AN INVESTIGATION ON THE RELATIONSHIP BETWEEN TECHNOLOGY ADOPTER CATEGORIES AND TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE LEVEL OF PRE-SERVICE EFL TEACHERS

Merve ŞENEN

JUNE 2019

AN INVESTIGATION ON THE RELATIONSHIP BETWEEN TECHNOLOGY ADOPTER CATEGORIES AND TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE LEVEL OF PRE-SERVICE EFL TEACHERS

A THESIS SUBMITTED TO THE
GRADUATE SCHOOL OF EDUCATIONAL SCIENCES
OF
BAHÇEŞEHİR UNIVERSITY

BY

MERVE ŞENEN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF ARTS
IN THE DEPARTMENT OF ENGLISH LANGUAGE EDUCATION

JUNE 2019

Approval of the Graduate School of Educational Sciences

Assist. Prof. Enisa MEDE
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Arts.

Assist. Prof. Hatime ÇİFTÇİ
Coordinator

This is to certify that we have read this thesis and in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts.

Assist. Prof. Mustafa POLAT
Supervisor

Examining Committee Members

Assist. Prof. Mustafa POLAT	(BAU, ELT)	
Assist. Prof. Enisa Saban MEDE	(BAU, ELT)	
Assist.Prof. Tuncer CAN	(IUC, ELT)	

I hereby declare that all 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 material and results that are not original to this work.

Name, Last Name : Merve SENEN

Signature :

ABSTRACT

AN INVESTIGATION ON THE RELATIONSHIP BETWEEN TECHNOLOGY ADOPTER CATEGORIES AND TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE LEVEL OF PRE-SERVICE EFL TEACHERS

Şenen, Merve
Master's Thesis, Master's Program in English Language Education
Supervisor: Assist. Prof. Mustafa POLAT

June 2019, 82 pages

The present research was conducted with the aim of presenting pre-service EFL teachers' technology adopter categories to display their attitudes towards technology in general, determining their Technological Pedagogical Content Knowledge (TPACK) levels to see their competence in integrating technology effectively and finding out the relationship between pre-service EFL teachers' technology adopter categories and TPACK levels in order to find out whether their attitudes define how effective they are in using technology pedagogically to teach in their content area.
This study is quantitative in nature and used correlational design. The data were collected through a survey which included the Technology Adopter Category Index (TACI) rubric developed by Dugas (2005) in order to detect prospective EFL teachers' technology adopter categories, and the TPACK-deep scale that was developed by Kabakçı Yurdakul et al. (2012) in order to detect the TPACK levels of the participants. A total of 130 pre-service EFL teachers, who were in the last year of their undergraduate program both in private and public universities from different cities of Turkey, participated voluntarily in the study.

The findings indicated that the technology adopter category of pre-service EFL teachers is predominantly early majority, and they had high level of TPACK.

However, it is inferred that even though female participants had slightly a higher mean score, there wasn't statistically significant difference between female and male participants' both in TACI scores and TPACK levels. Results also showed no statistically significant difference between academic success and TACI scores and TPACK levels. Finally, it was found out that there is not any relationship between pre-service EFL teachers' technology adopter categories and their TPACK levels. Based on these findings, this research contributes to the literature by providing several pedagogical implications about the ways of developing pre-service EFL teachers' approach towards technology.

Keywords: Technology in Education, Diffusion of Innovations, Technology Adopter Category Index, Technological Pedagogical and Content Knowledge, Pre-service EFL Teachers

ÖZ

İNGİLİZCE ÖĞRETMEN ADAYLARININ TEKNOLOJİ BENİMSEME KATEGORİLERİ İLE TEKNOLOJİK PEDAGOJİK ALAN BİLGİLERİ ARASINDAKİ İLİŞKİYE DAİR BİR ARAŞTIRMA

Şenen, Merve
Yüksek Lisans, İngiliz Dili Eğitimi Yüksek Lisans Programı
Tez Yöneticisi: Dr. Öğr. Üyesi Mustafa POLAT

Haziran 2019, 82 sayfa

Bu çalışma, öğretmen adaylarının teknolojiye karşı olan tutumlarını sergilemek amacıyla onların teknoloji benimseme kategorilerini ortaya çıkarmak, teknolojiyi etkili bir şekilde entegre etme konusundaki yetkinliklerini belirlemek için Teknolojik Pedagojik Alan Bilgisi (TPAB) seviyelerini belirlemek ve teknolojiye karşı olan tutumlarının, teknolojiyi kendi alanlarında pedagojik açıdan kullanmalarına etkisi olup olmadığını görmek amacıyla teknoloji benimseme kategorileri ile TPAB seviyeleri arasındaki ilişkiyi araştırmıştır.

Bu çalışma nicel olarak yürütülmüştür ve araştırma sorularına cevap verebilmek için korelasyonel araştırma yöntemi kullanılmıştır. Veriler Dugas (2005) tarafından geliştirilen TACI ölçeğini ve Kabakçı Yurdakul ve diğerleri (2012) tarafından ortaya konan TPACK-deep anketini içeren bir anketle toplanmıştır. Araştırmaya, Türkiye'nin farklı şehirlerinden özel ve devlet üniversitelerinin lisans programlarının son sınıflarında öğrenim görmekte olan toplam 130 İngilizce öğretmen adayı gönüllü olarak katılmıştır.

Elde edilen bulgular, İngilizce öğretmen adaylarının ağırlıklı olarak sorgulayıcılar kategorisinde olduğunu göstermiştir. Dahası, bu katılımcıların yüksek oran TPAB seviyesine sahip oldukları belirlenmiştir. Bununla birlikte, kadın katılımcıların

ortalama puanları erkek katılımcılardan biraz daha fazla olsa da, hem kadın hem de erkek katılımcıların hem TACI puanlarında hem de TPACK düzeylerinde istatistiksel olarak anlamlı bir fark olmadığı ortaya konulmuştur. Sonuçlar ayrıca akademik başarı ile TACI skorları ve TPAB seviyeleri arasında istatistiksel olarak anlamlı bir fark göstermemiştir. Son olarak, İngilizce öğretmen adaylarının teknoloji benimseme kategorileri ile TPAB düzeyleri arasında bir ilişki olmadığı tespit edilmiştir.

Anahtar Kelimeler: Eğitimde Teknoloji, Yeniliğin Yayılması, Teknoloji Benimseme Kategorileri, Teknolojik Pedagojik Alan Bilgisi, İngiliz Dili Eğitimi Öğretmen Adayları

To Everybody Who Have Always Believed In Me

ACKNOWLEDGEMENTS

Writing a thesis has become a challenging, but a proud procedure for me. I would like to express my deepest gratitude to everybody who has a contribution in this study. First and the most important of all, I would like to thank to my advisor Assist. Prof. Mustafa POLAT for his precious time, valuable ideas and directive guidance throughout this research. Besides, I must express my sincere thanks to my thesis committee: Asst. Prof. Enisa MEDE and especially Asst. Prof. Dr. Tuncer CAN for his great support in data collection procedure. Every pre-service EFL teachers who spared time for this research also deserves one appreciation. I also want to thank to my teacher, İlhan ECE, who has a big contribution in my success today. The help I got from my dearest friend, Özge ÖZLÜ, is worth thanking. Thanks for always being there for me when this period was drastic. I also owe a big praise to Aslin ARSLANOĞLU for her outstanding reviews on my study. Last but not least, this study wouldn't be complete without the support I got from my family. I wouldn't be standing where I am today without their endless faith in me.

