in hand, and the characteristic dimensions of it are listed as '*finding*', '*applying*', '*problem solving*', and '*creating*'. The fourth source '*analyzing*' is explained as the ability to reach at knowledgeable reasoning and to make choices in a digital domain and include three characteristic dimensions- '*deconstructing*', '*selecting*', and '*interrogating*'. Lastly, the final resources elaborated in the model '*persona*' is described as "sensitivity to the issues of reputation, identity and membership within different digital contexts together with the purposeful management and calibration of one's online persona in order to develop a sense of

belonging together with a confident participant role.” (p. 12) which is constituted by three characteristic dimensions- ‘*identity building*’, ‘*managing reputation*’, and ‘*participating*’.

2.4. Previous Studies

Previous studies conducted on the subject matter with frameworks and their findings were discussed under this heading.

2.4.1. Previous Studies on TAM

The studies conducted on TAM in relation to teacher education including pre- and in-service teachers have been diverse in terms of the contexts and the participant groups involved. Most of the research on this subject matter were conducted in Asia where the “Technology Acceptance Measure for Pre-service Teachers Scale” was introduced by Teo in 2010. There were also several other studies conducted in the Western context with pre-service teachers, as well. It is worth noting that studies performed worldwide included pre-service teachers studying at different departments, yet, to the researcher’s knowledge, none of them were performed in the EFL (or ESL) context, nor their participant groups did specifically consist solely of pre-service EFL teachers. Thus, this study will be preliminary in literature providing an insight into the technology acceptance and integration of pre-service EFL teachers in the Turkish context in relation to the other two frameworks, labelled as WPACK and CDL.

To elaborate previous studies on TAM, those performed with pre-service teachers had been the focal point of teacher education studies in Asia. The scholars had long debated the impact of TAM constructs on the BI and technology acceptance of pre-service teachers. Specifically, Timothy Teo could be regarded as the pioneer of these studies in the Asian context on the grounds that he conducted various studies with pre-service teachers within different TAM frameworks investigating the interrelations of the framework’s components. For instance, Teo et al. (2008) conducted research to make an analysis of the Computer Attitude (hereafter: CA) of 239 pre-service teachers in Singapore through administration of the TAM model and revealed that the pre-service teachers’ main determinant of CA was the PU and PEU, both having a direct impact on their CAs. Their study also highlighted that even though SN had a direct and indirect influence on the CA, its influence on the PU was stronger. This result confirmed the study findings of Davis et al. (1989) pointing the robust influence of the SN on pre-service teachers’ CA.

Following these, Teo and Van Schalk (2009) performed a study on the technology acceptance of the pre-service teachers in Singapore with 250 pre-service teachers and supported

the findings of Teo et al. (2008) in that PU was the main determinant of BI of pre-service teachers' technology acceptance. However, their study contradicted with the findings of Teo et al. (2008) in several other ways such as it demonstrated as PEU not having a direct impact on BI, yet it impacted FC and PEU directly. More importantly, Teo and Van Schalk (2009) found that SN did not have any impact on PU, and there was no relation between the CAs of pre-service teachers and their BI to use technology.

The issue of the main determinants of BI and technology acceptance of pre-service teachers had been a controversial and highly disputed subject within the teacher education studies. For example, research conducted in Asian context with pre-service teachers, applying a different framework and scales other than TAM, had the same conclusion with the previous studies by reporting that even though pre-service teachers had positive attitudes towards web 2.0 technologies' integration in the classroom and they were active users of social networking sites, they found teaching with technology to be complex by having reserved attitudes towards it (Lei, 2009). The findings of this study could be interpreted within the TAM framework as PEU being the main determinant of pre-service teachers' technology acceptance or their BI to use it in their teaching practices.

Similarly, Teo (2011) argued that Malaysian pre-service teachers were more likely to use technology when they perceived it useful, and it would enhance their job performance. The researcher also reported that PEU had an indirect impact on BI and affected both PU and ATU. This finding suggested that pre-service teachers did not merely accept a new technology just because it was perceived to be easy, but it was necessary to have a positive attitude towards it, and perceive it as useful, as well. Lastly, Teo (2011) concluded that BI to use technology was found to be mostly predicted by computer self-efficacy conveying that when pre-service teachers regarded themselves as competent in technology use, they were more likely to use it.

Corresponding to the previous findings, the study of Sang et al. (2010) with 727 pre-service teachers in China asserted that ATU was the most substantial construct in estimating potential technology use, and the confidence level of pre-service teachers with computer efficacy was highly correlated with technology use in their future teaching. Apart from this, the study findings also highlighted that there was no gender difference in prospective technology use among pre-service teachers (Sang et al., 2010). These findings were also in relation with the study of Sadaf et al. (2012), conducted with pre-service teachers at a Midwestern university in the USA within the Decomposed Theory of Planned Behavior framework, indicating that high level of self-efficacy beliefs, positive attitudes towards technology use and PU were the

significant predictors of the use of web 2.0 technologies in the future teaching of pre-service teachers.

Within a similar context, Bell et al. (2013) provided a different perspective by investigating the subject matter with 26 pre-service teachers in the USA qualitatively and concluded that pre-service teachers' use of technology was mainly governed by their intrinsic motivation and their pedagogical beliefs. Following, another qualitative study conducted with 58 pre-service teachers in the USA reported that pre-service teachers' main motivation to use technology was to improve their students' learning and complete their assignments (Funkhouser & Mouza, 2013) which could be illustrated within the TAM framework as the main predictor of BI to use technology was PU.

As mentioned earlier, numerous studies in the Asian context have investigated the interrelations between the TAM constructs with pre-service teachers. A more recent research on this subject matter, performed with 302 pre-service teachers in Malaysia, were contradictory with the findings of Teo et al. (2008), Teo (2011), and Lei (2009) with the claim that PU and ATU had a direct impact on pre-service teachers' technology integration in their teaching, the latter showing less variance, whereas PEU was not significant determinant of BI and ATU, yet it was detected to be a predictor of PU (Wong, 2013).

Following this, more recent attention has focused on the gender differences in technology acceptance in pre-service teachers. Teo et al. (2015) studied the gender difference in technology acceptance at a teacher training institute with 339 pre-service teachers and discovered that there was no statistically significant gender difference on the PU, ATU and BI constructs suggesting that pre-service teachers from both gender groups had equal perceptions about the usefulness of technology, attitudes towards technology use and intentions to use it in their teaching.

While numerous studies attempted to explain the technology acceptance of pre-service teachers, the measurement tools for those investigations had been limited to those developed for individuals in different business sectors, in-service teachers etc., and not developed specifically for pre-service teachers. However, it was not until the development of a scale for pre-service teachers that the studies on this subject matter diversified worldwide. Teo (2010) developed the five-factor scale, which are PU, PEU, SN, FC, and ATU, "Technology Acceptance Measure of Pre-service Teachers" (hereafter: TAMPST) drawing from various theoretical frameworks introduced in information systems and technology acceptance by using three studies with 759 pre-service teachers. Subsequently, Teo (2015) performed another

analysis on the technology acceptance with 387 pre- and 430 in-service teachers and proposed a new 7-point scale with seven variables which are PU, PEU, ATU, SN, FC, Computer Self-Efficacy (hereafter: CSE), and Technological Complexity (hereafter: TC). The results of the analysis revealed that all these seven variables were valid in explaining technology acceptance among both teacher groups, yet FC and TC were detected to be more significant in predicting technology acceptance.

Although the investigation of technology acceptance or technology integration had been a prominent research area in the Turkish context, the investigation of this subject matter with pre-service teachers under the TAM frameworks had not been abundant. In terms of educational technology acceptance and integration, there were few studies conducted with in-service teachers (Adıgüzel et al., 2011; Akar, 2019; Göktaş et al., 2008), and the participant groups of the studies with pre-service teachers were distributed among numerous departments in Turkey.

To illustrate, Özdamlı et al. (2009) investigated the attitudes of pre-service teachers from several departments, including English Language Teaching, towards educational technologies and reported that participants from all branches had an agreement on the positive effect of educational technologies with no statistically significant gender difference. Similarly, Efe (2011) examined science pre-service teachers' beliefs and intentions of educational technology use in instruction and revealed a high correlation between educational technology experience and intention to use it in future classrooms. Furthermore, Koc (2013) inspected on the technology conceptions of 237 technical pre-service teachers in Turkey through a metaphor analysis and highlighted that they had restricted conceptions, mostly centered on technical dimensions, albeit with no significant gender difference on educational technologies.

There had been few empirical investigations on the relationship between the technological/ computer competencies and the attitudes towards technology use among pre-service in Turkish context. For example, Çetin et al. (2012) conducted research with 642 pre-service teachers from several departments in Turkey. The researcher reported the technology competency level of pre-service teachers was at an average level and they had positive attitudes towards educational technology use in instruction. A more recent study inspected on the relationship between computer competence, attitudes towards computer-assisted education (hereafter: CAE) and technology acceptance intention of 476 pre-service teachers from various departments within three dimensions of TAM (PU, PEU and perceived enjoyment), and found a statistically significant relationship among these three subjects. It was also reported in the study that three dimensions of the TAM had a significant relation with attitude towards CAE,

PEU not being a determinant of attitudes towards CAE, and females were detected to have a higher levels of technology competence (Baturay et al., 2017). Lastly, Baydas and Goktas (2017) proposed a model for the analysis of pre-service teachers' ICT usage intentions in future lessons under the UTAUT framework. Their study acknowledged that PU, PEU and efficacy were intermediate factors in determining ICT usage intentions whereas they were all affected negatively by computer anxiety, which in turn, indirectly impacted BI.

So far, there had been some investigations on the technology acceptance, attitudes towards technology integration, and the technology competence of pre-service teachers in the Turkish context; however, they did not deal with pre-service EFL teachers. The number of studies on the technology acceptance of pre-service EFL teachers in Turkey had been limited to only a few studies in literature.

To elaborate, İlter (2015) analyzed the perceptions of pre-service EFL teachers and young learners on technology use qualitatively and reported that participants agreed on the positive effect of technology in language learning process. On the other hand, there were two other studies performed with 241 pre-service EFL teachers in Turkey within the TAM framework. The first one (Bozdoğan & Özen, 2014) examined the level and competence of ICT usage and the factors having an impact on the ICT self-efficacy levels of pre-service EFL teachers in Turkey. The study acknowledged that the ICT self-efficacy levels of most of the participants were high, and supportive and dynamic nature of ICTs were positively impactful on their ICT integration (Bozdoğan & Özen, 2014). The study also underlined that the knowledge and skills were the main determinants of ICT integration of pre-service teachers in their future teaching.

The second study (Kırmızı, 2014) investigated the technology acceptance of 213 pre-service EFL teachers in Turkey within the TAM framework and revealed that pre-service EFL teachers had positive awareness of PEU, FC, ATCU technological complexity, computer self-efficacy, and BI. It was also reported in the study that there were statistically significant differences between first and fourth grade students regarding PEU, FC, ATCU and computer self-efficacy. Lastly, PEU was detected not to be a determinant of BI, which is in line with the finding of Wong et al. (2013), and PU to have a positive effect on ATU.

2.4.2. Previous Studies on WPACK

The emergence of the WPACK paradigm in educational technology and teacher education has been regarded as a recent study field, and thus, studies conducted on this subject matter with pre-service teachers (Alsofyani et al., 2012; Chai et al., 2011; Chai et al., 2014; Joo et al., 2018; Kay, 2006; Keating & Evans, 2001; Maeng et al., 2013; Polly et al., 2010) originated mostly from the TPACK frameworks of Mishra and Koehler (2006) and Angeli and Valanides (2009). One of the leading studies in literature was conducted by Lee, Tsai and Chang (2008) who suggested a differentiation between TPACK and WPACK by asserting that explanation of web technologies usage in instruction would be insufficient under the framework of TPACK and developed a scale to assess WPACK levels of Taiwanese teachers. The confirmatory factor analysis of this scale was performed by Lee and Tsai (2010) who differentiated the TPACK framework with an add-on construct ‘web’ and renamed the TPACK framework as TPACK-W. They emphasized in their study that Taiwanese teachers with more web experience were highly likely to be more competent in technology use in their instruction. The researchers also developed a scale named as “TPCK-W Survey” to measure the web pedagogical content knowledge of teachers since TPACK framework did not encompass the specific use of web technologies in instruction.

Apart from the studies conducted worldwide with pre-service teachers, there were few studies conducted in the Turkish context with pre-service teachers on the TPACK framework, as well (Kul et al., 2019; Pamuk, 2012; Yurdakul, 2017). However, the studies on WPACK with pre-service teachers were more abundant than on the TPACK framework in the Turkish context whereas it was scarcer in other studies conducted in different countries. To illustrate, the number of studies on WPACK with pre-service teachers was so limited worldwide that it was almost non-existent while more than twenty studies on WPACK with pre-service teachers were detected in the Turkish context. Most of the studies on WPACK originated from the Asian context where the development of the scales and frameworks originated. Except from the studies on WPACK with pre-service teachers (Akayuure et al., 2013; Chai et al., 2014), there was no study performed with pre-service EFL teachers worldwide.

There were numerous studies performed on WPACK with pre-service teachers in the Turkish context, some of which focused mainly on the self-efficacy levels of pre-service teachers in relation to their WPACK levels. For example, Hiğde et al. (2014) conducted research with 150 pre-service science and physics teachers and revealed that the participants’ WPACK was high, and habits of Internet usage and computer ownership influenced their

WPACK levels whereas there was no statistically significant difference found regarding their gender and departments. On the same grounds, the research of Turan (2016) displayed identical results by highlighting that self-efficacy levels of pre-service teachers from several departments such as Social Sciences, Math and Science varied depending on their computer usage time, having a personal computer, frequency of Internet/computer usage, and their departments. Besides, there were a couple of studies conducted with prospective teachers from different branches enrolled at Pedagogical Formation Course.