TABLE OF CONTENTS

ETHICAL CONDUCT iii
ABSTRACT iv
ÖZ vi
DEDICATION vii
ACKNOWLEDGEMENTS ix
TABLE OF CONTENTS x
LIST OF TABLES xii
LIST OF FIGURES xiii
LIST OF ABBREVIATION xiv
Chapter 1 Introduction 1
1.1 Theoretical Framework 1
1.2 Statement of the Problem 3
1.2 Purpose of the Study 4
1.3 Research Questions 5
1.4 Significance of the Study 5
1.6 Definitions 6
Chapter 2 Literature Review 7
2.1 Information and Communication Technologies in Education 7
2.1.1 ICT and language education. 10
2.2 Technology Adoption 14
2.3 The framework of Technological Pedagogical Content Knowledge 18
2.4 Components of TPACK 20
2.4.3 Pedagogical content knowledge (PCK). 22
2.4.5 Technological content knowledge (TCK) 23
2.4.6 Technological pedagogical knowledge (TPK) 23
2.5 Previous Studies on TPACK 25
2.6 Previous Studies on TPACK of EFL Teachers 27
2.7 Previous Studies on TPACK in Turkey 28
Chapter 3 Methodology 30
3.1 Research Design 30

3.2 Setting and Participants 31
3.3. Procedures 32
3.3.1 Data collection instruments 32
3.3.2 Data collection procedures 35
3.3.3 Data analysis procedures. 36
3.3.4 Reliability and validity 37
3.4. Limitations 37
Chapter 4 Findings 39
4.1 Findings of the Demographic Inventory 39
4.2 Findings of the Research Question 1 44
4.3 Findings of the Research Question 2 49
4.4 Findings of the Research Question 3 56
Chapter 5 Discussion and Conclusion 58
5.1 Discussion of the findings 59
5.1.1 Discussion of the findings for the first research question 59
5.1.2 Discussion of the findings for the second research question 61
5.1.3 Discussion of the findings for the third research question. 63
5.2 Pedagogical Implications 64
5.3 Conclusions 66
5.4 Recommendations 67
REFERENCES 68
APPENDICES 76
A. Technology Adoption and TPACK Questionnaire 76
B. Curriculum Vitae 82

LIST OF TABLES

TABLES

Table 1 Rubric for the Evaluation of TPACK-deep Scale Scores……..…….... 34
Table 2 Overview of Research Questions and Corresponding Procedures...……. 37
Table 3 The Distribution of the Participants Based on Gender ……. 40
Table 4 The Distribution of the Participants Based on Expected GPA Score ….….. 41
Table 5 The Distribution of the Participants Based on Technological Devices They Own ……...…… 41
Table 6 The Distribution of the Participants Based on the Time They Spend on the Internet ……...…… 42
Table 7 The Distribution of the Participants Based on the Activities They Spend Time on the Internet ……...…. 43
Table 8 The Categorization of the "Others" Item Based on the Answers of Participants…….....…... 44
Table 9 TACI Rubric Items and the Categories They Represent ……..... 44
Table 10 The Distribution of the Participants Based on TACI ……..…….. 46
Table 11 Technology Adopter Categories of Pre-service EFL Teachers ……..…. 47
Table 12 Crosstabulation of Gender and TACI ……..… 48
Table 13 Means of Gender Based Adopter Categories ……..… 48
Table 14 Independent Samples Test for Gender and TACI …….…… 49
Table 15 One-Way ANOVA Test for Expected GPA and TACI …….…… 49
Table 16 Item Based TPACK Questionnaire Descriptives ……..….. 50
Table 17 Analysis of Pre-service EFL Teachers' TPACK Levels ……..….. 52
Table 18 Analysis of Pre-service EFL Teachers' Levels for 4 TPACK Factors ….. 53
Table 19 Independent Samples Test for Gender and TPACK …….…… 53
Table 20 Independent Samples Test for Gender and 4 TPACK Factors ……..…. 54
Table 21 One-Way ANOVA Test for Expected GPA and TPACK Level ……..….. 55
Table 22 Means of Expected GPA Scores Based on 4 TPACK Factors ……...….. 56
Table 23 Correlation Analysis between TACI and TPACK ……..... 57

LIST OF FIGURES

FIGURES

Figure 1 A Model of Stages in the Innovation-decision Process…… 15
Figure 2 The Bell-shaped Frequency Curve and the S-shaped Cumulative Curve for An Adopter Distribution …….. 17
Figure 3 Distribution of Adoption Population by Innovativeness Category …….. 18
Figure 4 ICT-TPCK …… 20
Figure 5 The TPACK Framework and Its Knowledge Components …….. 21
Figure 6 Percentile of Pre-service EFL Teachers' TPACK Levels …… 52

LIST OF ABBREVIATION

EFL	English as a Foreign Language
ICT	Information and Communication Technology
CALL	Computer Assisted Language Learning
MALL	Mobile Assisted Language Learning
TACI	Technology Adopter Category Index
PCK	Pedagogical Content Knowledge
TPACK	Technology Pedagogy and Content Knowledge
IWB	Interactive White Board

Chapter 1

Introduction

This chapter provides preliminary information explaining theoretical framework, statement of the problem, purpose and significance of the study along with research questions and definitions of some terms in order to enhance the comprehension of the thesis work.

1.1 Theoretical Framework

There are two theoretical frameworks that have been used to seek an answer to research questions in this study. The first one is Technology Adopter Category Index (TACI), which is a framework developed by Dugas (2005) based on Everett M. Rogers' (2003) Diffusion of Innovations theory. After doing research about the use of new methods in the field of agriculture, Rogers examined the diffusion of innovations among individuals in different fields and introduced the diffusion of innovation theory (Özbek, 2014). Rogers (2003) states that innovation can't be accepted and embraced by every person concurrently. Instead, diffusion of innovations differs from person to person. Some people might adopt innovation easily while it takes some time for others to do so even in the same business sector. The adoption requires a time sequence and might be classified under categories which can be detected according to the time when a person starts using a new notion. These categories are called innovators, early adopters, early majority, late majority and laggards. Dugas (2005) used the diffusion of innovations theory as the basis of his study and designed Technology Adopter Category Index rubric. In this rubric, the item that participants choose reflects their own adopter category. For the purpose of this study, TACI indicates the pre-service EFL teachers' approach to technological innovations in general. This framework also reveals the possible characteristics of pre-service EFL teachers according to the time they adopt or reject technology.

Another framework in this study is Technological Pedagogical Content Knowledge (TPACK). Chapelle (2009) stated that success in teaching and learning in a classroom where English is taught as a foreign language and teaching is done in a non-native environment can be enhanced with the integration of technology (as cited in Liu, Liu, Yu, Li, & Wen, 2014). However, integration of technology into education is being problematic as much as being popular because technology cannot be integrated into education without taking some points into consideration. This point has led educators to research in the field and create different models of technology integration in education such as a five-stage model of computer technology integration by Toledo (2005), systematic planning for ICT integration by Wang and Woo (2007), e-capacity model by Vanderlinde and Braak (2010) and Technological Pedagogical Content Knowledge model by Mishra and Koehler (as cited in Ünal, 2015). This study takes Technological Pedagogical Content Knowledge model as the second framework in order to demonstrate the competency level of pre-service EFL teachers in technology, pedagogy and content. TPACK has evolved in teacher education in order to outline the necessary knowledge framework for effective technology integration. It has demonstrated an ever-growing influence on teacher training, professional development and literature. The TPACK concept emerged from the notion of pedagogical content knowledge (PCK) which was suggested by Shulman in 1986. There are three knowledge areas in TPACK. These are Content Knowledge (CK), Pedagogy Knowledge (PK) and Technology Knowledge (TK). Angeli and Valanides (2005) presented the importance of a combination of each item, e.g. Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK), stating that teaching successfully by using technology necessitates a creative and dynamic balance.

A further explanation about the frameworks of TACI and TPACK is provided in the literature review and methodology chapters.

1.2 Statement of the Problem

New possibilities and new approaches in education create new types of students who are more likely to be found in new communicative environments where they use language and engage in the last form of technology (Hall & Cook, 2015). In today's information age, students have more and better chances to get access to education now because of technology's synchronous and asynchronous characteristics (Tinio, 2003). Prensky (2001) pointed out that those types of students think and act in a divergent way compared to their elders. They are in a ubiquitous environment where they grow up surrounded by computers, mobile phones, the Internet, cameras and all the other technological devices. They are born into the technology itself. They have a very close relationship with technology and start to speak the digital language from the day that they come into life. He called those students as digital natives. According to him, there is another kind of people as opposed to the digital natives. They are the people who are digital natives' elders. They are not born into this technology and try to acquire the digital language at later point of their lives as digital immigrants. He also claimed that the biggest conflict between these two groups of people is in education because teachers who are digital immigrants are having hard times at teaching to a group of students who communicate in a very different new language. Those teachers use out-of-date teaching techniques while new generation needs more games and computers and the Internet to get the information and process it. In this context, teacher education plays an important part in bringing up teachers who are able to provide digital natives' needs in this new technological era.

Believing that being able to use technology in the classroom correctly and effectively is of great importance, first, it is important to understand that the fundamentals of being a well-qualified teacher lie in a well-designed teacher education program. Moeller, Aleidine Kramer, Park, and Hyesung (2003) emphasized that developing student learning, increasing discourse on teaching and learning and initiating social networks among teachers are technology's central roles. These skills can possibly be put into use by pre-service teachers who own technology skills. For this reason, the aim of the teacher education programs should be to train foreign

language teachers who can use technology effectively to enhance student learning. Van Olphen (2008) also pointed out that teaching with technology is likely to become casual and not enough if it is done without sufficient experience and proficiency (as cited in Köse, 2016). Therefore, the training that the teachers take to integrate technology into the curriculum has a significant role. Regarding that, the problem in the educational technology field in language teaching is that whether teachers are educated or developed well enough to string along with the purpose of using technology and whether they know how to teach and what to teach through technology. Koehler and Mishra (2009) stated that an approach is demanded while teaching with technology in order to overcome some possible problems. Keeping this in mind, this study takes Technology Adopter Category Index (TACI) and Technological Pedagogical Content Knowledge (TPACK) as two separate but complementary frameworks and seeks answers to some research questions in order to understand the pre-service teachers' attitudes towards technology while they are still being educated when they are about to complete their degree in English Language Teaching,. With the aim of developing an insight into the pre-service English as a Foreign Language (EFL) teachers' training, this study makes it possible to question whether pre-service EFL teachers appeal to new type of generation, take students' needs and expectations into account to have successful teaching and keep themselves updated in the design of materials and methods, lesson planning, etc.

1.2 Purpose of the Study

The first purpose of this study is to introduce pre-service EFL teachers' technology adopter categories to see their stance on technology in general. The second one is to present their technological pedagogical content knowledge levels to detect how practical they are in integrating technology into lessons, and the last aim is to find out the relationship between their technology adopter categories and TPACK level to explain if pre-service EFL teachers' adopter categories decide on how competent they are in using technology pedagogically to teach their subject.

1.3 Research Questions

The following research questions were specified in order to reach the above-mentioned aims:

1. What is pre-service EFL teachers' approach in adopting new technologies?
   a. Does gender have an effect on their adoption?
   b. Does academic success have an effect on their adoption?
2. What is the TPACK level of pre-service EFL teachers?
   a. Does gender have an effect on their TPACK level?
   b. Does academic success have an effect on their TPACK level?
3. Does the pre-service EFL teachers' technology adoption have an impact on their TPACK level?

1.4 Significance of the Study

The idea of integrating technology into the education area has been increasing in recent years. For many years, teachers have been integrating technology into lessons due to the advent of the Internet. There are so many websites, applications and interactive platforms, etc. that are developed by stakeholders or individuals to help teachers in the education. Teachers have lots of opportunities to advance the quality of their lessons. However, in a classroom environment with lots of opportunities, the main issue is if teachers have had a training eligible enough to integrate technology effectively into the lessons before starting their teaching duty.

This study differs from the previous ones with its first purpose. To be able to reveal how much a pre-service EFL teacher is competent in technology, first, it is better to understand their attitudes towards new technology and how much they use technology in their daily lives. It is possible to state that if teachers follow technology closely and make it part of their daily lives, they may have the skills to integrate technology easily into the curriculum. This study used the TACI framework for the first time in literature in order to find out Turkish pre-service EFL teachers' adopter categories. At the same time, this study was important for providing a deep

understanding on Turkish pre-service EFL teachers' TPACK level as it also reflected some clues about the efficiency of teacher training.

1.6 Definitions

EFL: It is an abbreviation for English as a Foreign Language, which is a term used to describe teaching or learning English generally at an institutional context in a country where English is not the first language.

Pre-service teachers: This term refers to the teacher candidates who are in their last year of teaching program at undergraduate level.

ICT: Information and communication technologies refer to all the digital tools that are used to gather and transfer data electronically.

Diffusion of innovations: It is a framework which focuses on the adoption of innovations which helps to understand eagerness of individuals to use technology.

Technology adopter categories: A concept which was brought out by Rogers (2003) so as to classify individuals according to their readiness in adopting new innovations. There are five technology adopter categories: innovators, early adopters, early majority, late majority, and laggards.

TPACK: It is a framework which was developed by Koehler and Mishra (2008) in order to reveal teachers' knowledge in three main areas that are technology, pedagogy and content. It is a model which explains how to use technology effectively in a subject specific area.

Chapter 2

Literature Review

This chapter provides a framework and background by establishing connections with the areas related to this study. It reviews the research literature on information and communication technologies in education, especially in language education and teacher education, technology adoption and technological pedagogical content knowledge.

2.1 Information and Communication Technologies in Education

Haddad and Jurich (2002) state that education is more sensitive than ever before because of social, economic and technological changes. It is known that not every community in the world has a chance to supply academic opportunities for its entire people. Likewise, some countries are having challenges to possess the required power to support their citizens with the needed knowledge and ability to be a part of growing marketplaces and modern life circumstances. Countries have to deal with those struggles by concentrating on how to enlarge access, develop internal productivity and enhance educational conditions. This is why some countries have begun to orient their perspectives based on technology to realize their educational objectives.

Developed or developing countries are aware that education is a factor that affects the health of the economy. Therefore, they are rebuilding their education system and have adopted the principle of using technology, especially Information and Communication Technology (ICT), in education (Jhurre, 2005). Information and communication technologies can be described as the utilization of digital tools with the purpose of gathering, using, and transmitting data electronically (ICT, n.d.). These technologies consist of computers, the Internet, radio, television, telephones, and tablets. Countries are urged to integrate those technologies into their educational systems because they give importance to provide their citizens with the necessary

knowledge and skills to prepare them for the future information age (Jimoyiannis & Komis, 2007).

Governments do some reforms to create better circumstances in education with the help of technology. One of them is, for example, a project called FATİH by the Ministry of National Education of Turkey. The name FATİH in Turkish context stands for the movement to increase opportunities and improve technology. The aim of this project is to create equal opportunities in education and improve technology in schools by transforming classrooms into smart ones by making use of ICT tools in the course of teaching and learning (Eğitimde FATİH Projesi Hakkında, n.d.). One field of study, which researchers have focused on, is teachers' views about the FATİH project. Results of the studies that have been carried within the scope of this project show diversity. Usta (2013), for example, explains that teachers who are a part of the FATİH project have positive beliefs that the project not only saves time, provides material diversity, and simplifies the revision of the subjects but also increases student attention and makes lessons more enjoyable (as cited in Arıcan, 2014). On the other hand, in his study, Türkmen (2011) discovered that teachers had serious shortcomings in ICT and they rarely used computers. Their limited amount of computer literacy is mentioned as a negative effect, so the requirement of in-service training is pointed out significantly in order to attain FATİH project's goals (as cited in Arıcan, 2014).

Likewise, a movement regarding educational technology in the United States of America happened in the State of Maine in the fall of 2002. In this project, 7th and 8th-grade students and their teachers were given laptops. All the necessary technical support and professional development were provided both with students and teachers in order to integrate laptop technology into the learning and teaching process (Eryılmaz & Salman, 2014). Silvernail and Gritter (2007) carried out a study about the effectiveness of laptops on student writing. They found out that laptops had a significant effect on the development of students' writing skill.

France, on the other hand, started education with computers in the 1970s. Between the years of 1970 and 1976, authorities provided every high school with a computer and 550 teachers had the necessary training. In 1980, 500 teachers were

trained for one year within the framework of the project of implementation of 100 thousand computers, and the place of computer technology was kept on the agenda. 140 million were devoted to computer-assisted education in universities in 1983. In 1985, purchase of 120 thousand computers, training of 110 thousand teachers and users, preparation of 700 software programs and 50 thousand computer workshop project was put into practice. Through the 1990s, the approach of the introduction of the computer into the life of 7 of every 10 French people began to be adopted.

There are some points that people who are interested in technology use in education should take into account. Some proper conditions have to be set up to use ICT in education. Haddad and Jurich (2002) mentioned three factors that affect the proper implementation of technology in institutions. They named those factors as: access, acceptance and availability. Access is the suitability situation of setup and use of technology. It is a significant factor whether the institution or individual has suitable conditions for sufficient groundwork or be able to cover the expenses in legal ways. The second factor, acceptance, is a society's perspectives on technology from cultural and political aspects. It is about adjusting traditions, priorities, and instructional objectives to integrate technology into education. Lastly, availability is the convenience of content, trained workforce and creating a resource to promote or prevent technology-related projects. It was stated that after arranging all these conditions appropriately and minimizing limitations, effective ICT use in classrooms would be possible.

Young (2003) states that using technology in the classroom increases student motivation, and it prevents the environment to be distressing as students are able to reveal their own views and ideas openly. He also emphasizes that learning goes beyond the walls of a classroom and becomes an active experience which students discover, and explore in a less stressed manner. Technology also boosts learner encouragement and commitment, assists the progress of gaining main skills such as creativity, and problem-solving skills etc. (Haddad & Jurich, 2002).