One of those studies was performed by Gömleksiz (2011) who revealed that pre-service teachers' self-efficacy levels regarding WPACK differed in accord with their gender and their departments which contradicted with the previous study findings in literature. According to Gömleksiz (2011), prospective teachers from the department of Geography had the highest self-efficacy score whereas the ones from the department of Biology had the lowest, and differences among gender groups were detected in the sub-dimensions of the WPACK (e.g., web general, web communicative etc.). In addition, another study conducted with the students from the department of Tourism and Hotel Management at teacher training certificate program in the Faculty of Education at a state university in Turkey demonstrated that WPACK and self-efficacy levels of participants increased concurrently as they proceeded with their training program underlining that effective use of web 2.0 technologies was influential in developing a high level of WPACK and self-efficacy perceptions. Finally, the study of Oskay and Odabaşı (2016) operated with 250 pre-service teachers registered at an online KPSS (aka Public Personnel Selection Examination) preparation course disproved the findings of Gömleksiz (2011) by revealing that self-efficacy levels of pre-service teachers regarding WPACK did not differ according to their gender; yet, confirming it in that pre-service teachers had a high level of self-efficacy levels of WPACK.

A couple of studies in literature on this subject matter with the students from the department of Science and Technology at the Faculty of Education were performed in the Turkish context, as well. For instance, Horzum (2011) studied on the adaptation of WPACK Survey developed by Lee and Tsai (2010) in the Turkish context with 232 pre-service teachers from the department of Science and Technology and developed a valid and a reliable Turkish version of the WPACK Survey with .94 reliability score. Following this, Horzum and Güngören (2012) examined the relations between beliefs for web-based instruction (hereafter: WBI), acceptance of WBI tools, and WPACK levels of 363 pre-service teachers and reported that PU, PEU and perceived attitude and attention had a positive impact on WBI tools acceptance of pre-

service teachers. They also detected in their study that beliefs for WBI affected the WBI tools' acceptance levels of the participants, which in turn, influenced their WPACK levels. Another more recent study operated with the same participant group contained 49 students from the same department at another state university in Turkey (Yağcı, 2019). The study investigated the correlations between the participants' academic achievement, study approach and WPACK levels, and indicated that academic achievement and study approach did not vary according to the WPACK levels of the pre-service teachers.

Most of the studies on WPACK with pre-service teachers in the Turkish context included participant groups who were students at different departments of the Faculty of Education in several universities in Turkey. To exemplify, Eren and Alkan (2014) operated a study with 453 pre-service teachers from several branches and class levels at a state university to examine the relations between the TPACK and WPACK variables. Their study indicated that 31% of the WPACK variance could be explained by the TPACK, suggesting that teachers were required to combine their technological and pedagogical knowledge with web knowledge to be able to integrate web technologies into their instruction successfully. Additionally, Yazar and Şimşek (2015) investigated the WPACK levels of 637 pre-service teachers from nine different departments regarding WBI. Their study revealed that WBI had a significant role in developing the WPACK and the Internet usage frequency of the participants increased WPACK of pre-service teachers, which was in line with the findings of Hiğde et al. (2014) and Turan (2016). Another research with mixed groups of 343 pre-service teachers from multiple departments at different class levels confirmed the findings of studies by demonstrating that variables such as having a personal computer, Internet usage frequency and Internet usage motivations had a positive impact on the WPACK development of the participants (Arabacıoğlu & Dursun, 2015).

Recently, researchers had examined the relations between the WPACK and other certain paradigms with pre-service teachers in the Turkish context. To illustrate, Gökçearslan et al. (2016) conducted research aiming at uncovering whether the individual innovativeness of pre-service teachers was a significant predictor of high level of WPACK with 170 pre-service teachers from various branches and acknowledged that all sub-dimensions of the WPACK were significantly affected by the innovativeness levels of pre-service teachers positively. Another recent study exploring the relationship between WPACK with other concepts was performed by Tuluk and Kepçeoğlu (2019) who inspected the interplay between mathematics pre-service teachers' WPACK and online information searching strategies. The study demonstrated that 17.3% common variance was determined between WPACK and online information searching

strategies, pointing that teacher training programs should integrate an effective training of appropriate usage of web technologies in relation to pedagogical and content knowledge development. Finally, a present-day study of Başaran and Yalman (2020) included 416 pre-service teachers from different departments, 15% of whom were from English Language Teaching Department. Their study aimed at examining the impact of pre-service teachers' academic achievements, frequency of connection to the distant learning system, gender, and related sub-factors on their web-based self-efficacy perceptions and attitudes towards distance education. It was reported in the study that the factor of 'web communication' was positively and directly affected by the self-efficacy levels of male pre-service teachers whereas it was not valid for the females, and positive attitudes towards WBI was increased by the connection' recurrence to the distance education system for both gender groups.

The research to date has mostly centralized on the WPACK analysis with several pre-service teacher groups from various departments in the Turkish context, and the few research have researched WPACK levels of pre-service teachers in EFL context. One of these studies was conducted by Kavanoz et al. (2015) who operated her research on the WPACK self-efficacy levels of 120 pre-service EFL teachers. The study findings demonstrated that Turkish EFL pre-service teachers had a high WPACK self-efficacy levels and positive attitudes towards WBI, and it did not vary according to their gender or class level. Correspondingly, Bağcı and Atar (2019) inspected on the WPACK self-efficacy levels of 110 Turkish pre-service EFL teachers and revealed self-efficacy of participants were high in all five sub-dimensions of WPACK which supported the findings of Kavanoz et al. (2015). The study also revealed that the only variable that had a significant impact on WPACK among other variables (e.g., university, gender, daily amount of time spent on the Internet social networks) was the grade level, suggesting that higher grade level was positively correlated with higher level of WPACK self-efficacy. Finally, Aydın et al. (2017) performed research with 263 pre-service English Language and Turkish Language teachers to examine and compare their WPACK self-efficacy levels, and reported that self-efficacy of general web, communicative web, web content, WPC, and attitude toward web-based education levels of pre-service English Language teachers was higher than those of Turkish Language. The study also underscored that there was a statistically significant difference on attitudes towards WBI and web pedagogical perceptions based on the grade levels.

2.4.3. Previous Studies on CDL

The concept of digital literacy dates to the beginning of the 20th century (Gilster, 1997); however, its evolution to the concept of CDL and its evaluation within teacher education research could be deemed as a fairly distinct and new research subject in literature. Hence, although extensive research has been carried out on digital literacy, ICT literacy, and critical literacy in secondary and tertiary level (Bennett, 2014; Dowdall, 2009; Fernández-Díaz et al., 2014; Kahn & Kellner, 2005; Kellner & Share, 2007; Kvavik, 2005; Margaryan & Littlejohn, 2008; Martin, 2006; Merchant, 2007; Torres & Mercado, 2006; Tuamsuk & Subramaniam, 2017; Lohnes Watulak, 2016), the number of the studies dealing with the CDL in teacher education are considerably limited.

The studies which could be regarded as relevant to the current research topic did not take account of CDL as a solely unit construct, nor did they investigate its relationship with the other two frameworks included in the current research. To illustrate, Watt (2019) examined the CDL in elementary teacher education and reported that the most critical action to take for the development of teachers was to help pre-service teachers analyze how digital tools might create a new body of knowledge by representing different types of learning. Another study focusing on the promotion of critical thinking skills with digital tools in primary teacher education consisted of 322 pre-service teachers in Spain revealed that participants had a quite low score in critical thinking, and they were not capable of questioning and critically evaluating the online information, and they were not aware of the appropriate use of digital media (Castellví et al., 2020).

Empirical studies on the CDL with pre-service teachers in the EFL context did not receive much attention, such that, only few studies treated the concept in detail from different perspectives. For instance, Røkenes and Krumsvik (2016) performed a case study with the students of an ESL Teacher Education Program in Norway to analyze how pre-service teachers were educated to integrate ICT into their teaching and ESL Didactics course. The study findings highlighted that student teachers were not able to realize the evident uses of ICT in their future teaching, and they were not capable of differentiating its usage within appropriate contexts because they did not have pedagogical reasoning practices within critical ICT competence. Furthermore, Liza and Andriyanti (2019) examined 54 EFL pre-service teachers' digital literacy levels and their readiness for the digital technologies' utilization and reported that the perceptions of the pre-service teachers were not proportionate with their ability to use them on the grounds that the knowledge, skills, and criticality they had was limited. It was also

underlined in the study that participants were not ready to utilize digital tools in their teaching due to a lack of CDL practices.

Until recently, no research has been found to investigate the subject matter with pre-service EFL teachers in the Turkish context. However, there were a couple of studies conducted on digital literacy practices, critical literacy, and digital literacy with pre-service teachers in the Turkish context. For instance, Çukurbaşı and İşman (2014) explored the digital native features of 472 pre-service teachers at a state university in Turkey and discovered that nearly 58% of the participants had digital native features suggesting that pre-service teachers could use web 2.0 technologies effectively. It was also noted in the study that the digital nativity of the pre-service teachers did not vary according to their grade level; however, it did according to their gender, age, and families' socioeconomic status, which implied that acquiring digital nativity was related to the economic and social constraints of the individuals.

Moreover, there were two other studies analyzing the perceptions of pre-service teachers on digital literacy in the Turkish context. The first one was conducted with 357 pre-service teachers studying at different departments such as Primary Teaching, Computer Education and Instructional Technology, Pre-Schooling, Social Sciences, Elementary Mathematics, Science and Technology, Psychological Counseling, Special Education, Turkish Language Teaching and English Language Teaching. The study findings revealed that information literacy, software literacy, technology literacy, and computer literacy of pre-service teachers studying at Computer Education and Instructional Technology Teaching were higher than those of other departments, and male participants' visual and computer literacy levels were higher than females (Çam & Kiyici, 2017). The study had contrasting results with that of Çukurbaşı and İşman (2014), in that it asserted that gender had a significant impact on digital literacy whereas income level did not have any impact on it.

Lastly, another study with 295 Turkish pre-service teachers from several departments, not including English Language Teaching Department, noted that participants had positive and high perceptions on digital literacy, and it was differentiated by their major, Internet access, and gender (Ata & Yıldırım, 2019). It was also reported in the study that the major group with the highest digital literacy level was Science Teaching, where females found digital tools more challenging than males, and having a personal computer with Internet access had a significant impact on digital literacy promotion.

To conclude, the studies conducted on the CDL or other literacies regarding the digital tools in the Turkish context, especially with pre-service teachers, is almost non-existent in the literature. Thus, this study will be the first study in literature that highlights on the CDL levels of pre-service EFL teachers with respect to the two aforementioned frameworks in both global and the Turkish context. The investigation of CDL levels of pre-service EFL teachers will provide a fresh insight into teacher educators, authorities, and the pre-service teachers themselves so that they can develop strategies and methods that may contribute to the improvement of their CDLs in lieu of their TAM and WPACK levels.



CHAPTER THREE

3. METHODOLOGY

Research design, settings and participants, data collection procedures, instruments and data analysis process were presented below under this heading.

3.1. Introduction

This non-experimental mixed-method study focuses on the investigation of the Turkish pre-service EFL teachers' Web Pedagogical Content Knowledge (WPACK), their Critical Digital Literacy (CDL) and Technology Acceptance levels together with their relationships within each other. In this thesis, it is also examined whether there are any statistically significant differences among EFL pre-service teachers' gender, age and personal computer ownership which are reported as essential in literature, as well. For this purpose, this thesis poses the following questions:

1. What are the Turkish pre-service EFL teachers' levels of Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy?
 - 1.1. Is there a statistically significant difference of Technology Acceptance, WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of age?
 - 1.2. Is there a statistically significant difference of Technology Acceptance, WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of gender?
 - 1.3. Is there a statistically significant difference of Technology Acceptance and WPACK, and CDL levels Turkish pre-service EFL teachers in terms of owning a personal computer?
2. Is there a statistically significant relationship between Technology Acceptance and WPACK of Turkish pre-service EFL teachers?
3. Is there a statistically significant relationship between Technology Acceptance and CDL levels of Turkish pre-service EFL teachers?
4. Is there a statistically significant relationship between WPACK and CDL levels of Turkish pre-service EFL teachers?

This part of the thesis consists of six sections: research design, setting and participants, instruments, data collection procedures, and data analysis procedures. The first section provides a detailed explanation for the design of the research. In the second section, information regarding the setting and participants of the research are provided. In the fourth section, data

collection tools are introduced. In the fifth section, data collection procedures are demonstrated. In the final section, data analysis procedures are illustrated.

3.2. Research Design

This non-experimental study has a mix-method research design which includes the employment of qualitative and quantitative data analyses as a stand-alone survey provides limited data in refinement (Clough, & Nutbrown, 2012). More specifically, the research has a quantitatively driven design in which there are quantitative data at its core complemented with them to postulate on the findings in depth, and from a wider perspective (Johnson, 2001; Johnson et al., 2007). Herein, quantitative data are utilized to reveal the Turkish pre-service EFL teachers' Web Pedagogical Content Knowledge (WPACK), their Critical Digital Literacy (CDL) and Technology Acceptance levels together with their relationships within one another while qualitative data obtained from the open-ended questions given at the end of the survey in order to get their reflections and in tow employed to gain an insight regarding the perceptions of the Turkish pre-service EFL teachers on their WPACK, CDL and Technology Acceptance levels and the interplay among them.

3.3. Setting & Participants

The research was conducted at the department of English Language Teaching at a state university in Turkey during 2020-2021 academic year. All the students in the department were invited to participate in the study; however, participation in the research was based on the principle of voluntariness.

Beyond question, whether the research method was employed qualitatively or quantitatively, sampling methods were demanded for maximizing efficiency and validity of the research (Morse & Niehaus, 2009). Thus, for sampling, convenience sampling method was utilized which was a quite common sampling method in second language studies (Mackey & Gass, 2005) as it provided researcher with a sampling group who were easy to access and met the criterion for the sample as a type of purposeful sampling designs (Johnson & Christensen, 2004).