One discipline which ICT is highly connected is language education. According to McManis and Gunnewig (2012), technology is put forward as a powerful learning

tool particularly for additional language and social skills development. Taking this into consideration, importance of the relationship between ICT and language teaching and learning is presented under the next title along with how language teachers view ICT use in the classrooms.

2.1.1 ICT and language education. To start with, it is appropriate to look at the history of using technology in language education to understand how it has developed and took its form today. In language education, using technology dates back to 1960s. When computers started to be used in education, a new term named Computer-Assisted Language Learning (CALL) generated in order to define employing computers in the procedure of language learning and teaching. There are three fundamental periods of CALL which have been formed based on the technological, linguistic, sociological and psychological developments over the years (Warschauer & Healy, 1998).

Warschauer and Healy (1998) described all three periods as follows: The first approach to CALL is named behaviouristic CALL that is also known as structural or restricted CALL. It emerged in the 1960s and 1970s with the behaviourist view of learning. The role of the computer was tutoring at this stage. It was inspired by the grammar-translation and audio-lingual language teaching methods. It consisted of drill-and-practice activities to provide accuracy (Walker & White, 2013). After a while, behaviouristic CALL started to be rejected because of pedagogical reasons. Then, the second period, communicative CALL, appeared through the 1980s as language learning started to become more personalized with an increasing amount of personal computers. Communicative CALL took communicative language teaching method into its base, and activities were done to support the use of target language through forms. Grammar was thought implicitly and the emphasis was on what students do with each other while using the computer. However, no matter how much communicative CALL was further from behaviouristic CALL, it started to be criticized, too. This criticism caused integrative CALL to emerge. Integrative CALL had a more social view in which the role of the technology was more like a mediational tool. Approaches such as task-based, project-based and content-based were used to

provide learners with an authentic usage of language. In integrative CALL, the four skills that are listening, speaking, reading and writing was also blended with the technology. To sum up, when using computers in a lesson was merely at text level, language education through computers has changed considerably over the years (Warschauer & Healy, 1998).

Besides CALL, thanks to the immense technological and pedagogical advancement, the computer has started to share its popularity in the classroom with other kinds of devices. According to the data from GSMA, two-thirds of the world's population is connected by mobile devices and by 2020, almost 75% of the global population will be connected by mobile (Hollander, 2017). Therefore, it is possible to state that the more mobile technology develops, the more people become dependent on it, and use it in every part of their lives. This dependence has led mobile technology to take its place in education. The growing amount of mobile technology in educational settings has brought a new approach to language learning named Mobile Assisted Language Learning (MALL). MALL has been becoming widely popular day by day. Mobile and smartphones, tablets, music players, electronic dictionaries, personal digital assistants, e-book readers, and even game consoles are some examples of mobile devices that can be benefited. (Kukulska-Hulme, 2012; BBC, 2010).

This ongoing development of technology-assisted language learning brings significant issues into the field along with its advantages. Teachers, being one of the main subjects of education, own an important place here. Today's students cannot be trained in a particular way. For this reason, teachers' roles should be handling changes properly, and help students to be up-to-date (Warschauer & Healy, 1998). At this point, it is appropriate to mention how teachers and their attitudes, experience and knowledge of ICT matter for successful language education.

Saleh and Saleh (2012) used teachers' views to research the challenges of integrating ICT in language teaching. A questionnaire was applied to 30 high school English teachers who lived in Iran, and it was concluded that teachers had sufficient knowledge of ICT; yet, some key factors such as lack of technical support at schools, not being able to connect to the Internet appropriately, limited time of the lessons was

identified as challenges which affected the use of ICT in the classroom. The challenges that were said to exist restrict the use of technology in the classroom because they seemed as barriers.

Zhelezovskaia (2016) presented an insight into the attitudes of five English language teachers in one of the Finnish schools towards their use of ICT in the classroom. She prepared semi-structured interview questions. At the end of the study, she found out that participants actively used technology in their classroom, had positive attitudes towards the use of ICT, and they had the support from the school administration with teacher training programs and well-prepared schedules. Furthermore, in light of the results, she suggested some points to be taken into consideration for the effective improvement of ICT use in the classroom. Those suggestions were sufficient teacher training programs which fulfil teachers' needs, assistance for the development of curriculum, cooperation between teachers, and providing teachers with current technological supplies.

Likewise, a study was conducted in Turkey about the attitudes of students and teachers towards the use of interactive whiteboards (IWB) in classes where English was taught as a foreign language. It was found out that both groups of participants had positive thoughts about using IWB. They stated that lessons became more engaging and pleasing but it was again stated that teachers should have had satisfactory training and should have been supported with enough equipment (Mathews-Aydinli & Elaziz, 2010).

In another study, Yüksel and Kavanoz (2011) studied the attitudes of pre-service language teachers towards technology. Overall, they found out positive attitudes towards technology. However, they found a significant difference in gender. It was seen that female students tended to show more negative attitudes. Moreover, this study was different from previous ones because the researchers didn't find any differences between the use of ICT and university type, subject domain, and the attitudes.

To sum up, it is possible to see different results among those studies due to different variables and background information of the participants. However, it is

inevitable for all teachers, including language teachers, to learn how to integrate technology in their lessons by using the most common technological devices (Altun, 2015). Regarding that, the following section involves how ICT and foreign language teacher education intersect.

2.1.2 ICT and English as a foreign language teacher education. Koehler and Mishra (2009) made a comparison between old and new technology. They state that old technology are known for their stability whereas new technology is recognized as more functioning. However, even though new technology is thought as more functioning, it is obvious that it brings new challenges and complexity to teachers who are not very competent in using technology in the class because most of the teachers today had graduated when technology was not this much developed and involved in people's daily life. That's why it is normal if they feel out of technology because of the social and contextual factors.

Being a qualified teacher requires qualified education. It is important for teachers to get elaborated education to develop themselves. Teacher education starts at university and the courses that are taken at university plays a critical role in teachers' professional lives. Hlas, Conroy and Hildebrandt (2016) claim that there are three significant periods which pre-service teachers are subjected to. This might be during coursework, during extra workshops for efficient technology use provided by university administration, or during teaching experience times. That's why professional development is required for teachers in order to make them aware of the impacts of affordances and limitations of technology on what teachers perform in the class.

In the early years of the CALL emergence, formal training for CALL was not common. Only educators who were interested in this field were trying to develop themselves through their own trial and errors. When computers began to become widespread in language classrooms and Language Teaching & Technology (LLT) published a special issue about the teacher education in CALL in 2002, more and more people started to share their own experiences and ideas with each other (Kessler & Hubbard, 2017). For example, in a study by Egbert, Paulus, and Nakamichi (2002),

they aimed to find out if teachers practiced their coursework experiences of CALL in their work life and how they carried on their professional improvement in this field. According to the results, it was supported that teachers who had previous background knowledge of CALL in their courses used technology more in the classroom. Besides, they implied that "teachers learn better in situated contexts, and technology courses should be designed accordingly" (p.108).

In brief, teacher training is very important to help teachers have knowledge of integrating technology into their teaching. They should be familiar with the correct ways of using technological materials efficiently, and have the capacity to develop the curriculum that they are using to be able to meet their own students' needs. Besides professional development, teachers' positive attitudes towards technology have an impact in their use of technology in teaching and learning process (Mustafina, 2016). How teachers view and use technology in their daily life should be one of the main questions. It is important to discuss if the teachers who are expected to use technology in the classroom is following the new trends or approach innovations in technology in an open way. Acceptance of innovations in technology by teachers themselves might play a critical role in their teaching. Therefore, under the next title, a theory for innovation adoption is introduced in order to clarify how this theory might have a place in educational technology and reveal the relationship between language teachers' technology adoption and their use of technology in the classroom.

2.2 Technology Adoption

Rogers (1995), being one of the leading specialists, wrote a book about a theory named diffusion of innovations in order to display the procedure of how innovations are adopted over time by all individuals in communities. His theory is an extensively accepted framework in the field of technology diffusion and adoption. According to Rogers, the words technology and innovation are equivalent (Sahin, 2006). He also identifies innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p.11). For the purposes of this

paper, innovation refers to growing changes in educational technologies. The adoption of these technologies is explained in terms of diffusion of innovations theory.

According to Rogers (1995), adoption of innovations is a decision-making process and passes through certain stages. He forms a model of this innovation-decision process (see Figure 1).

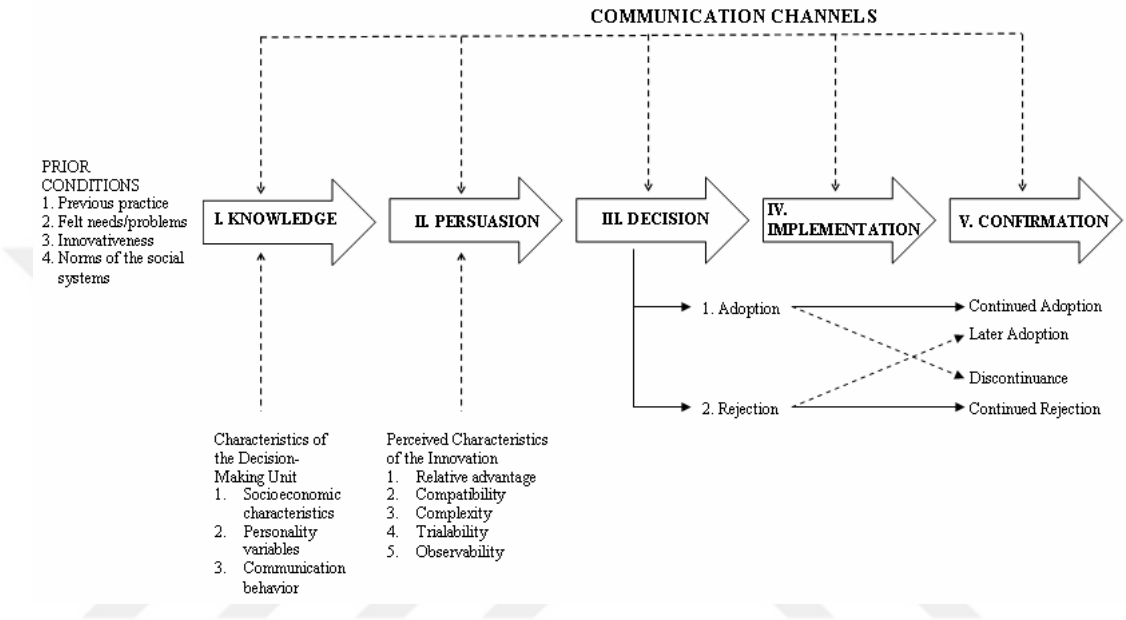


Figure 1. A model of stages in the innovation-decision process (Rogers, 1985, p.165).

Sahin (2006) explains the stages as follows:

Knowledge is the first stage that a person becomes aware of the presence of the innovation and wants to learn more about it by directing the questions of what, how, and why. Persuasion stage is the one where the person develops a viewpoint about the innovation. He can have positive or negative thoughts and continue to search for more information about the innovation. Decision stage is where the person makes a determination about the innovation by either adopting or rejecting it. Implementation is the fourth stage in which the decision is applied. At this stage, the person looks for information about the innovation such as where to get it, how to use it, or what problems he might face, etc. Confirmation is the last stage where the decision is

finalized and the person seeks affirmation. If he encounters contradictory ideas, he might change his decision. However, in order not to experience this, he tries to keep away from opposing views.

According to Rogers, it is not possible for every human being to adopt an innovation at the same time. Every individual follows a decision-making process and goes through some certain stages. The time that each person completes that decision-making process is changeable. It may take a long time for a person to know, be persuaded, and decide whether to adopt or reject an innovation while it wouldn't be the same for others. Herein, adoption categories are detected based on the time when a person first start using an innovation. These adoption categories are as listed below:

Innovators are the people who perform a vital role in the diffusion system (Parisot, 1995). Rogers (1983) also uses the term venturesome to describe this group. They are disposed to go through new experiences and discover new ideas. It is hard for them to be appreciated by others in a social system because of their imperishableness (as cited in Parisot, 1995). This group has the smallest part with only a 2.5% share in the whole adopter categorization chart (Dugas, 2005).

Early adopters are the second group, which has 13.5 % share. They adopt the innovation if they see some benefits of doing so. They act as role models and get respect from others more than innovators (Dugas, 2005) because future adopters rely on their suggestion and intelligence (Parisot, 1995).

Early majority is the group who adopts innovation just before half of the other people. They are in a good position in the social system but they rarely take leading roles. Their decision-making process takes more time (Rogers, 1983). They have 34% share in the chart and they will adopt an innovation after they monitor what other people go through, and when they are satisfied with the innovations' benefits (Dugas, 2005).

Late majority is the fourth group who needs to be influenced by others more and also forms 34% of the whole. Their adoption of innovation happens only when they feel it is essential (Dugas, 2005). They are affected by peer pressure and economic need. They are also called sceptical people (Rogers, 1995).

Laggards, being the last group, are traditional people, and their economic resources are minimal. Therefore, this makes them adopt an innovation after they decide that it won't let them down. They also have little awareness of change. When they are ready to adopt innovation, it is likely that a newer version of the old innovation might come out (Rogers, 1983).

Rogers (1983) specifies that representation of data for adoption can be displayed by either a bell-shaped frequency curve or s-shaped cumulative curve (see Figure 2). He points out that "bell-shaped curve shows these data in terms of the number of individuals adopting each year, whereas the s-shaped curve shows these data on a cumulative basis." (p.243).

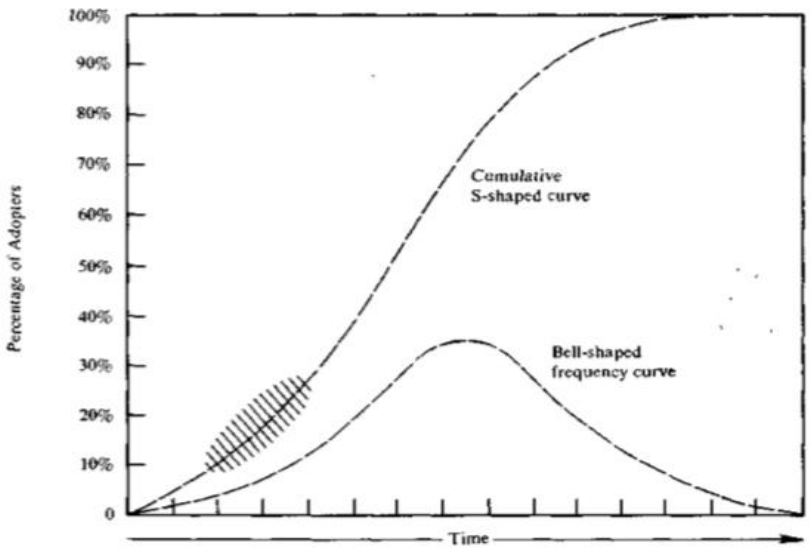


Figure 2. The bell-shaped frequency curve and the s-shaped cumulative curve for an adopter distribution (Rogers, 1985, p.243).

Dugas (2005) also explains that the adopter categories follow a sequence from the most innovators to the least ones. He states "like many other human traits, such as height, weight, or intelligence, innovativeness has been found to be normally distributed" (p.25). As a result, a bell-shaped curve can display the innovativeness of a population of adopters (see Figure 3).

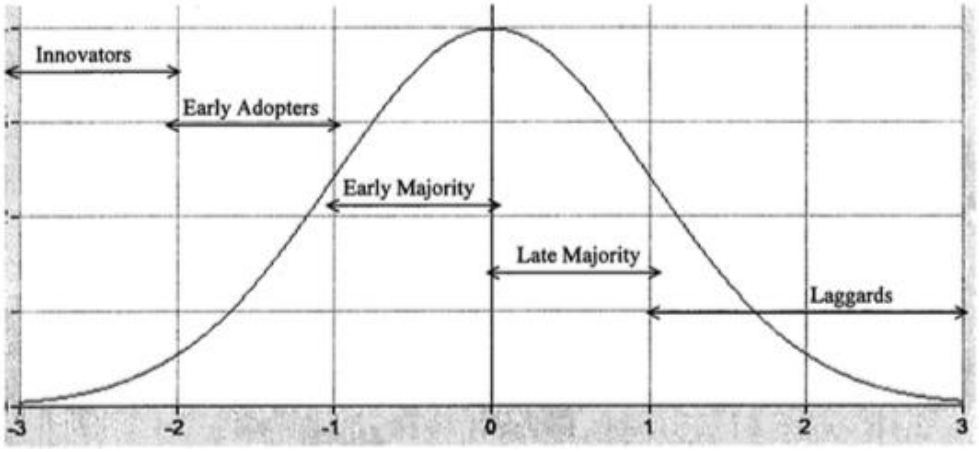


Figure 3. Distribution of adoption population by innovativeness category (Dugas, 2005, p.25)

Regarding the purpose of this study, understanding innovativeness and adopter categories have a place in this research because defining pre-service EFL teachers' adopter categories can explain attitudes of those teachers towards technology. Another framework that can be used to evaluate teachers' effectiveness in using technology in a subject specific area is explained in the following sections.