Demographic information obtained from the participants regarding their age, gender, level of education, family income level, personal computer ownership, and frequency of web tools usage (i.e., always, sometimes, rarely, very rarely, never). The sample size of the study consisted of 94 participants in total studying at the department of English Language Teaching

at a state university in Turkey. Demographic information of the participants is presented in the table given below:



Table 1.*Demographic Information*

		Frequency	Percent	Valid Percent	Cumulative Percent
Age	17-21	77	81.9	81.9	81.9
	22-26	12	12.8	12.8	94.7
	27+	5	5.3	5.3	100.0
Valid	Total	94	100.0	100.0	
Gender	Female	56	59.6	59.6	59.6
	Male	36	38.3	38.3	97.9
	Not Applicable	2	2.1	2.1	100
Valid	Total	94	100.0	100.0	
Level of Education	Freshmen	44	46.8	46.8	46.8
	Sophomore	26	27.7	27.7	74.5
	Junior	20	21.3	21.3	95.7
	Senior	4	4.3	4.3	100
Valid	Total	94	100.0	100.0	
Family Income	1500-2500	15	16.0	16.0	16.0
	2600-3600	21	22.3	22.3	38.3

	3600+	53	56.4	56.4	94.7
	Not Applicable	5	5.3	5.3	100.0
Valid	Total	94	100.0	100.0	
	Always	73	77.7	77.7	77.7
Frequency of Web Tools Use	Sometimes	20	21.3	21.3	98.9
	Very Rarely	1	1.1	1.1	100.0
Valid	Total	94	100.0	100.0	
Personal Computer Ownership	Yes	85	90.4	90.4	90.4
	No	9	9.6	9.6	100
Valid	Total	94	100.0	100.0	

As illustrated in Table 1, of 94 participants in total 56 were female (59.6%), 26 were male (38.3%), and 2 were reported as non-defined (2.1%). The age distribution of the participants was ranged as 17-21 (n= 77), 22-26 (n= 12), and 27 and above (n= 5). The participants of the research consisted of 44 freshmen (46.8%), 26 sophomores (27.7%), 20 juniors (21.3%), and 4 seniors (4.3%). It is worth noting that all senior students in the department have taken the courses of BIL101 Information Technologies, EBB605 Instructional Technologies, and IDE201 Approaches to English Language Learning and Teaching, all of which are likely to have an indirect impact on the participants' responses to the questionnaires. To note more, junior students have taken BIL101 Information Technologies and EBB605 Instructional Technologies courses, and the sophomores have only taken BIL101 Information Technologies course.

In terms of family income level, participants were grouped as 1500-2500 (n= 15), 15 2600-3600 (n= 21), and 3600 and above (n= 53). Herein, 5.3% of the participants did not define

their family income levels, though (n= 5). It was also demonstrated in Table 1 that 85 of them (P= 90.4%) owned a personal computer whereas 9 of them (P= 9.6%) did not. Lastly, of 94 participants, the frequency of web tools usage was reported as always (n= 73, P= 77.7%); sometimes (n= 20, P= 20.3%), and very rarely (n= 1, P= 1.1%).

3.4. Procedures for Data Collection

Due to the restrictions of the worldwide pandemic situation, the quantitative data were not collected face-to-face at one sitting yet collected through an online survey created on Google through Google Forms. The online survey was shared with the participants through the agency of their instructors on Microsoft Teams, which was employed as a learning management system during the pandemic at the university.

The researchers attended the first 15 minutes of each online course for each level and were briefly explained the research topic. The data collection tools within the survey (mentioned in detail in the following section) were introduced to the participants and responded to any possible questions of the participants regarding them. The consents of the participants were obtained before filling. After the introduction part, the participants were given probable time to fill in them under the provision of their course instructor(s) on voluntary basis. The online survey was shared in the course groups on Microsoft Teams for absent students and they filled it after the course when they were available, as well.

Besides, students were invited to respond three open-ended questions listed at the end of the survey regarding their personal opinions and beliefs, which constituted the reflective (qualitative) part of the study. The consents of the voluntary participants were obtained before filling. The data collection as an overall process was completed in two weeks in sum.

3.5. Instruments

For data collection, an online survey, which was consisted of five sections, was employed in the form of Google Forms. The instruments were explained in detail in the following sections; however, it was noteworthy to briefly mention them before mingling with the details of each.

The first section required demographic information of the participants, which were age, gender, level of education, family income level, personal computer ownership, and frequency of web tools usage. The second section was composed by the 5-point Likert type items, ranked from *Strongly Disagree* (1) to *Strongly Agree* (5), named as ‘Technology Acceptance Measure

for Pre-service Teachers' developed by Teo (2011). The third section of the survey included the 5-point Likert type items, also ranked from *Strongly Disagree* (1) to *Strongly Agree* (5), named as 'Technological Pedagogical Content Knowledge-Web (TPCK-W) Survey' proposed by Lee and Tsai (2010). The fourth section comprised of 5-point Likert type items again, ranked from *Strongly Disagree* (1) to *Strongly Agree* (5), adapted from the 'Critical Digital Literacy Framework' of Henrichsen and Koombs (2013). One more to note, the last section of the survey included the qualitative phase of the research with three open-ended questions.

3.5.1. Instrument 1

The first instrument utilized for data collection was the 'Technology Acceptance Measure for Pre-service Teachers' developed by Teo (2011) with 5 constructs and 16 items in sum. The items and constructs were adapted from distinctive theoretical frameworks employed in information systems usage behavior, which were the TRA, TAM, TPB, and UTAUT (Teo, 2011).

Reliability analysis was employed with an attempt to measure internal consistency of the instrument, from which the Cronbach Alpha coefficient was stipulated to be above .70 in order to be deemed as internally consistent in the field of Social Sciences (Mujis, 2004). The Cronbach Alpha coefficient of the instrument was calculated as .918 as illustrated in the table below. Additionally, split-half reliability analysis was also conducted to reaffirm the internal consistency through the results created from the two subsets of items by halves ($n_1 = 8$; $n_2 = 8$) and reported as .893 (r_1) and .815 (r_2).

Table 2

Reliability Statistics for TAMPST

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.918	.921	16

The scale consisted of five factors: (1) *perceived usefulness* (PU), (2) *perceived ease of use* (PEU), (3) *subjective norm* (SN), (4) *facilitating conditions* (FC), and (5) *attitudes toward computer use* (ATCU). The distribution of the factors among items were demonstrated in the table given below:

Table 3

The Distribution of the Factors among Items of TAMPST

-
1. Using computers will improve my work (PU)
 2. Computers make work more interesting (ATCU)
 3. My interaction with computers is clear and understandable (PEU)
 4. When I need help to use computers, specialized instruction is available to help me (FC)
 5. Working with computers is fun (ATCU)
 6. I find it easy to get computers to do what I want it to do (PEU)
 7. Using computers will increase my productivity (PU)
 8. I find computers easy to use (PEU)
 9. When I need help to use computers, a specific person is available to provide assistance (FC)
 10. People whose opinions I value will encourage me to use computers (SN)
 11. I like using computers (ATCU)
 12. People who are important to me will support me to use computers (SN)
 13. Using computers will enhance my effectiveness (PU)
 14. When I need help to use computers, guidance is available to me (FC)
 15. I find computers a useful tool in my work (PU)
 16. I look forward to those aspects of my job that require me to use computers (ATCU)
-

3.5.2. Instrument 2

The second instrument employed for data collection was the ‘Technological Pedagogical Content Knowledge-Web (TPCK-W) Survey’ developed by Lee and Tsai (2010) with five factors composed by 30 items.

Reliability analysis was employed with an attempt to measure internal consistency of the instrument, from which the Cronbach Alpha coefficient was stipulated to be above .70 in order to be deemed as internally consistent in the field of Social Sciences (Mujis, 2004). The Cronbach Alpha coefficient of the instrument was calculated as .949 as illustrated in the table below. Additionally, split-half reliability analysis was also conducted to reaffirm the internal consistency through the results created from the two subsets of items by halves ($n_1= 15$; $n_2= 15$) and reported as .935 (r_1) and .927 (r_2).

Table 4*Reliability Statistics for TPCCK-W*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.949	.955	30

The factors in the instrument were (1) *web-general*, (2) *web-communicative*, (3) *web-content knowledge*, (4) *web-pedagogical-content knowledge*, and (5) *attitude toward web-based instruction*. The distribution of the factors among items were demonstrated in Table 5.

Table 5*The Distribution of the Factors among Items of TPCCK-W**Web-general*

1. Be able to click the hyperlink to connect to another Website.
2. Be able to key in the Website address to connect to a particular Website.
3. Be able to print out the content of a Website.
4. Be able to search for information on the Web using keywords.
5. Be able to download pictures from the Web.
6. Be able to use the Web search engines.
7. Be able to copy text on the Web into the “Word”.

Web-communicative

8. Be able to read others’ messages in a chatroom.
9. Be able to set a nickname by yourself in an online chatroom.
10. Be able to talk to others one on one in an online chatroom.
11. Be able to provide information or respond to someone else on a BBS (Bulletin Board System).

Web-Content Knowledge

12. Know that Web technology can provide various materials to enrich course content.
13. Know how to search online resources for course content.
14. Know how to select proper content from Web resources.
15. Be able to search related online materials for course content.
16. Be able to search for various materials on the Web to be integrated into course content.

Web-Pedagogical-Content Knowledge

17. Know how to apply teaching modules on the Web into courses.
18. Be able to use Web technology to enhance teaching.
19. Be able to use the Web to enhance students’ learning motivation.
20. Be able to select proper existing Web-based courses to assist teaching.

21. Be able to apply Web technology to use multiple teaching strategies on a particular course unit.
22. Be able to guide students to use Web resources to study a certain course unit.
23. Be able to use Web resources to guide students' learning activities for a certain course unit.
24. Be able to use Web technology to support teaching for the content of a particular course unit.

Attitude toward web-based instruction

25. Web technology can be actually used in the practice of teaching.
26. The characteristics of the Web can help instruction.
27. Web technology can enhance teaching skills.
28. Web-related resources can enrich course content.
29. Web-based teaching can enhance students' learning motivation.
30. Web-based teaching is a future trend in education

3.5.3. Instrument 3

The third instrument utilized for data collection was adapted from the 'Critical Digital Literacy Framework' of Henrichsen and Koombs (2013) and transformed into a 5-point Likert type format. The questionnaire involved five constructs with 45 items.

Reliability analysis was employed with an attempt to measure internal consistency of the instrument, from which the Cronbach Alpha coefficient was stipulated to be above .70 in order to be deemed as internally consistent in the field of Social Sciences (Mujis, 2004). The Cronbach Alpha coefficient of the instrument was calculated as .970 as illustrated in the table below. Additionally, split-half reliability analysis was also conducted to reaffirm the internal consistency through the results created from the two subsets of items by halves ($n_1 = 23$; $n_2 = 22$) and reported as .962 (r_1) and .927 (r_2).

Table 6

Reliability Statistics for CDL

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.970	.972	45

The constructs were (1) *decoding*, (2) *meaning making*, (3) *using*, (4) *analyzing*, and (5) *persona*, each of which included their own sub-dimensions. To elaborate, the sub-dimensions of *decoding* construct were *navigation*, *conventions*, *operations*, and *modalities*. The sub-

dimensions of *meaning making* construct were *reading, relating, and expressing*. The sub-dimensions of *using* construct were *finding, applying, problem solving, and creating*. The sub-dimensions of *analyzing* were *deconstructing, selecting, and interrogating*. Lastly, the sub-dimensions of *persona* were *identity building, managing reputation, and participating*. The distribution of the factors and their sub-dimensions among items were demonstrated in the table given below:

Table 7

The Distribution of the Factors and Sub-Dimensions among Items of CDL

Decoding

(Navigation)

1. I can understand navigational mechanisms (e.g., scrolling, active windows, menus, buttons, etc.).
2. I can understand conceptual notions of movement in the digital landscape, such as metaphors and avatars.
3. I can understand practical notions of movement in the digital landscape, such as mouse, swiping, and VR.
4. I can locate myself spatially, such as when following links.
5. I can locate myself operationally, such as having several programs, or sites running simultaneously.

(Conventions)

6. I can understand the practices and norms of ICT usage including safety and security, presentational and accessible production.
7. I can understand the practices and norms of participation in online communities including communication protocols, ethics, privacy, sharing and attribution.

(Stylistics)

8. I can grasp common functional procedures, such as saving, printing and organizing files, uploading and downloading, starting up and shutting down.
9. I have confidence in engaging with new tools, and/or applications.

(Modalities)

10. I am aware that different modes of digital texts (e.g., video, immersive game, SMS, twitter streams) have different characteristics and conventions.
11. I can understand these help in decoding them, in much the same way as knowledge of idiom and register is important in using language.

Meaning Making

(Reading)

12. I can fluently and confidently assimilate the digital content.
13. I can purposefully and efficiently move around software and platforms.
14. I can follow and create narratives across diverse semantic, visual and structural elements.

(Relating)

15. I can make connections both with developing linkages and relationships between new and existing knowledge.

16. I can acquire and adapt mental models.

(Expressing)

17. I have the capacity to translate a purpose, or intention.

18. I have the capacity to form my ideas through my feelings into a digital form across a range of communicative modes (e.g., development of content, artefacts, or social relations, and an understanding of potential readerships.)

Using

(Finding)

19. I can gather appropriate information, resources and tools for a given purpose.

20. I can recognize and exploit the potential in communities, information, resources and tools encountered (e.g., asking, searching, filtering, curation and sharing).

(Applying)

21. I can deploy tools and techniques effectively for given purposes and audiences within the bounds of ethical, legal and usability criteria.

(Problem Solving)

22. I can exploit digital tools, resources and networks for problem finding and definition, problem analysis and approaches to solutions.

(Creating)

23. I can generate imaginative approaches, techniques, artefacts or content through the application of digital literacy skills.

24. I have the confidence to explore, experience and innovate digital literacy skills.

Analyzing

(Deconstructing)

25. I can discern the elements that contribute to the meanings, uses and messages in digital products and communications.

(Selecting)

26. I can make judgments and draw conclusions about digital tools, environments, and artefacts.

27. I can evaluate digital systems, content, networks, or artefacts.

28. I can choose digital systems, content, networks, or artefacts.

29. I can recommend digital systems, content, networks, or artefacts.

30. I can reject digital systems, content, networks, or artefacts.

(Interrogating)

31. I can employ skills of analysis and rigor in questioning the provenance, purpose and impact of digital content and interactions.

32. I can perceive affordances and opportunities of the digital content.

33. I can exploit affordances and opportunities of the digital content.

Persona

(Identity Building)

34. I have a sense of my own roles within different digital environments.

35. I have a sense of sensitivity to relationships and alignments within groups and communities.

36. I have an understanding of the multi-faceted nature of identity.

37. I have an understanding of how the multi-faceted nature of identity operates in different digital contexts.

38. I have an understanding of the relationships between digital and other identities.

(Managing Reputation)

39. I am aware of my own and other communities' reputations as assets that should be developed and managed effectively to support aspirations (e.g., career and employment).

40. I am aware of a need of safeguard against loss of reputation in digital contexts.

41. I know how to protect myself in online communities.

(Participating)

42. I can work with others in a variety of modes (e.g., synchronous and asynchronous) via digital interaction and exchange.

43. I have the experience to contribute to individual, group and community works in digital contexts.

44. I am aware of the ethical challenges that may rise in digital contexts.

45. I am aware of the cultural challenges that may rise in digital contexts.

3.5.4. Instrument 4

The final section of the survey utilized for data collection included three written open-ended questions to be answered by the participants on voluntary basis. The main objective of collecting qualitative data in this research was to reflect on the perspectives of the participants on the subject matter in depth as the surveys alone were limited in providing broader perspectives and opinions of the participants (Clough & Nutbrown, 2012).

The questions were formed with an attempt to provide an insight on the perceptions of the participants in a more detailed and broader aspect. The open-ended questions also contributed to the researcher in terms of suggesting implications from an objective perspective. Thus, volunteer participants were asked to give short answers to the following questions:

1. How can you improve your Technology Acceptance and integration as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?
2. How can you improve your Web Pedagogical Content Knowledge as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?
3. How can you improve your Critical Digital Literacy as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?

The participants choosing to respond to these questions were informed that they were required to complete all three questions if they chose to do so. Thus, there were no participant in the study who answered only one or two of the questions above. The qualitative data were also collected through an online platform through Google Forms as a supplementary part to the other instruments located at the end. Surely, the consent of the participants was attained before they gave answers to the questions, and they were informed about the anonymity and confidentiality of their answers. The answers were analyzed via thematic coding and the results were presented in the following section.

3.6. Procedures for Data Analysis

The quantitative data were analyzed by the Statistical Package for Social Sciences (SPSS, Version 27.0). Discovering items throughout data entry, frequency analysis yielded no abnormality. There were neither reverse coded nor controlling items in the instruments. The emergent data showed that neither of the items did have a big impact on the reliability statistics; and thus, none of them was omitted.

The assumption of normality for the sample scale ($n=94$) was analyzed via examination of the items within the scope of TAM as this study aimed to analyze participants' technology acceptance in pre-service EFL teachers' WPACK and CDL development. The test of normality was conducted in order to check if data were normally distributed or not. According to the results gained by the Kolmogorov-Smirnov test of normality, the factor list was spotted to be insignificant for each of the variables (i.e., gender, age, owning a personal computer) respectively with the p level above .05; thus, appropriate to run parametric tests. As the

Kolmogorov-Smirnov test of normality confirmed normality, no other test (i.e., Test of Homogeneity) was conducted.

In order to stipulate normal univariate distribution, the values for skewness should be between -2 and +2 whereas the values for kurtosis should be between -7 and +7 (Bryne, 2010). Correlatively, the values for skewness (= -1.368) and kurtosis (= 3.452) were considered acceptable, which also proved normality as an assumption. However, it was to be noted that there were some outliers revealed by the histogram chart with a slightly *leptokurtic* distribution in which the tails were little bit fatter since kurtosis was greater than +3. Yet, normality was enabled albeit for some outliers as the Q-Q Plots and histogram chart together with the appropriate sample size (N= 94) indicated so.

Additionally, the range (= 63.00) was divided by six to see the expected standard deviation (= 10.50). The calculated standard deviation of the test was accepted as proportionate (SD= 10.31). The scores of mean (= 61.00), mode (= 62.00) and median (= 62.00) were either so close or equal to one another confirming the normality of the distribution as another assumption. In the light of these, it was stipulated that the total scores of TAM were normally distributed which favored the use of parametric tests in order to see the group differences.

To note, the results of the reliability tests in relation to the utilized instruments confirmed that the instruments were highly reliable (r above .80). Besides, descriptive statistics were used to mark demographic information of the participants (given under the heading of participants and setting). Independent samples t-tests and ANOVA were performed to analyze if specific differences blossomed across the participants in lieu with independent variables. To add with, correlations (both bivariate and partial) were used to explore the relationships among three frameworks mentioned so far.

Lastly, qualitative data were analyzed through thematic coding according to the *grounded theory* known as an inductive approach in qualitative analysis in which the data analysis results were inductive to a theory (Glaser & Straus, 1967). The themes emerging from the data were categorized according to the frequency of occurrence in the responses and induced to a phenomenon. The results were presented in a detailed way in the following part.

CHAPTER FOUR

4. RESULTS

This research focused on the analysis of Technology Acceptance Model (TAM) in developing pre-service EFL teachers' critical digital literacy and their web-pedagogical content knowledge. Additionally, this research also analyzed if there were statistically significant differences among frameworks and constructs regarding several variables. To this end, the following research questions were addressed:

1. What are the Turkish pre-service EFL teachers' levels of Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy?
 - 1.1. Is there a statistically significant difference of Technology Acceptance, WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of age?
 - 1.2. Is there a statistically significant difference of Technology Acceptance, WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of gender?
 - 1.3. Is there a statistically significant difference of Technology Acceptance and WPACK, and CDL levels Turkish pre-service EFL teachers in terms of owning a personal computer?
2. Is there a statistically significant relationship between Technology Acceptance and WPACK of Turkish pre-service EFL teachers?
3. Is there a statistically significant relationship between Technology Acceptance and CDL levels of Turkish pre-service EFL teachers?
4. Is there a statistically significant relationship between WPACK and CDL levels of Turkish pre-service EFL teachers?

In order to answer the research questions, several quantitative and qualitative data analyses were conducted, and the analysis results were presented under related headings below in relation with the frameworks.

4.1. Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy Levels of Turkish Pre-service EFL Teachers

The results in relation to the independent variables were estimated separately by frequency analysis in order to reveal the mean scores of the participants on each. The analysis results were presented below under related headings.

4.1.2. The Analysis of Technology Acceptance Levels of the Turkish Pre-Service EFL Teachers

In order to reveal the technology acceptance level of the participants, frequency analysis was conducted. Means and standard deviations were presented in the following table.

Table 8

Frequency Analysis of the Technology Acceptance Levels of the Turkish Pre-service EFL Teachers

<i>N</i>	Valid	94
	Missing	0
<i>M</i>		3.8118
<i>SD</i>		.64449
Range		3.94
Min		1.06
Max		5.00

The results from the Table 8 suggested that technology acceptance levels of the Turkish pre-service EFL teachers were moderately high ($M = 3.81$, $SD = .64$). Additionally, the descriptive component analysis of TAMPST was operated and mean scores for each construct were presented in the following table.

Table 9

Descriptive Statistics for TAMPST

	<i>N</i>	Min	Max	<i>M</i>	<i>SD</i>
TAM (total)	94	1.06	5.00	3.8118	.64449
PU	94	1.00	5.00	4.1064	.79607
ATCU	94	1.00	5.00	3.8032	.80144
PEU	94	1.00	5.00	3.9574	.81244
FC	94	1.33	5.00	3.3617	.74561
SN	94	1.00	5.00	3.6968	.86204

The results from Table 9 indicated that the construct with the highest mean score was PU ($M = 4.10$, $SD = .79$) and the lowest was FC ($M = 3.36$, $SD = .74$). According to this result, it could be stipulated that technology acceptance levels of the Turkish pre-service EFL teachers was mostly affected by perceived usefulness, foregrounding the fact that when pre-service EFL teachers found a technology useful, they were more likely to accept and use it. Herewith, the factor having a slightly lower impact on the participants' technology acceptance was facilitating conditions, implying that the participants were likely to accept and use a technology even when the facilitating conditions were not fully met, yet the usefulness of the technology was perceived by the users.

Lastly, the component based descriptive statistics analysis of TAMPST was conducted to uncover the three highest and lowest mean scores of each component in the survey. The results of the component based descriptive statistics were presented in Table 10.

Table 10

Component Based Descriptive Statistics of TAMPST

	<i>N</i>	Min	Max	<i>M</i>	<i>SD</i>
Using computers will improve my work.	94	1.00	5.00	4.3404	.88662
Computers make work more interesting.	94	1.00	5.00	3.8617	.94586
My interaction with computers is clear and understandable.	94	1.00	5.00	3.9894	.86129
When I need help to use computers, specialized instruction is available to help me.	94	1.00	5.00	3.5745	.89790
Working with computers is fun.	94	1.00	5.00	3.6809	1.00764

I find it easy to get computers to do what I want it to do.	94	1.00	5.00	3.9255	.96430
Using computers will increase my productivity.	94	1.00	5.00	3.8191	1.05711
I find computers easy to use.	94	1.00	5.00	3.9574	.91481
When I need help to use computers, a specific person is available to provide assistance.	94	1.00	5.00	3.0532	1.15811
People whose opinions I value will encourage me to use computers.	94	1.00	5.00	3.6170	1.00650
I like using computers.	94	1.00	5.00	4.0319	1.04163
People who are important to me will support me to use computers.	94	1.00	5.00	3.7766	.89388
Using computers will enhance my effectiveness.	94	1.00	5.00	3.9468	.93172
When I need help to use computers, guidance is available to me.	94	1.00	5.00	3.4574	.95788
I find computers a useful tool in my work.	94	1.00	5.00	4.3191	.81929
I look forward to those aspects of my job that require me to use computers.	94	1.00	5.00	3.6383	1.00377
Valid N (listwise)	16				

The data obtained from Table 10 indicated that the component based descriptive statistics of TAMPST reported the highest mean score as the first statement “*Using computers will improve my work.*” (M = 4.34, SD= .88) and the lowest as the eighth statement “*When I need help to use computer, a specific person is available to provide assistance.*” (M = 3.05, SD= 1.15), pointing that the Turkish pre-service EFL teachers believed that the use of

computers would contribute to their work whereas they were slightly prone to suppose that they might not be able to get help with computer usage from a specific person whenever they needed. This result was in line with the previous mean score analysis of survey's construct(s) highlighting the constructs with the highest and the lowest mean scores as PU and FC.

4.1.3. The Analysis of Web Pedagogical Content Knowledge (WPACK) Levels of the Turkish Pre-service EFL Teachers

In order to reveal the WPACK levels of the participants, frequency analysis of the 'Technological Pedagogical Content Knowledge-Web (TPCK-W) Survey' developed by Lee and Tsai (2010) was conducted. Means and standard deviations were presented in the table given below:

Table 11

Frequency Analysis of the WPACK Levels of the Turkish Pre-service EFL Teachers

<i>N</i>	Valid	92
	Missing	2
<i>M</i>		4.2406
<i>SD</i>		.50975
Range		2.97
Min		2.03
Max		5.00

The results from Table 11 indicated that the WPACK levels of the Turkish pre-service EFL teachers were high ($M = 4.24$, $SD = .50$). Additionally, the descriptive component analysis of TPCK-W was conducted and mean scores for each construct were presented in Table 12.

Table 12

Descriptive Statistics for TPCK-W

	<i>N</i>	Min	Max	<i>M</i>	<i>SD</i>
WPACK (total)	92	2.03	5.00	4.2406	.50975
Web General	92	1.57	5.00	4.4472	.57308
Web Communicative	94	2.25	5.00	4.3590	.57567

Web Content Knowledge	94	2.00	5.00	4.4340	.54920
Web Pedagogical Content Knowledge	94	1.75	5.00	3.9295	.78835
Attitude Towards Web-Based Instruction	94	2.50	5.00	4.1897	.65701
Valid N (list wise)	92				

The results from the Table 12 demonstrated that the construct with the highest mean score was Web General ($M = 4.44$, $SD = .57$) and the lowest was Web Pedagogical Content Knowledge ($M = 3.92$, $SD = .78$). Accordingly, it could be presumed that participants had relatively lower score of web pedagogical content knowledge compared to the other constructs; however, they had a high mean score of web general knowledge. This result implied that having a high level of web general knowledge might not necessarily lead to the acquisition of a high level of web pedagogical content knowledge, which might be since WPACK was a knowledge type consisted of different segments and the interaction between these knowledge areas.