2.3 The framework of Technological Pedagogical Content Knowledge

Koehler and Mishra (2009) state that there is not a single perfect way of integrating technology into curriculum because of its complicated structure. For this reason, teachers are required to comprehend approaches to prosperous technology integration, and Technological Pedagogical Content Knowledge (TPACK) is an important theory to evaluate teachers in this issue.

The idea of TPACK comes from Shulman's (1987) Pedagogical Content Knowledge framework. Shulman introduced Pedagogical Content Knowledge (PCK) framework to help teacher knowledge to progress. Content and pedagogy are mainly focused areas of knowledge in various approaches towards teacher education. (Mishra & Koehler, 2006). Shulman (1987) divided teacher knowledge into categories as content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics,

knowledge of educational contexts and knowledge of educational ends, purposes and values and their philosophical, historical grounds. He specifies Pedagogical Content Knowledge (PCK) as the most unique intrigue for the reason that it demonstrates how content and pedagogy is introduced for instruction, and mixed with the purpose of introducing the comprehension of how specific themes or issues are sorted out, spoken to and regulated to the various concerns and capacities of students (as cited in Mishra & Koehler, 2006).

Researchers have used Shulman's framework to reveal how to use technology in education effectively in accordance with PCK. They expanded the framework of Shulman's PCK calling it in different ways such as ICT-PCK, TPCK, or more common one TPACK. Even though Mishra and Koehler seem like the proponents of the Technological Pedagogical Content Knowledge term, it was used much before (Voogt et al., 2012). Pierson (2001), for example, was one of the first scholars who used the term with the aim of describing teachers' exemplary technology implementation into the lessons. In her study, which she examined the level of technology use and teaching abilities of teachers, she claimed "understanding can be found in a theoretical definition of technology integration derived from the literature on expertise in teaching" (p.426). This was where she referred to Shulman's PCK and suggested technological knowledge as another component. According to her, technological knowledge was also about comprehending technology with all of its specific characteristics not just knowing how to use some technological devices.

Then Niess (2005) used technology-enhanced PCK (TPCK) frame in her study which she examined competency of pre-service teachers questioning whether teacher preparation programs led pre-service teachers to broaden their knowledge of TPCK when technology became a part of the classroom at a considerable amount. She believed that a teacher's ability in technology might be blended with his/ her expertise in the subject area and indicated the technology as a mean for teaching the subject.

This period was also when Koehler and Mishra (2005) used TPCK as a conceptual framework. They stated that three domains of TPCK, namely, pedagogy, content, and technology, and the concord among them were the core of a reliable

technology integrated teaching. They called those domains as the components of teachers' knowledge. According to them, being important separately, the mutual effect among them plays an important role in this knowledge.

Then, Angeli and Valanides (2005) objected to Koehler and Mishra's TPCK definition and developed the conceptualization of ICT-TPCK (see Figure 4) defining it as an unconnected core of knowledge that should be expanded and evaluated on its own. They didn't consider technology as a medium for learning only, they rather thought that technology enlarges or maximizes student learning by becoming a part of it.

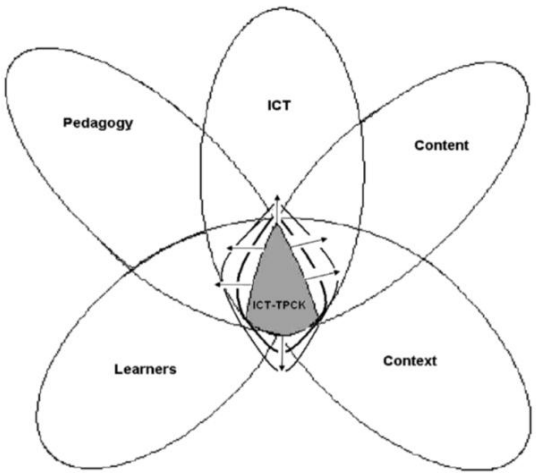


Figure 4. ICT-TPCK. (Angeli & Valanides, 2009, p.159).

Consequently, studies on TPCK can be classified into three. First one is Niess's technology-enhanced PCK which she used PCK disciplines as a mean for teaching with technology. Second is Angeli & Valanides's ICT-TPCK which they took TPCK "as a unique and distinct body of knowledge" (2005), and the last one is Koehler and Mishra's TPCK which they believed in the mutual interaction between four domains of knowledge (Voogt, Fisser, Pareja Roblin, Tondeur, & Van Braak, 2012).

2.4 Components of TPACK

Misra and Koehler's TPCK became TPACK in order to make it easy to remember easily in 2007 (as cited in Angeli & Valanides, 2015; Thompson & Mishra,

2007). Additionally, it is possible to state that among the TPCK or TPACK related frameworks, Mishra and Koehler's is the one that differs from others or studied mostly because they justify the absolute relationship between content, pedagogy, and technology. They specify that these three components cannot be employed independently. Considering their interaction in pairs is as fairly critical as individual parts (Mishra & Koehler, 2006). Interactions among these components are listed as follows: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) (see Figure 5). After this point, it will be better to review each component and the interactions among them respectively.

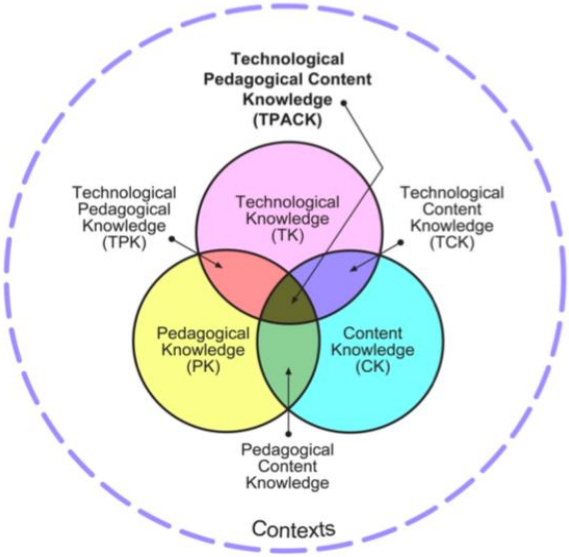


Figure 5. The TPACK framework and its knowledge components (Koehler & Mishra, 2009, p.63).

2.4.1 Content knowledge (CK). If a teacher specifies that he has enough content knowledge, it means that they have the expertise in the subject that they are teaching. This domain contains "knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches towards developing such knowledge (Mishra & Koehler, 2008, p. 13). A teacher should be aware of different ways of constructing a discipline. The teacher should know not only the information about what something is, but also why it is like that and worth knowing, in which conditions its validity would weaken (Shulman,

1986). Teachers have to have a vast amount of knowledge in their field in order not to direct students incorrectly.

2.4.2 Pedagogical knowledge (PK). Act of teaching is what forms the pedagogical knowledge (Shulman, 1986). Pedagogical knowledge is the ability of a teacher to use pedagogical activities in lessons while presenting the content. Those pedagogical activities might cover approaches to motivate students, interact with students and parents, introduce classroom management etc. (Cox & Graham, 2009). Being competent in pedagogical knowledge is being conscious and using the teaching and learning methods effectively. It is about how these methods are handled in implementations and how those strategies align with the objectives of lessons, instructional purposes, values, and goals (Mishra & Koehler, 2006).

2.4.3 Pedagogical content knowledge (PCK). Pedagogical content knowledge aims to further students' learning by blending knowledge of exercises and knowledge of presentation (Cox & Graham, 2009).

According to Shulman (1986), PCK includes making a subject understandable to other people by using different methods of presenting and planning. Arguing that there is a best and single way to represent a topic generates incorrect perceptions. A teacher must have a broad knowledge of different techniques, forms and ideas for PCK both by researching and by years of experience. Teachers are also required to have knowledge of plans of actions to be taken in case they witness students' misunderstandings on a precise topic from their previous learning. A teacher with PCK will be successful in annihilating prior misconceptions, addressing student problems, and encourage relevant learning (Mishra & Koehler, 2006).

Pedagogical content knowledge deals with how well the knowledge of pedagogical component of teaching methods is combined with the knowledge of representations. The other general pedagogical activities such as classroom management, classroom assessment, structures of a lesson and adaptivity (Guerriero, 2013) are not included in PCK because it is about the representations in a subject-specific area to help students with meaningful learning (Cox & Graham, 2009).