Lastly, the component based descriptive statistics of TPCCK-W was operated in order to reveal the three highest and lowest mean scores of each component in the survey. The results of the component based descriptive statistics were presented in Table 13 given below:

Table 13*Component Based Descriptive Statistics of TPCK-W*

	<i>N</i>	Min	Max	<i>M</i>	<i>SD</i>
I am able to click the hyperlink to connect to another website.	94	2.00	5.00	4.0851	.86335
I am able to key in the website address to connect to a particular website.	94	2.00	5.00	4.2766	.70945
I am able to print out the content of a Website.	92	2.00	5.00	4.2283	.74278
I am able to search for information on the Web using keywords.	94	2.00	5.00	4.5638	.66492
I am able to download pictures from the Web.	94	1.00	5.00	4.6915	.58708
I am able to use the Web search engines.	94	1.00	5.00	4.6383	.63671
I am able to copy text on the Web into the “Word”.	94	1.00	5.00	4.6809	.60841
I am able to read others’ messages in a chatroom.	94	2.00	5.00	4.7340	.53230
I am able to set a nickname by myself in an online chatroom.	94	2.00	5.00	4.6170	.64101
I am able to talk to others one on one in an online chatroom.	94	2.00	5.00	4.5745	.74038
I am able to provide information or respond to someone else on a BBS (Bulletin Board System).	94	1.00	5.00	3.5106	1.10468
I know that web technology can provide various materials to enrich course content.	94	2.00	5.00	4.5638	.59674
I know how to search online resources for course content.	94	2.00	5.00	4.4574	.63356
I know how to select proper content from Web resources.	94	2.00	5.00	4.3617	.66963

I am able to search related online materials for course content.	94	2.00	5.00	4.4574	.59865
I am able to search for various materials on the Web to be integrated into course content.	94	2.00	5.00	4.3298	.67821
I know how to apply teaching modules on the Web into courses.	94	1.00	5.00	3.7660	.97744
I am able to use Web technology to enhance teaching.	94	1.00	5.00	4.0745	.89490
I am able to use the Web to enhance students' learning motivation.	94	1.00	5.00	3.9362	.94821
I am able to select proper existing Web-based courses to assist teaching.	94	1.00	5.00	3.9787	.96139
I am able to apply Web technology to use multiple teaching strategies on a particular course unit.	94	1.00	5.00	3.9043	.91662
I am able to guide students to use Web resources to study a certain course unit.	94	2.00	5.00	3.9043	.90482
I am able to use Web resources to guide students' learning activities for a certain course unit.	94	2.00	5.00	3.9255	.89490
I am able to use Web technology to support teaching for the content of a particular course unit.	94	1.00	5.00	3.9468	.89643
Web technology can be actually used in the practice of teaching.	94	1.00	5.00	4.2128	.84079
The characteristics of the Web can help instruction.	94	2.00	5.00	4.1915	.73728
Web technology can enhance teaching skills	94	1.00	5.00	4.1809	.81601
Web-related resources can enrich course content.	94	2.00	5.00	4.4043	.66104

Web-based teaching can enhance students' learning motivation.	94	1.00	5.00	3.8830	1.09600
Web-based teaching is a future trend in education.	94	1.00	5.00	4.2660	.94101
Valid N (listwise)	30				

As illustrated on the table above, the statement with the highest mean score was the eighth statement “*I am able to read others' messages in a chatroom.*” ($M = 4.73$, $SD = .53$) and the lowest was the eleventh statement “*I am able to provide information or respond to someone else on a BBS (Bulletin Board System).*” ($M = 3.51$, $SD = 1.10$), implying that the Turkish pre-service EFL teachers marked themselves as capable of reading others' messages in a chat room, however; they did not mark the same regarding the providing information or responding to someone else on a BBS.

The statements with the highest and lowest mean scores were both related to Web Communicative construct in the survey which contradicted with the previous mean score analysis of the survey's constructs, pointing the constructs with the highest and lowest mean scores as Web General and WPACK. This might be caused by the total numbers of statements residing to each construct differed, in that, there were 4 items of Web Communicative whereas 7 for Web General, and 8 for WPACK.

4.1.4. The Analysis of the Critical Digital Literacy (CDL) Levels of the Turkish Pre-service EFL Teachers

In order to uncover the Critical Digital Literacy levels of the participants, frequency analysis was operated. Means and standard deviations were presented in the table given below:

Table 14

Frequency Analysis of the CDL Levels of the Turkish Pre-service EFL Teachers

<i>N</i>	Valid	94
	Missing	0
<i>M</i>		3.9563
<i>SD</i>		.53893
Range		2.96

Min	2.00
Max	4.96

The results from Table 14 demonstrated that the CDL levels of the Turkish pre-service EFL teachers were moderately high ($M = 3.95$, $SD = .53$). Additionally, the descriptive component analysis of CDL was conducted and each construct's mean scores were presented in Table 15.

Table 15

Descriptive Statistics for CDL

	<i>N</i>	Min	Max	<i>M</i>	<i>SD</i>
Decoding	94	1.82	5.00	4.1596	.65293
Meaning making	94	2.00	5.00	3.9590	.67288
Using	94	2.00	5.00	3.9858	.62584
Analyzing	94	2.22	4.78	3.6726	.54442
Persona	94	2.00	5.00	3.9663	.55873
Valid N (list wise)	94				

The results from Table 15 demonstrated that the construct with the highest mean score was Decoding ($M = 4.15$, $SD = .65$) and the lowest was Analyzing ($M = 3.67$, $SD = .54$). Accordingly, it could be stipulated that participants perceived themselves as highly capable of comprehending the practical and operational aspects of CDL; on the other hand, they did not perceive their capability of making critical and ethical judgements on digital materials as high as decoding.

In addition to this, the sub-construct mean score analysis of each main construct with the highest (i.e., modalities) and lowest (i.e., conventions) mean scores of them were also provided below in Table 16.

Table 16*Descriptive Statistics for CDL*

<i>Decoding</i>	Navigation	Conventions	Stylistics	Modalities
Valid N	94	94	94	94
Missing	0	0	0	0
<i>M</i>	4.1617	4.0479	4.1755	4.2500
<i>SD</i>	.72573	.76927	.69448	.64237
Range	3.40	3.00	3.00	3.00
Min	1.60	2.00	2.00	2.00
Max	5.00	5.00	5.00	5.00
<i>Meaning making</i>	Reading	Relating	Expressing	
Valid N	94	94	94	
Missing	0	0	0	
<i>M</i>	3.9043	3.9255	4.0745	
<i>SD</i>	.81741	.74400	.66784	
Range	3.33	3.00	3.00	
Min	1.67	2.00	2.00	
Max	5.00	5.00	5.00	
<i>Using</i>	Finding	Applying	Problem Solving	Creating
Valid N	94	94	94	94
Missing	0	0	0	0
<i>M</i>	4.1809	3.9255	3.9468	3.8404
<i>SD</i>	.63859	.77929	.82132	.77325
Range	3.00	3.00	3.00	3.00
Min	2.00	2.00	2.00	2.00
Max	5.00	5.00	5.00	5.00
<i>Analyzing</i>	Deconstructing	Selecting	Interrogating	
Valid N	94	94	94	
Missing	0	0	0	

<i>M</i>	3.8723	3.6170	3.6986
<i>SD</i>	.73666	.56467	.73335
Range	3.00	2.80	3.33
Min	2.00	2.20	1.67
Max	5.00	5.00	5.00
<i>Persona</i>	Identity Building	Managing Reputation	Participating
Valid N	94	94	94
Missing	0	0	0
<i>M</i>	3.9681	3.9681	3.9628
<i>SD</i>	.63266	.60675	.61888
Range	3.00	3.00	3.00
Min	2.00	2.00	2.00
Max	5.00	5.00	5.00

The results from Table 16 indicated that the sub-construct of the Decoding construct with the highest mean score was Modalities ($M = 4.25$, $SD = .64$) and the lowest was Conventions ($M = 4.04$, $SD = .76$) among four sub-constructs. This result implied that participants marked that they were able to decode the information and present it to the others competently whereas their ability to envision the practices and norms of ICT usage in terms of norms and practices were relatively lower.

The results also demonstrated that the sub-construct of the Analyzing construct with the highest mean score was Deconstructing ($M = 3.87$, $SD = .73$) and the lowest was Selecting ($M = 3.61$, $SD = .56$). This result also indicated that the sub-constructs' mean scores of Analyzing was relatively lower compared to Decoding, entailing that participants' level of analyzing the digital information and drawing conclusions on it was comparably lower than their comprehension level of ICT usage and its norms.

Moreover, the results from the tables suggested that participants' capability of distinguishing meaningful aspects of digital transmission was relatively higher than their level of making inferences about digital tools and products.

Lastly, the component based descriptive statistics for CDL was conducted in order to reveal the three highest and lowest mean scores of each component. The results of the component based descriptive statistics were presented in Table 17.

Table 17

Component Based Descriptive Statistics of CDL

	N	Min	Max	M	SD
I can understand navigational mechanisms (e.g., scrolling, active windows, menus, buttons, etc.).	94	2.00	5.00	4.2660	.72104
I can understand conceptual notions of movement in the digital landscape, such as metaphors and avatars	94	2.00	5.00	4.0638	.88971
I can understand practical notions of movement in the digital landscape, such as mouse, swiping, and VR (virtual reality).	94	2.00	5.00	4.1383	.82437
I can locate myself spatially, such as when following links.	94	1.00	5.00	4.1809	.82908
I can locate myself spatially, such as when following links.	94	1.00	5.00	4.1596	.88358
I can understand the practices and norms of ICT usage including safety and security, presentational and accessible production.	94	2.00	5.00	3.9043	.90482
I can understand the practices and norms of participation in online communities including communication protocols, ethics, privacy, sharing and attribution.	94	2.00	5.00	4.1915	.75172

I can grasp common functional procedures, such as saving, printing and organizing files, uploading and downloading, starting up and shutting down.	94	2.00	5.00	4.3085	.71882
I have confidence in engaging with new tools, and/or applications.	94	1.00	5.00	4.0426	.93802
I am aware that different modes of digital texts (e.g., video, immersive game, SMS, twitter streams) have different characteristics and conventions.	94	2.00	5.00	4.3830	.67372
I can understand these help in decoding them, in much the same way as knowledge of idiom and register is important in using language.	94	2.00	5.00	4.1170	.77399
I can fluently and confidently assimilate the digital content.	94	1.00	5.00	3.8936	.95566
I can purposefully and efficiently move around software and platforms.	94	2.00	5.00	3.9574	.96068
I can follow and create narratives across diverse semantic, visual and structural elements.	94	2.00	5.00	3.8617	.81123
I can make connections both with developing linkages and relationships between new and existing knowledge.	94	2.00	5.00	4.1064	.82264
I can acquire and adapt mental models.	94	1.00	5.00	3.7447	.89125
I have the capacity to translate a purpose, or intention.	94	2.00	5.00	4.2128	.71651
I have the capacity to form my ideas through my feelings into a digital form across a range of communicative modes (e.g., development of content, artefacts, or social relations, and an understanding of potential readerships.)	94	2.00	5.00	3.9362	.81397

I can gather appropriate information, resources and tools for a given purpose.	94	2.00	5.00	4.2979	.65303
I can recognize and exploit the potential in communities, information, resources and tools encountered (e.g., asking, searching, filtering, curation and sharing).	94	2.00	5.00	4.0638	.80065
I can deploy tools and techniques effectively for given purposes and audiences within the bounds of ethical, legal and usability criteria.	94	2.00	5.00	3.9255	.77929
I can exploit digital tools, resources and networks for problem finding and definition, problem analysis and approaches to solutions.	94	2.00	5.00	3.9468	.82132
I can generate imaginative approaches, techniques, artefacts or content through the application of digital literacy skills.	94	2.00	5.00	3.7447	.85429
I have the confidence to explore, experience and innovate digital literacy skills.	94	1.00	5.00	3.9362	.86520
I can discern the elements that contribute to the meanings, uses and messages in digital products and communications.	94	2.00	5.00	3.8723	.73666
I can make judgments and draw conclusions about digital tools, environments, and artefacts.	94	2.00	5.00	3.9468	.80812
I can evaluate digital systems, content, networks, or artefacts.	94	2.00	5.00	3.9043	.83046
I can choose digital systems, content, networks, or artefacts.	94	1.00	5.00	3.9468	.85970
I can recommend digital systems, content, networks, or artefacts.	94	1.00	5.00	3.8085	.94216
I can reject digital systems, content, networks, or artefacts.	94	1.00	5.00	2.4787	1.09475

I can employ skills of analysis and rigor in questioning the provenance, purpose and impact of digital content and interactions.	94	2.00	5.00	3.5638	.82382
I can perceive affordances and opportunities of the digital content.	94	1.00	5.00	3.8511	.78914
I can exploit affordances and opportunities of the digital content.	94	1.00	5.00	3.6809	.88248
I have a sense of my own roles within different digital environments.	94	2.00	5.00	4.0106	.72579
I have a sense of sensitivity to relationships and alignments within groups and communities.	94	2.00	5.00	4.0532	.73860
I have an understanding of the multi-faceted nature of identity.	94	1.00	5.00	3.8830	.85328
I have an understanding of how the multi-faceted nature of identity operates in different digital contexts.	94	2.00	5.00	3.8404	.84628
I have an understanding of the relationships between digital and other identities.	94	2.00	5.00	4.0532	.69355
I am aware of my own and other communities' reputations as assets that should be developed and managed effectively to support aspirations (e.g., career and employment).	94	2.00	5.00	3.8830	.70110
I am aware of a need of safeguard against loss of reputation in digital contexts.	94	2.00	5.00	3.9255	.75119
I know how to protect myself in online communities.	94	1.00	5.00	4.0957	.83046
I can work with others in a variety of modes (e.g., synchronous and asynchronous) via digital interaction and exchange.	94	2.00	5.00	3.7979	.86235

I have the experience to contribute to individual, group and community works in digital contexts.	94	2.00	5.00	3.8617	.87499
I am aware of the ethical challenges that may rise in digital contexts.	94	1.00	5.00	4.0745	.76537
I am aware of the cultural challenges that may rise in digital contexts.	94	1.00	5.00	4.1170	.74569
Valid N (list wise)	45				

The data from Table 17 hinted that the highest mean score for the components of CDL was the tenth statement “*I am aware that different modes of digital texts (e.g., video, immersive game, SMS, twitter streams) have different characteristics and conventions.*” (M = 4.38, SD = .67) and the lowest was thirtieth statement “*I can reject digital systems, content, networks, or artefacts.*” (M = 2.47, SD = 1.09), verifying the previous results on descriptive construct and sub-construct analysis. This result indicated that participants’ levels of discarding certain digital system by differentiating about appropriateness were quite low whereas their levels of apprehensiveness of digital texts’ different conventions were relatively high.

4.1.5. Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy Levels of the Turkish Pre-service EFL Teachers in Terms of Age

With an attempt to uncover whether there was a statistically significant difference in technology acceptance, WPACK and CDL levels of the Turkish pre-service EFL teachers in terms of age, a one-way analysis of variance (ANOVA) test was performed. The results were presented in the table given below.

Table 18

ANOVA Test Results (Age)

		Sum of Squares	df	Mean Square	F	Sig*. (2-tailed)
TAM	Between Groups	.102	2	.051	.120	.887
	Within Groups	38.527	91	.423		
	Total	38.629	93			

WPACK	Between Groups	.065	2	.032	.122	.885
	Within Groups	23.581	89	.265		
	Total	23.646	91			
CDL	Between Groups	.628	2	.314	1.082	.343
	Within Groups	26.384	91	.290		
	Total	27.012	93			

* $p < .05$

The one-way analysis of variance (ANOVA) test results from Table 18 demonstrated that there was no statistically significant difference at the $p < .05$ level in technology acceptance [$F(2, 91) = .120, p = .887$], WPACK [$F(89, 91) = .122, p = .885$], and CDL [$F(2, 91) = 1.082, p = .343$] levels of the Turkish pre-service EFL teachers in terms of age. This result could be attributed to the distribution of sample group's age as 81.9% percent was between 17-21 years old and only 5.3% was 27 years above. Thus, the age variable did not have a significant effect on the results of this research.

4.1.6. Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy Levels of the Turkish Pre-service EFL Teachers in Terms of Gender

In order to reveal whether there was a statistically significant difference in technology acceptance, WPACK and CDL levels of the Turkish pre-service EFL teachers in terms of gender, an independent-samples T-test was conducted to compare the gender groups. The results of the independent-samples T-test were presented in the table given below:

Table 19

Independent-samples T-test Results (Gender)

Group (F/M)	t	df	Sig*. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
TAM	-.050	90	.960	-.00694	.13842	-.28193	.26804
WPACK	-.663	88	.509	-.07351	.11090	-.29389	.14688

CDL	-.180	90	.857	.02072	.11484	-.20743	.26619
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*p<.05

According to the independent-samples T-test results given above, no significant differences at the $p<.05$ level were found in technology acceptance of females ($M = 3.79$, $SD = .65$) and males ($M = 3.80$, $SD = .64$); $t(90) = -.050$, $p = .960$, as in WPACK levels of females ($M = 4.20$, $SD = .45$) and males ($M = 4.27$, $SD = .10$); $t(88) = -.663$, $p = .509$ and, CDL levels of females ($M = 3.96$, $SD = .46$) and males ($M = 3.94$, $SD = .63$); $t(90) = -.180$, $p = .857$. Besides, the magnitude of the differences in the means was not calculated with eta squared (η^2) since the results were insignificant.

4.1.7. Technology Acceptance, Web Pedagogical Content Knowledge, and Critical Digital Literacy Levels of the Turkish Pre-service EFL Teachers in Terms of Personal Computer Ownership

To reveal whether there was a statistically significant difference in technology acceptance, WPACK and CDL levels of the Turkish pre-service EFL teachers in terms of personal computer ownership, an independent-samples T-test was employed. Independent-sample T-test results were presented in Table 20.

Table 20

Independent-samples T-test Results (Personal Computer Ownership)

Group (O/NO)	t	df	Sig*. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
TAM	-.342	92	.733	-.07753	.22700	-.52837	.37330
WPACK	.710	90	.479	-.12744	.17938	-.48382	.22893
CDL	.263	92	.793	.04993	.18987	-.32716	.42703

*p<.05

According to the independent-samples T-test results above, no significant differences at the $p < .05$ level were found in technology acceptance level of owning a personal computer ($M = 3.80$, $SD = .65$) and not owning ($M = 3.88$, $SD = .57$); $t(92) = .342$, $p = .733$, as in WPACK level of owning a personal computer ($M = 4.22$, $SD = .52$) and not owning ($M = 4.35$, $SD = .37$); $t(90) = .710$, $p = .479$ and, CDL levels of owning a personal computer ($M = 3.96$, $SD = .54$) and not owning ($M = 3.91$, $SD = .54$); $t(92) = .263$, $p = .793$. This could be resulting from the fact that 90.4% of the participants stated that they owned a personal computer. Besides, the magnitude of the differences in the means was not calculated with eta squared (η^2) since the results were insignificant.

4.2. Correlations Amidst the Turkish Pre-service EFL Teachers Technology Acceptance, WPACK, and CDL Levels

In order to reveal whether there was a statistically significant relationship amidst the Turkish pre-service EFL teachers' levels of the technology acceptance, WPACK and CDL, a Pearson product-moment correlation analysis (bivariate) was computed. The results were presented in the table given below:

Table 21

The Results of Pearson Correlation Analysis (Bivariate)

		TAM	WPACK	CDL
TAM	Pearson Correlation	1	.646	.505
	Sig*. (2-tailed)		.000	.000
	N	94	92	94
WPACK	Pearson Correlation	.646	1	.732
	Sig*. (2-tailed)	.000		.000
	N	92	92	92
CDL	Pearson Correlation	.505	.732	1
	Sig*. (2-tailed)	.000	.000	
	N	94	92	94

* $p < .05$

According to the results illustrated in Table 21, all three variables were positively correlated with one another. The bivariate correlation between TAM and WPACK of the Turkish pre-service EFL teachers was reported to be positively high by $r = .65$, $p < .01$, and the bivariate correlation between TAM and CDL of the Turkish pre-service EFL teachers was marked as positively moderate by $r = .51$, $p < .01$. Finally, the bivariate correlation between WPACK and CDL of the Turkish pre-service EFL teachers was signed as positively high by $r = .73$, $p < .01$. According to these results, the highest correlation among three variables was between WPACK and CDL of the Turkish pre-service EFL teachers while the lowest was between TAM and CDL.

Herein, the coefficient of determination (r^2) was also estimated in order to explain the measures (i.e., percentage levels) in terms of how well this statistical model could predict the expected outcome. Likewise, a coefficient of determination of 42% between TAM and WPACK showed that 58% of the data fit the regression model. Besides, a coefficient of determination of 26% between TAM and CDL showed that 74% of the data fit the regression model. One more to note, a coefficient of determination of 53% between WPACK and CDL showed that 47% of the data fit the regression model. Since a higher coefficient indicated a better fit for the model, it could be stipulated that the coefficients of determination for TAM, WPACK and CDL were relatively high.

Confronting the idea that TAM was the keystone for technology acceptance, use and maintenance and the highest correlation was estimated between WPACK and CDL, a partial correlational analysis between WPACK and CDL was computed to reveal whether this highest positive correlation between WPACK and CDL was still existing when TAM was controlled. The results were demonstrated in Table 22.

Table 22

Partial Correlation Analysis Results Between WPACK and CDL

Control Variables			WPACK	CDL
TAM	WPACK	Correlation	1.000	.615
		Significance (2-tailed)	.	.000
		<i>df</i>	0	89

	Correlation	.615	1.000
CDL	Significance (2-tailed)	.000	.
	<i>df</i>	89	0

According to the results reported by the table above given, the correlation between WPACK and CDL of the Turkish pre-service EFL teachers was still existing by positively high scores of $r = .62$ when TAM was controlled, and this relationship was still statistically significant at the level of $p < .01$ ($r^2 = .38$).

The correlational analysis results presented above demonstrate that there was a high positive linear relationship among three given variables of the Turkish pre-service EFL teachers, implying that an increase in the technology acceptance levels of the participants could lead to an increase in their WPACK and CDL levels as well as in decrease. Furthermore, it could be deduced from the results that the relationship between WPACK and CDL of the Turkish pre-service EFL teachers was not decreased by their technology acceptance levels, signifying that technology acceptance alone might not be the main determinant of the correlational relationship between the participants' levels of WPACK and CDL.

4.3. The Reflections of the Turkish Pre-Service EFL Teachers on the Development of the Pre-service EFL Teachers' WPACK, CDL and Technology Acceptance Levels

As for the analysis of the Turkish pre-service EFL teachers' beliefs on the development of their technology acceptance, WPACK and CDL, the following open-ended questions were addressed, and the responses given to these questions were presented in the following section:

1. How can you improve your technology acceptance and integration as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?
2. How can you improve your Web Pedagogical Content Knowledge as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?
3. How can you improve your Critical Digital Literacy as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?

4.3.1. Qualitative Data Analysis Results

The responses given the addressed open-ended questions at the end of the questionnaires were transferred to Excel from Google Forms and was analyzed through thematic analysis method since it was known as an effective method for revealing the thoughts and beliefs of

participants through a set of data (Braun & Clarke, 2012). However, the number of responses given to the open-ended questions were detected as four answers for the first and the second questions, and three answers for the third question. The participation in the qualitative data collection was based on voluntariness of the participants, and as the data were collected through online forms due to the restrictions resulted by the Covid-19 pandemic, the number of responses given to the open-ended questions could not be regarded to reach at a satisfactory level, albeit noted. Each of the responses was noted as given by the participants without any correction regarding grammar, word choice, coherence, or typo, and the participants' names were kept anonymous for the sake of individual's confidentiality; and thus, labelled as P1, P2, P3, and the like ('P' as the abbreviated form of 'participant').

The responses given to the open-ended questions were analyzed on the basis of the *grounded theory* (Glaser & Strauss, 1967) where the most occurring themes were categorized an induced to phenomenon. Besides, as the responses of the participants were not totally different in terms of meaningful connections on the subject matter, they highlighted different points. That was to say, there was not a common frequent occurring theme that could be categorized as a "theme", yet the responses could be induced to a common subject.

As for the first question of *"How can you improve your technology acceptance and integration as a pre-service EFL teacher? What are the ways to promote it?"*, there were four responses given by the participants:

P1: *"Familiarizing yourself with the usage of computers and web should be enough because accessing information has never been easier."*

P2: *"I think we can improve our web pedagogical content knowledge by watching videos and joining online communities."*

P3: *"Certainly, this information should be given to students comprehensively under a lesson."*

P4: *"People are inspirations. This, I would observe and learn from other teachers and try to find different ways to implement a specific content."*

The participants' responses presented above indicated that the opinions and beliefs of the pre-service EFL teachers varied on the basis that each of them had a different approach and perspective on the subject matter. While some participants believed that their technology acceptance and integration could be promoted through self-effort such as providing self-

familiarization with computers or being active in online communities, some others agreed that it could be taught under a curriculum as a part of their pre-service teacher training.

As for the second question of *“How can you improve your Web Pedagogical Content Knowledge as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?”*, there were four responses addressed by the participants:

P1: *“They can focus on the today’s world and this rapid changes and developments on the topic. They must keep pace with the world.”*

P2: *“The only way to get the future teachers ready for future is to make them use the technological applications such as Teams, Zoom, Google Meets etc. Online courses have become a huge part of teaching and equipping them with these skills will be critical.”*

P3: *“First of all, it should be learned exactly what technology has to offer us now. And in order to use it with maximum efficiency, education can be provided in the best way thanks to the programs developed for education.”*

P4: *“Seminars and information can be given on this subject. It can be told how necessary it is in today's world.”*

The participants’ responses presented above demonstrated that the opinions and beliefs of the pre-service EFL teachers could be regarded to point to a common principle that the WPACK development of pre-service EFL teachers ought to be provided to them as a part of their teacher training program as it was a requisite for 21st century teachers. The responses of the participants also highlighted that future teachers were required to be conscious about what technology offered to them for educational purposes, and they ought to follow technological changes to be able to keep up with the ever-changing world.

Lastly, there were three responses given to the third question of *“How can you improve your Critical Digital Literacy as a pre-service EFL teacher? As for your further suggestions, what are the ways to promote it?”* which were presented below:

P1: *“By using social media for collaborating and learning, by taking a digital learning program that includes online classes and on-the-job training courses based on what is needed.”*

P2: *“I believe that we should do research and practice in our field. It will not be enough if we just learn how to do it.”*

P3: *“Effective courses and more capable instructors can be enough for this.”*

The participants' responses, herein, highlighted that opinions and beliefs of the pre-service EFL teachers on their CDL development could be improved through educational programs or courses and via more effective usage of social media. The responses given to the open-ended questions provided a better understanding of the pre-service EFL teachers' reflections on their technology integration, WPACK and CDL development from their own perspectives.



CHAPTER FIVE

5. CONCLUSION

The discussion of major findings, concluding remarks, pedagogical implications, limitations, and suggestion for further studies were presented under this heading.

5.1. Discussion of the Major Findings

This section of the thesis starts with an overview of the study focusing on the discussion of the results regarding the analysis of TAM in developing pre-service EFL teachers WPACK and CDL levels considering related literature. Following this, the implications for practice and limitations of the study are presented. This non-experimental mixed-method study focused on the investigation of the Turkish pre-service EFL teachers' Web Pedagogical Content Knowledge (WPACK), their Critical Digital Literacy (CDL) and Technology Acceptance levels together with their relationships within one another. In this thesis, it was also examined whether there were any statistically significant differences among EFL pre-service teachers' gender, age and personal computer ownership together with correlations among three frameworks examined.

The first research question is related to a descriptive status about the participants' technology acceptance, web pedagogical content knowledge, and critical digital literacy levels. It has three subsections about any possible significant differences among the related variables including Technology Acceptance, WPACK, and CDL levels in terms of age, gender and owning a personal computer. The findings have showed that the average score of technology acceptance levels of the per-service EFL teachers is around 3.81 (out of 5.00) with the standard deviation of .64. Minimum and maximum scores are found between 1.06 and 5.00. The average level of technology acceptance levels of the participants is considered as moderately high level.

Regarding the sub scales of TAMPST (technology acceptance survey), the average scores of sub-levels of PU and FC are calculated as 4.10 and 3.36 respectively. PU sub-levels have the highest average score and FC sub-level have the lowest average score. Finally, the highest and lowest scores are found as '*Using computers will improve my work*' (M= 4.34) and '*When I need help to use computers, specialized instruction is available to help me*' respectively (M= 3.57). These levels have expected pre-service teachers as more technology-oriented by

belonging to Z generation who are born into a digital world. Also, these results have supported previous research findings regarding teachers' having higher levels of technology acceptance (Akarsu & Güven, 2014; Hu et al., 2003; Teo & Ursavas, 2012).