2.4.4 Technological knowledge (TK). Technological knowledge is the knowledge of how to use technology in an educational context. Mishra and Koehler (2006) divide the technology as standard and advanced technologies. Standard technology includes books, chalk, blackboard, while advanced technology is more about digital technology including the Internet, videos etc. In TK, it is important to have knowledge of hardware, and software, the ways to install and remove the programs and create documents. Designating specific standards in TK is not possible because technology evolves and develops day by day. Consequently, what is important in TK is the capacity to string along with the new technology.

2.4.5 Technological content knowledge (TCK). TCK is about the relationship between technology and content. It deals with the amount of the effect they have on each other. TCK simply can be defined as being aware of the ways to represent content through technology (Cox & Graham, 2009). Different fields from science to education, history to medicine have been affected by the furtherance of technology. Having the knowledge of these developments in the particular field will possibly help teachers to manage to appreciate, select, and use correct technological tools efficiently to realize the objectives and to meet the needs of education (Mishra & Koehler, 2006).

Mishne (2012) states that there is no doubt that teachers have to specialize in what they teach. They are supposed to research and find ways to present their topic by using technology. Students will be able to understand a topic better with the convenient technological materials if teachers have sufficient knowledge in technology (as cited in Tunçer, 2014).

2.4.6 Technological pedagogical knowledge (TPK). TPK is perception of using technology to elaborate pedagogical activities such as using technology to engage students in collaborative works and using different incentive technological tools to motivate students (Cox & Graham, 2009).

Koehler and Mishra describes (2006) TPK as being conscious about the innovations in teaching which might be brought by using technology. They state that

the importance of TPK comes from its characteristic of regenerating the tools at hand by providing a new role to them for particular pedagogical aims.

2.4.7 Technological pedagogical content knowledge (TPACK). As explained by Koehler and Mishra (2006):

> TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones (p. 1029).

According to Cox and Graham (2009), some researchers think that when the technology is fully acquired, there might not be any need for the TPACK framework. On the other hand, some researchers express that TPACK will always be there as technology progresses day by day.

Also, Koehler and Mishra (2006) specifies the inseparability of these three elements for beneficial teaching. They also mention the necessity of teacher training for effective technology integration. They believe that technology knowledge is something that can be applied and if teachers show their competence, and then they will be able to integrate technology in their lessons well. However, they also discuss some issues that teachers might face. Swift development of technology is the first of them. The training that teachers have for an effective use of technology in the classroom faces the possibility of being obsolete within a year so it is very important for teachers to keep up with the time and follow the new trends. The second problem is the impropriety of software programs. Most of the programs are not developed for educational purposes. Because of this reason, teachers are required to repurpose these programs to meet their own educational objectives. Another concern is the settled essence of learning. The subject, grade, student background are basic characteristics

of a classroom. Technology use in the classroom needs to be shaped based on these varieties. One single way of teaching and using technology the same way cannot be mentioned. The last problem is about the emphasis on what rather than how. Training programs or workshops don't necessarily provide teachers with recommendations on how teachers are supposed to accomplish these skills.

2.5 Previous Studies on TPACK

Many studies have been conducted to contribute to the development of TPACK. There are studies that are categorized under specific subject domains. In this part of the research, those studies in different subject domains are explained.

According to a study by Dikmen and Demirer (2016), the TPACK research studies that are conducted in Turkey between the years of 2009 and 2013 revealed that the number of those studies have been rising year by year. It was found that the studies on pre-service teachers were more common than the studies on in-service teachers. Mathematics and science subjects were the most investigated areas.

To start with, Guerrero (2010) introduced four components of knowledge that were required to be possessed by mathematics teachers for the effective use of technology in the classroom. Those components were conception and use of technology, technology-based mathematics instruction, technology-based classroom management, and depth and breadth of content. Conception and use of technology were about to what extent a maths teacher was competent in using technology to make learning more understandable and reachable. Second and third components, technology-based mathematics instruction, and technology-based classroom management were explained as a way of utilizing technology in the mathematics lessons regarding the factors of involving common standards of education, organization, and classroom management while the last component, depth, and breadth of content, referred to the commitment of teachers have to "understand their content areas with both breadth and depth as a result of using technology as part of their instruction".

In science subject domain, Jimoyiannis (2010) is probably the researcher who has proposed the most detailed teacher preparation program (as cited in Voogt, Fisser, Pareja Roblin, Tondeur, & Van Braak, 2012). At the end of his research in which he intended to find out the effectiveness of the program, he came up with the conclusion that teachers needed regular and authentic learning experiences in real classrooms, criticism, and assessment to be able to develop their TPACK competency.

Niess (2005) analysed student teachers' considerations of the technology-enhanced PCK program. In this program, students were prepared to learn about how to diversify teaching with technology. At the end of this study, she found out that in order to improve TPCK, it was important to look at the student teachers' acceptance of technology and understanding of the structure of the subject. After the program, it was concluded that not all student teachers were able to appreciate the interaction between technology and discipline. The reason for this problem was explained with student teachers' personal ideas and discomfort with using technology. On the other hand, even though an apparent reason couldn't be given, it was also concluded that some other student teachers showed more extensive awareness regarding this topic. The researcher also suggested that student teachers' recognition of the interaction between technology and content knowledge should be increased.

Regarding the studies which researchers have examined teachers' TPACK competency level, Jang and Tsai (2012) investigated the Taiwanese elementary mathematics and science teachers' TPACK in the matter of using interactive whiteboards (IWBs). They revealed that teachers who used IWBs demonstrated higher TPACK. Also, it was seen those science teachers were considerably more competent in TPACK than maths teachers. The researchers didn't observe any difference in TPACK regarding gender. However, it was reported that more experienced teachers had more TPACK competency than those with fewer years of experience.

Archambault and Crippen (2009) studied the TPACK level of 596 K-12 online distance education teachers in the United States. According to the results, teachers showed high knowledge in pedagogy, content, and pedagogical content domains

implying that they seemed to be confident in these fields. However, they felt uncertain about their competence in technology.

Aksin (2014) investigated social studies teachers' ability of using technology and teaching methods in line with the content of the subjects they taught by taking the pedagogical characteristics of students into account. According to the results, it was found that social studies teachers' technological knowledge was at the lowest, while content knowledge was at the highest level.

2.6 Previous Studies on TPACK of EFL Teachers

Teaching English in context with meaningful and real-life like activities is required for successful learning in areas where English is not the mother tongue. Therefore, bringing the authentic environment into the classroom is of great importance. If teachers wants to create this kind of context, there is no doubt that they have to benefit from the advantages of the Internet. However, if a teacher is not qualified in using the Internet to decide on what and how to teach, then it will not be possible to mention the usefulness of the Internet (Liu, Liu, Yu, Li & Wen, 2014). There have been many studies in literature measuring the TPACK competencies of teachers. It is possible to state that generally those studies are done in two different areas. Some studies are the ones that directly evaluate teachers' TPACK level, while the others are experimental studies that are about designing courses or training to develop teachers' TPACK level. The studies that directly measure EFL teachers' TPACK level are reviewed under this title.

Akcay, Mancilla, and Polat (2015) conducted a research study about the difference between TPACK competency of in-service and pre-service teachers. 54 teachers participated in the survey explaining whether and in what ways they integrate technology into their lessons. The outcomes of the research revealed no significant difference between the two groups of teachers.

Kwangsawad (2016) also explored pre-service EFL teachers' TPACK levels. However, he didn't use the most common way of obtaining the data that was applying

a questionnaire. He measured teachers' TPACK through self-report, lesson plans and actual practice. The findings revealed that 33 Taiwanese pre-service EFL teachers presented high scores for all the TPACK areas.

In another study by Rubadeau (2016), English language (EL) teacher educators' awareness, and usual procedures related to pedagogical technology integration were surveyed. Only a total of 5 teacher educators who are English natives at a South Korean university participated in the study. The procedure of the study took twenty weeks with interviews and observations. Results of this study showed that participants had extensive levels of TPACK and utilized Web 2.0 tools effectively in the lessons.

2.7 Previous Studies on TPACK in Turkey

This section mainly focuses on the studies that are applied to look for TPACK levels of pre or in-service EFL teachers.