In the next step, the web pedagogical content knowledge (WPACK) levels of the participants are calculated. The average score of the WPACK level is found as 4.24 with the standard deviation of .51 out of 5.00, which is high. The highest and lowest mean scores of its sub-levels are Web General with 4.45 and Web Pedagogical Content Knowledge with 3.93. This finding indicates that the pre-service EFL teachers possess high level of web general knowledge and low general knowledge of web pedagogical content.

When component-based analysis is conducted on WPACK elements, the survey items '*I am able to read others' messages in a chatroom*' (M= 4.73) and '*I am able to download pictures from the Web*' (M= 4.69) get the highest mean scores. On the other hand, the survey items '*I am able to provide information or respond to someone else on a BBS (Bulletin Board System)*' (M= 3.51) and '*I know how to apply teaching modules on the Web into courses*' (M= 3.76), have received the lowest average scores from the pre-service EFL teachers. The findings that are related to the web pedagogical content knowledge of pre-service EFL teachers are also aligned with the previous research findings (Kavanoz et al., 2015; Lee & Tsai, 2010; Gökçearslan et al., 2017) as possessing higher levels of web pedagogical content knowledge by teachers and teacher candidates.

Another major key finding of the present research asserts that the WPACK levels of the Turkish pre-service EFL teachers are high, consistent with the previous studies in literature by the studies of Hiğde et al. (2014), Oskay and Odabaşı (2016), and Bağcı and Atar (2019). Following, the technology acceptance levels are detected to be moderately high in line with the research findings of Baturay et al. (2017) as with their CDL levels being moderately high as well, in accord with the study results of Çam and Kiyici (2017). Yet, this finding is on the contrary to the research findings of Ata and Yıldırım (2019) which can be attributed to the differences in sampling groups in terms of number and participants' departments.

Next important result of the study is related to critical digital literacy levels (CDL) of the pre-service EFL teachers. The data analysis has showed that they have scored an average of 3.96 out of 5.00, considered as medium-high level of critical digital knowledge. Specifically, they have showed high level knowledge regarding decoding and using their critical digital literacy. The lowest average scores are received from analyzing and persona. Considering

teachers' levels of higher knowledge being at low levels and difficulty in achieving higher cognitive skills, such a finding is not surprising. Previous studies (Silvhiany et al., 2021; Soifah et al., 2021) have also showed similar results as they indicate that despite born as a Z generation in the global and digital world and adapted to using social media and online resources in their everyday practices, learners cannot critique various platforms such as online sources.

The sub-levels of CDL for the Turkish pre-service EFL teachers showed that navigation and modalities are highly developed for them. They get the lowest mean scores for the areas of deconstructing, creating and selecting. Such findings have also revealed that teachers lack higher levels of cognitive skills. These results are aligned with the previous research findings (Silvhiany et al., 2021; Soifah et al., 2021), as well.

In the next step, data related to technology acceptance, web pedagogical content knowledge, and critical digital literacy levels of the Turkish pre-service EFL teachers in terms of their ages are analyzed. The findings of ANOVA test have indicated that there exist no significant differences in terms of age groups regarding technology acceptance, web pedagogical content knowledge, and critical digital literacy levels. Specifically, this finding has indicated that web pedagogical content knowledge, critical digital literacy and technology acceptance levels do not increase with age. These results can barely justify that age intervals are not high enough and the number of the participants in each age group are different which may not get results with significance. Such a result is surprising considering previous research findings (Kavanoz et al., 2015; Yesiltas, 2016) as they have asserted that age is a critical independent variable that affects web pedagogical content knowledge of the teachers.

Besides, Venkatesh et al. (2003) have found out indirectly that age is one of the demographics that promotes using behavior via behavioral intention, facilitating conditions, social influence, effort expectancy and performance expectancy. Age, in addition to experience, is considered as a very important factor and demographic feature that positively affects the levels of technology acceptance, web pedagogical content knowledge and critical digital literacy (Chung, 2010; Wang & Chen 2009) since young generations easily manage to create a higher understanding and acceptance of digital tools and technologies compared to the older counterparts.

Another research question is related to gender to check whether the Turkish pre-service EFL teachers are differing with their levels of technology acceptance, web pedagogical content knowledge and critical digital literacy by being a female, or male. The findings of the data

analysis showed that there were no statistically significant differences in terms of gender within the scope of technology acceptance, WPACK and CDL levels of the Turkish pre-service EFL teachers. This result can be resulted by the fact there were more female teachers than male teachers. In the same vein, the result is supported with some previous studies as they (Chung, 2010; Morris & Venkatesh, 2000; Nazzal et al., 2021; Wang & Chen 2009; Trocchia & Janda, 2000) have found that gender does not play a role in any way to improve digital literacy. On the other hand, compared to other previous research findings (Li, 2010; Venkatesh et al., 2003), such a result is surprising as they (Venkatesh et al., 2003) have also found out that gender is indirectly accepted as one of the demographics that promote using behavior via behavioral intention, social influence, effort expectancy, and performance expectancy. In order to better understand how gender affects decision-making and buying behavior, several research on the acceptability of new IT systems have been conducted. These studies have found that different gender types evaluate different IT characteristics and uses (Kavanoz et al., 2015; Morris & Venkatesh, 2000).

In the next part, the Turkish pre-service EFL teachers' personal computer ownerships is evaluated whether is statistically significant in lieu of their technology acceptance, web pedagogical content knowledge, and CDL levels. The findings have showed that no significant differences exist between having a personal computer and their technology acceptance, web pedagogical content knowledge, and critical digital literacy levels. However, it should be noted that the percentage of participants with personal computer (P= 95%) was much more than those with no personal computer. Since compared to some of the findings in the previous studies (Varma, 2010), it is found that experiencing and using personal computers affects technology acceptance intentions in two different ways, levels or areas including mediated and/or direct effects. Specifically, being proficient in a technology is expected by the gathered benefits of the acceptance of a computer and/or other technologies; henceforth, there is a direct correlation between owning technology and technology acceptance. This topic should be investigated in more detailed way in order to identify the relationships between owning, using, and being proficient on technology together with the levels of technology acceptance.

Another finding is regarding the relationships among the Turkish pre-service EFL teachers' levels of technology acceptance, WPACK and CDL. To elaborate, there is a high positive correlation between web pedagogical content knowledge and technology acceptance. This means that the higher their levels of web pedagogical content knowledge, the higher the levels of their technology acceptance. This result is aligned with the previous research findings

(Altun, 2019; Akar & Guzin, 2019; Zhang, 2022) as they have found out that technology acceptance model and teachers' technology acceptance levels can be shaped by their web pedagogical content knowledge and critical digital literacy levels. Similarly, Zhang (2022) has indicated that given that instructional technology is advancing quickly and has an impact on learning settings, it is important for teachers to successfully integrate technology into their classrooms.

Secondly, it is found that there exists a statistically significant relationship between technology acceptance and critical digital literacy, technology acceptance and web pedagogical content knowledge, and critical digital literacy and web pedagogical content knowledge. Specifically, the relationships between three variables are positively high. Such findings are also aligned with the studies conducted in literature (Akar & Guzin, 2019; Korucu, 2011). Akar and Guzin (2019) have concluded that web pedagogical content knowledge could be explained by technology acceptance.

In the final part, the Turkish pre-service EFL teachers' reflections within the scope of technology acceptance, web pedagogical content knowledge and critical digital literacy are qualitatively investigated from the structured interviews conducted with them by means of open-ended questions listed at the end of the Google Forms. Specifically, they are asked to provide their perspectives about how to improve technology acceptance and integration; how to improve web pedagogical content knowledge; and how to improve critical digital literacy levels as being future EFL teachers. According to the previous findings, instructors have had positive opinions on the value, practicality, context, and usage of digital technology in EFL courses.

The findings of the qualitative part have showed that the Turkish pre-service EFL teachers have indicated four typical responses to suggest how the levels of technology acceptance and integration can be accomplished as a future teacher. They have stated that teachers should familiarize themselves with computer usage and web itself since accessing and retrieving data and information is much easier in this information era. Second suggestion is that teachers should join online communities and watch videos to improve their web pedagogical content knowledge. Another suggestion is about giving related information which should be instructed to the learners in language classes. And finally, they have suggested that learning from their colleagues and utilizing similar and useful approaches and techniques from them is of vital importance. They have also suggested that teachers' self-efforts play an important role in terms of enhancing teachers' technology acceptance and integration levels and skills.

Considering previous studies and their findings, these suggestions are aligned with the previous research (Mouza et al., 2014). Mouza et al. (2014) have signified that joining social technology related communities and taking opportunities to learn technological advances as well as understanding technology can boost their technology awareness and technology acceptance together with their integration efforts. In addition, they have suggested integrating into groups and related professional development courses which may help teachers and teacher candidates increase their technology acceptance. For instance, such courses can include a semester-long content related to the current technologies utilized in language classrooms such as web 2.0, Internet sources, concept mapping software, and interactive manipulatives. Especially, learning practices of technology tools enhance teachers' understanding of technology and increase their levels of technology acceptance efforts.

For the second questions related to the ways that can boost teachers' web pedagogical content knowledge, four typical ideas are noted by the responses of the Turkish pre-service EFL teachers. They have suggested that teachers should keep themselves up to date with technological and web developments as it is too fast. Secondly, they have suggested that future teachers or current in-service teachers should be ready for future developments by using advanced and popular learning management tools such as Zoom and Microsoft Teams. Since in case of emergency learning situations, they are the ones highly used by virtual learners and teachers. In this respect, online courses and other preparation methodologies can help them. In addition, in order to profit from technology at most, educational programs and other pedagogical content development tools should be familiarized. Also, they have suggested that it is important to participate in seminars and other professional development courses to learn about necessary and up-to-date educational programs in the learning market.

What's more, pedagogical content knowledge is initially proposed as a third important component of teaching competence, in addition to instructors' subject matter (content) knowledge and their general understanding of instructional procedures (pedagogical knowledge). Considering fast developments in the pedagogical content and related application tools used in the language classrooms, such suggestions are considered as promising. Such suggestions are also supported by previous research findings (Kavanoz et al., 2015; Teed & Franco, 2014) as they have suggested web-based instructions as a method to improve teachers' web pedagogical content knowledge. They have noted that especially language teachers as pre-service or in-service can benefit from web-based professional development and instructional approaches in their professions or at teacher preparation programs. They have also confirmed

that additional qualitative methods, including observation or interviews, may help paint a fuller picture of how pre-service EFL teachers feel about using Internet and other web-based tools for instruction. In a similar study, Teed and Franco (2014) have suggested that teachers' web pedagogical content knowledge can be enhanced by organizing workshops and follow-up programs for teachers. They have also recommended how to set up and implement workshops for such purposes. Each time a workshop is offered, the themes are different, allowing participants to revisit the material and create curriculum that is acceptable for new requirements every year.

Finally, teachers have suggested three typical ways to promote critical digital literacy for pre-service EFL teachers. They have reported that teachers should collaborate and learn by using social media as well as taking digital learning programs including online classes and training courses for what is necessary for them. Secondly, it is suggested that teachers should conduct research and practice on the field (i.e., action research) because it is not enough just to learn how to do them. Instead of that, they are expected to learn practicing on the levels of implementation. Finally, effective courses should be utilized for teachers to learn more about critical digital literacy. Considering teachers' needs and necessities of being digitally literate, learning practical concepts in professional development courses and practicing them in their future language classrooms are considered as promising. The findings of this study, herein, are also in line with the other studies in literature (Miller & McVee, 2012; Reisoğlu & Çebi, 2020; Watt, 2019) as they have suggested that learning on-the-job (e.g., video production) can improve elementary teachers' critical literacy levels and understandings. Also, they have showed that video production courses or instructional technologies can be included in online courses and other professional development workshops and seminars as well as courses in teacher preparation programs. Correlatively, Reisoğlu and Çebi (2020) have used both inductive and deductive analytical methods whereby they have found that pre-service teachers need to be given instruction in relation to information and data literacy, communication and teamwork, creating digital material, safety and problem-solving, as well.

5.2. Concluding Remarks

In today's world and education systems, the understanding of technology and technology literacy are regarded as necessary skills for learners. Teachers as being at the central position in the field of education for the goodness of next generations, it is essential to possess higher understanding of related skills, knowledge and perspectives.

As described in TPACK's theoretical underpinnings, technology, education, content knowledge and pedagogy are interrelated and necessary for today's educational systems. Likewise, web pedagogical content knowledge and critical digital literacy are important and essential for teachers. Herein, it is important to assess pre-service teacher's knowledge and levels of understanding about topics regarding technology and technology acceptance within related concepts.

At this point, this study was aimed to investigate the Turkish pre-service teachers' levels of knowledge and understandings of Web Pedagogical Content Knowledge (WPACK), their Critical Digital Literacy (CDL) and Technology Acceptance. Our findings somewhat supported previous research findings. Although some of our expectations were not satisfied, they could be justified by limited sample of the study. For example, although age and gender were two important and effective demographic features for technology acceptance (Baturay, 2017), CDL (Çam & Kiyici, 2017) and WPACK (Gömleksiz, 2011), our findings did not support it which was in line with some other studies (Koç, 2011; Özdamlı et al., 2009; Sang et al., 2010; Teo et al., 2015), though. In addition, owning a personal computer was not found as effective as expected because almost all the participants had personal computers and there were no participants who could be compared with them, which was contradicted with the results of the studies conducted by Arabacıoğlu and Dursun (2015), and Ata and Yıldırım (2019) respectively.

On the other hand, most of the findings were aligned with the previous studies. Teachers' levels of technology acceptance were found high (Baturay et al., 2017; Bozdoğan & Özen, 2014; Wong et al., 2013) as they were considered as the members of Z generation, and they were born into the digital world. Similarly, their levels of WPACK together with their CDL levels were found high which was also aligned with the previous studies in the field (Aydın et al., 2017; Bağcı & Atar, 2019; Kavanoz et al., 2015).

Finally, the pre-service EFL teachers' levels of technology acceptance, WPACK, and CDL were found interrelated (as presumed), and this thesis was a pioneer in exploring the correlations among aforementioned frameworks in literature and contributing to the educational arena.

5.3.Implications

The findings of the current thesis revealed that pre-service EFL teachers' technology acceptance, WPACK and CDL levels could be improved by providing them with technology

and web-oriented classes more under the supervision of their technologically competent professors and educators, implementing technology and digital- oriented courses into the teacher education curricula, and guiding and mentoring them with professors being technologically competent with a high level of WPACK and CDL. In order to raise awareness of the pre-service EFL teachers in terms of technology acceptance, WPACK, and CDL, they could be given more opportunities during their pre-service education where they could practice their digital skills with the help of web tools. They could also be involved in different educational programs or courses focusing on their educational development in addition to their circular educational practices as future Z-generation teachers as a part of extra-curricular educational activities.

5.4.Limitations

The current study was limited to the following conditions in data collection and data analysis processes:

- 1- The participants of the study were limited to pre-service EFL teachers (as to the researcher's convenience), which might hinder the comparison of pre- and in-service EFL teachers.
- 2- The findings of the study were limited to the responses and comments from the participants.
- 3- As majority of participants (P= 95%) did have a personal computer (meaning almost all the participants had personal computers), owning a personal computer was not employed as an independent variable to be statistically tested; albeit estimated as not statistically significant.
- 4- The findings of the study were limited to the results of descriptive and inferential statistics according to the responses gathered from the participants. Besides, the pre-service EFL teachers' levels of technology acceptance, WPACK, and CDL were found interrelated (as presumed), and this result supported the previous research findings, yet limited to the correlation analysis. However, a more robust statistical estimation was needed (i.e., regression analysis, structural equation modelling-SEM, etc.) in order to report the line that most closely fit the expected criterion by specific mathematical estimations, and thus identify the impact of variables on each, albeit limited to the knowledge of the researcher.

- 5- The COVID-19 pandemic period restricted the qualitative data collection process as face-to-face interaction was somehow limited and the researcher herself did not find appropriate time blocks for seeing the participants at hand. In response to that, the participants might not be so eager to participate in the qualitative part (which was composed of open-ended questions; and thus, time consuming) where the COVID-19 pandemic period restricted the availability of participants even for convenience sampling although the number of participants was reported to be 94.

5.5. Suggestions For Future Studies

Based on the results addressed in this thesis, the following recommendations are acknowledged in order to improve the quality of future studies:

- 1- The number of participants should be more than the current study to compare groups and participants with proper statistical tools and estimations.
- 2- The sample groups could be selected from both pre-service and in-service teachers within the perspective of a comparative analysis in between.
- 3- Owning a personal computer should be investigated in more detailed way in order to identify the relationships between owning, using, and being proficient on technology together with the levels of technology acceptance as the literature reported so, which might affect the results in a different way.
- 4- The participants could be face-to-face interviewed to have a better understanding of their perspectives toward technology and its usage in the language classrooms.
- 5- In order to eliminate social desirability as an effect to hinder the reliability and validity of the results, a more robust way of understanding if pre-service EFL teachers' own belongings (knowledge and skills) could be employed, or they might report themselves with the highly desired values that an EFL teacher should have in the future to be having web pedagogical content knowledge embellished with technological and critical literacy. Herein, in-class observations might be executed in order to identify whether they could implement them in real classroom environment.

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APPENDICES

Appendix A. Questionnaires with Open-Ended Questions

Bölüm 1/6

An Analysis of Technology Acceptance Model (TAM) in Developing Pre-service EFL Teachers' Web Pedagogical Content Knowledge (WPACK) and Critical Digital Literacy (CDL)

You are invited to participate in a research study conducted by Rabia Ölmez, who is a master degree student at the department of English Language Teaching at Izmir Democracy University under the supervision of Asst. Prof. Dr. Nurdan Kavaklı.

This research is conducted for her master thesis. Your participation in this study is entirely voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

The purpose of this study is to analyze Turkish pre-service EFL teachers' Web Pedagogical Content Knowledge (WPACK), Critical Digital Literacy (CDL) and Technology Acceptance levels together with revealing the interplay among these three frameworks. Any information that is obtained in connection with this study and that can be identified with you will remain confidential, and will be disclosed only with your permission or as required by law. Information that can identify you individually will not be released to anyone apart from this study. However, the researcher may use the information collected in her thesis and other publications. Any information used for publication will not identify you individually albeit will be kept anonymous.

The survey consists of three different questionnaires and a written interview with three questions in the end. When you complete one section, you may move on to the next one. The last three interview questions are optional to answer but please keep in mind that you are required to answer all of three questions if you decide to answer them.

Lastly, since the responses you give will be a part of the MA thesis, it is critically vital for the researcher to get authentic and appropriate answers from the participants.

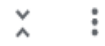
Thank you for your cooperation, and taking your time to fill in the questionnaires.

Rabia Ölmez
MA Student, Izmir Democracy University

Consent Approval *

☐ I understand the procedures described above. My questions have been answered to my satisfaction, and...

DEMOGRAPHIC INFORMATION



Açıklama (isteğe bağlı)

AGE *

- ☐ 17-21
- ☐ 22-26
- ☐ 27+

GENDER *

- ☐ Female
- ☐ Male
- ☐ Prefer not to say

LEVEL OF EDUCATION *

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

FAMILY INCOME LEVEL *

- ☐ 1500-2500
- ☐ 2600-3600
- ☐ 3600+
- ☐ Not applicable

Do you own a personal computer? *

- ☐ Yes, I do.
- ☐ No, I do not.

How often do you use web tools (e.g. search engines, mails etc.) ? *

- ☐ Always
- ☐ Sometimes
- ☐ Rarely
- ☐ Very Rarely
- ☐ Never

QUESTIONNAIRE 1: Technology Acceptance Measure for Pre-service Teachers (Teo, 2011)



In this section, you are required to rate the statements from "Strongly Disagree" to "Strongly Agree".

1. Using computers will improve my work. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

2. Computers make work more interesting. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

3. My interaction with computers is clear and understandable. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

4. When I need help to use computers, specialized instruction is available to help me. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

5. Working with computers is fun. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

6. I find it easy to get computers to do what I want it to do. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

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7. Using computers will increase my productivity. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

8. I find computers easy to use. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

9. When I need help to use computers, a specific person is available to provide assistance. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

10. People whose opinions I value will encourage me to use computers. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

11. I like using computers. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

12. People who are important to me will support me to use computers. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

13. Using computers will enhance my effectiveness. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

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14. When I need help to use computers, guidance is available to me. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

15. I find computers a useful tool in my work. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

16. I look forward to those aspects of my job that require me to use computers. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

QUESTIONNAIRE 2: Technological Pedagogical Content Knowledge-Web (WPACK) Survey
(Lee & Tsai, 2010)

In this section, you are required to rate the statements from "Strongly Disagree" to "Strongly Agree".

1. I am able to click the hyperlink to connect to another website. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

2. I am able to key in the website address to connect to a particular website. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

3. I am able to key in the Website address to connect to a particular Website.

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

4. I am able to search for information on the Web using keywords. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

5. I am able to download pictures from the Web. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

6. I am able to use the Web search engines. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

7. I am able to copy text on the Web into the "Word". *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

8. I am able to read others' messages in a chatroom. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

9. I am able to set a nickname by myself in an online chatroom. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

10. I am able to talk to others one on one in an online chatroom. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

11. I am able to provide information or respond to someone else on a BBS (Bulletin Board System). *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

12. I know that web technology can provide various materials to enrich course content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

13. I know how to search online resources for course content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

14. I know how to select proper content from Web resources. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

15. I am able to search related online materials for course content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

16. I am able to search for various materials on the Web to be integrated into course content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

17. I know how to apply teaching modules on the Web into courses. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

18. I am able to use Web technology to enhance teaching. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

19. I am able to use the Web to enhance students' learning motivation. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

20. I am able to select proper existing Web-based courses to assist teaching. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

21. I am able to apply Web technology to use multiple teaching strategies on a particular course unit. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

22. I am able to guide students to use Web resources to study a certain course unit. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

23. I am able to use Web resources to guide students' learning activities for a certain course unit. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

24. I am able to use Web technology to support teaching for the content of a particular course *
unit.

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

25. Web technology can be actually used in the practice of teaching. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

26. The characteristics of the Web can help instruction. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

27. Web technology can enhance teaching skills *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

28. Web-related resources can enrich course content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

29. Web-based teaching can enhance students' learning motivation. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

30. Web-based teaching is a future trend in education. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

QUESTIONNAIRE 3: Critical Digital Literacy Survey (Henrichsen & Koombs, 2013)



In this section, you are required to rate the statements from "Strongly Disagree" to "Strongly Agree".

1. I can understand navigational mechanisms (e.g. scrolling, active windows, menus, buttons, etc.). *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

2. I can understand conceptual notions of movement in the digital landscape, such as metaphors and avatars *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

3. I can understand practical notions of movement in the digital landscape, such as mouse, swiping, and VR (virtual reality). *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

4. I can locate myself spatially, such as when following links. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

5. I can locate myself operationally, such as having several programs, or sites running simultaneously.

*

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

6. I can understand the practices and norms of ICT usage including safety and security, presentational and accessible production.

*

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

7. I can understand the practices and norms of participation in online communities including communication protocols, ethics, privacy, sharing and attribution.

*

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

8. I can grasp common functional procedures, such as saving, printing and organizing files, uploading and downloading, starting up and shutting down. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

9. I have confidence in engaging with new tools, and/or applications. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

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10. I am aware that different modes of digital texts (e.g. video, immersive game, SMS, twitter streams) have different characteristics and conventions. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

11. I can understand these helps in decoding them, in much the same way as knowledge of idiom and register is important in using language. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

12. I can fluently and confidently assimilate the digital content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

13. I can purposefully and efficiently move around software and platforms. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

14. I can follow and create narratives across diverse semantic, visual and structural elements. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

15. I can make connections both with developing linkages and relationships between new and existing knowledge. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

16. I can acquire and adapt mental models. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

17. I have the capacity to translate a purpose, or intention. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

18. I have the capacity to form my ideas through my feelings into a digital form across a range *
of communicative modes (e.g. development of content, artefacts, or social relations, and an
understanding of potential readerships.)

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

19. I can gather appropriate information, resources and tools for a given purpose. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

20. I can recognize and exploit the potential in communities, information, resources and tools encountered (e.g. asking, searching, filtering, curation and sharing). *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

21. I can deploy tools and techniques effectively for given purposes and audiences within the bounds of ethical, legal and usability criteria. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

22. I can exploit digital tools, resources and networks for problem finding and definition, problem analysis and approaches to solutions. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

23. I can generate imaginative approaches, techniques, artefacts or content through the application of digital literacy skills. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

24. I have the confidence to explore, experience and innovate digital literacy skills. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

25. I can discern the elements that contribute to the meanings, uses and messages in digital products and communications. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

26. I can make judgments and draw conclusions about digital tools, environments, and artefacts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

27. I can evaluate digital systems, content, networks, or artefacts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

28. I can choose digital systems, content, networks, or artefacts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

29. I can recommend digital systems, content, networks, or artefacts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

30. I can reject digital systems, content, networks, or artefacts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

31. I can employ skills of analysis and rigor in questioning the provenance, purpose and impact of digital content and interactions. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

32. I can perceive affordances and opportunities of the digital content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

33. I can exploit affordances and opportunities of the digital content. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

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34. I have a sense of my own roles within different digital environments. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

35. I have a sense of sensitivity to relationships and alignments within groups and communities. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

36. I have an understanding of the multi-faceted nature of identity. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

37. I have an understanding of how the multi-faceted nature of identity operates in different digital contexts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

38. I have an understanding of the relationships between digital and other identities. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

39. I am aware of my own and other communities' reputations as assets that should be developed and managed effectively to support aspirations (e.g. career and employment). *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

40. I am aware of a need of safeguard against loss of reputation in digital contexts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

41. I know how to protect myself in online communities. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

42. I can work with others in a variety of modes (e.g. synchronous and asynchronous) via digital interaction and exchange. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

43. I have the experience to contribute to individual, group and community works in digital contexts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

44. I am aware of the ethical challenges that may rise in digital contexts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

45. I am aware of the cultural challenges that may rise in digital contexts. *

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Bölüm 6/6

Interview Questions



This part consists of three questions which are not obligatory to fill in. Yet, if you choose to answer the questions, please make sure that you give answers to all of them. If not, thank you for taking your time to fill in the questionnaires and for your cooperation!

1. How can you improve your Web Pedagogical Content Knowledge as a pre-service EFL teacher? What are the ways to promote it?

Kısa yanıt metni

.....

2. How can you improve your Critical Digital Literacy as a pre-service EFL teacher? What are the ways to promote it?

Uzun yanıt metni

.....

3. What could be done to develop EFL teachers' Web Pedagogical Content Knowledge and enhance their technology integration in their future teaching?

Kısa yanıt metni

.....

Appendix B. Ethics Permission (Izmir Democracy University)





Kavaklı, N. & Ölmez, R. (2021). The role of technology acceptance model in constructing unbounded learning environments for second language learners. In *Handbook of research on developing a post-pandemic paradigm for virtual technologies in higher education* (pp. 282-298). IGI Global.

Ölmez, R. & Kavaklı, N. (2021). The role of technology acceptance model in the adaptation of new technologies by teachers: a review of literature. In B. Tunçsiper (Ed.), *Proceedings of the 4th International Conference on Educational Research* (pp. 13-20). Izmir, Turkey.

Foreign Languages

Advanced English, Pre-intermediate German, Beginner Dutch