Solak and Çakır (2014) looked into the TPACK competency of 137 pre-service English teachers who studied at a public university. The aim of their research study was to see whether there was any difference in TPACK levels of the prospective EFL teachers regarding their gender and academic achievement. They found out that the participants were familiar with technology because all of them used the Internet every day with some specific purposes. However, it was also reported that participants needed to develop their problem-solving skills related to hardware because of the risk of having technical problems. Even though student teachers stated that they used technology every day, their technological competence was found to be at the lowest level. Consequently, the researchers suggested that advanced training for using technology more effectively in the classroom was required for pre-service English teachers. Also, according to the relation between TPACK and gender, it was discovered that the Technological Knowledge of male pre-service teachers was higher than female pre-service teachers while females prevail males in Pedagogical Knowledge. Lastly, the researchers didn't determine any difference between TPACK level and academic achievement of the participants.

In another study, Delen (2016) aimed to demonstrate TPACK levels of 33 EFL teachers' who worked at a high school. He also examined the relationship between TPACK competency and their gender and year of experience. According to his results, teachers showed a high level of TPACK. He stated that teachers felt confident in using technology in the classroom in accordance with pedagogy and content. Also, he noted that no meaningful relationship between gender and TPACK level was found. Moreover, he discovered a negative relationship between year of experience and TPACK level which meant that teachers who worked for more time presented lower TPACK score, while the teachers who had less work experience presented higher TPACK level.

Likewise, Öz (2015) conducted a study in Turkey with 76 pre-service EFL teachers who studied at a leading state university to examine their TPACK level. According to his findings, teachers performed a highly improved level of TPACK. Besides, he found significant differences between their gender and TK and PK level of teachers indicating that female teachers surpassed male teachers in technology and content areas.

Köse (2016) researched the TPACK level of English language instructors at different state universities in Turkey. At the end of the study, she found that instructors felt adequate in their subject-specific area; however, they didn’t feel confident in using technology in their lessons along with the content that they were teaching.

To sum up, this chapter displayed theoretical database along with the studies and their results carried out both in technology adoption and TPACK areas. The next chapter clarifies the methodological process of this study including information about the participants, setting, data collection tools, and analytical procedures.

Chapter 3

Methodology

This research aims to find out how pre-service EFL teachers adopt technology in their life, and what Technological Pedagogical and Content Knowledge (TPACK) competency level they have and if there is a relation between the two regarding their gender and academic success.

This chapter provides detailed information about the methodological process which is implemented in order to obtain findings of it. It consists of four sections. First, the strategies that are applied to answer the research questions of the study is identified and discussed under the section of research design. Then, information about the context and participants of the study is explained in setting and participants section. After that, data collection instruments, data collection procedures, data analysis procedures, reliability and validity of the study are mentioned in the procedures part. Lastly, the limitations of the study are identified.

3.1 Research Design

In research studies, there are two methods which are used to provide necessary information for the research questions, namely qualitative and quantitative. In consideration of the aims of this study, quantitative method was found to be the most appropriate one. In quantitative research, the focus is on collecting numeric data and making assumptions regarding them (Babbie, 2010). According to Creswell (2002), statements in a quantitative study should be precise, narrow, measurable and observable. He states that after deciding on the research method, the researcher should choose which design to use.

The design of a quantitative research can be experimental, correlational or survey design. This study utilizes a correlational design to correspond to its research

questions. In correlational design, the researcher aims to investigate the degree of association between two or more variables that can be either attribute or characteristic of people (Creswell, 2002). Applying the mentioned design, this research attempts to find answers to the following questions;

1. What is pre-service EFL teachers' approach in adopting new technologies?
    a. Does gender have an effect on their adoption?
    b. Does academic success have an effect on their adoption?
2. What is the TPACK level of pre-service EFL teachers?
    a. Does gender have an effect on their adoption?
    b. Does academic success have an effect on their adoption?
3. Does the pre-service EFL teachers' technology adoption have an impact on their TPACK level?

3.2 Setting and Participants

In the process of collecting quantitative data, the starting point is to determine the people and places to study. While selecting the people, a researcher has to decide on the population, and subsequently, sample group. A group of individuals who share the same characteristic is called population (Creswell, 2002). Regarding the aims of this study, the population was chosen as EFL teachers. After that, in order to narrow down the research area, sample group, which was a subgroup of the population formed to make generalizations based on the study, was agreed to be pre-service EFL teachers.

Eventually, this research study was carried out with pre-service teachers who were in their last year at undergraduate level at four different universities in Turkey. In an effort to reach out to the target group, convenience sampling technique, which was a type of non-probability sampling, was used. Convenience sampling was a way of collecting data from people who were more accessible, and eager to participate in the study (Creswell, 2002). A total of 130 voluntary students, who are in their last year of university, contributed to the study in the spring semester of the 2018-2019 academic year. Participants were teacher candidates who attended English Language Teaching programs. These teacher candidates were expected to have necessary

pedagogical and content knowledge along with at least minimum level of technology knowledge because they were provided with some courses both theoretical and practical such as methodology, first and second language acquisition, educational sciences, linguistics, information technologies in education, material design, teaching skills, etc., and they had their school experience internship.

3.3. Procedures

This part of the research includes detailed clarification about data collection instruments, data collection procedures, data analysis procedures, reliability and validity and limitations of the study.

3.3.1 Data collection instruments. For the purposes of the study, the researcher prepared a questionnaire online through Google Forms. Applying the questionnaire online was preferred because it was faster to collect data and easy to gather information automatically. Also, it was quick to analyse, easy and comfortable for participants to complete because they were able to take the test from their own devices.

There were three sections in this questionnaire which consisted of questions about demographic information, a rubric for Technology Adopter Category Index, the TPACK-deep scale.

The questionnaire started with questions asking for information about the participants' demographic features (see Appendix A, part I). First, participants were required to define their gender and choose the range of their expected Grade Point Average (GPA) on a given scale. Then, they answered some questions which were included in the questionnaire to gain more information about their attitude towards technology. Those questions were about device possession amount, daily Internet usage, and the reasons participants used the Internet. This section of the questionnaire was going to help the researcher to know the participants better demographically.

The second part of the survey was a rubric designed by Dugas (2005) called Technology Adopter Category Index (see Appendix A, part II). It was a rubric which

participants determined own approach to new technology. It consisted of nine items which were scored from 1 to 9. Participants were to choose only one of those items that best described them about their adoption of new technology. Kim et al. (2013) state that "The TACI score is inversely proportional to the participants' degree of comfort with innovation." (p.53). This means that the more a person feels relaxed with innovation, the lower TACI score they will have or vice versa. For example, the highest score 9 belongs to the last expression "I am usually not interested in adopting new technology" indicating that a person who chooses this item feels troubled about innovation. This section of the questionnaire helped the researcher to learn participants' technology adopter categories.

TPACK-deep scale was the third section of this questionnaire (see Appendix A, part III). This scale was developed by Kabakçı Yurdakul et al. (2012) with the aim of measuring pre-service teachers' TPACK. It was a 33 itemised scale in which participants answered questions to reflect the degree of their competencies. Each item could be answered as 'strongly disagree' (1 point), 'disagree' (2 points), 'neither agree or disagree (3 points), 'agree' (4 points), and 'strongly agree' (5 points). Researchers carried out the validity and reliability study of the scale with 995 Turkish pre-service teachers. After their participants took the test, researchers determined a scoring criteria as the scores which were lower than 95 meant that those participants had a low level of TPACK; those between 96 and 130 were regarded to possess an average level of TPACK; and those higher than 131 were thought to have a high level of TPACK (see Table 1).

Table 1

Rubric for the Evaluation of TPACK-deep Scale Scores

Score (x)	Mean	TPACK level
$x \leq 95$	1.00-2.33	Low
$95 \leq x \leq 130$	2.34-3.67	Average
$x > 130$	3.68-5.00	High

For the purposes of this study, even though there are some other scales in literature, TPACK-deep scale was used with the permission of the corresponding author because this scale was specifically developed with the participation of pre-service teachers. Another significance of using this test was that it didn't measure TPACK components separately on the contrary to other questionnaires or surveys in this field. With this scale, it was possible to estimate and analyse pre-service EFL teachers' TPACK competency level together without creating any limitation regarding the philosophy of the TPACK framework (Kabakçı Yurdakul et al. 2012).

While developing this scale, Kabakçı Yurdakul et al. (2012) found four factors in this scale. Each item belonged to a factor regarding the area that they were measuring. The four factors were design, exertion, ethics and proficiency. The developers of the scale emphasized that design was the most significant factor of the scale. It reflected how well pre-service teachers designed their content to teach by means of their technological and pedagogical knowledge. Items 1-10 represented the skills regarding the design factor. Exertion was the second most important factor of the scale and it reflected the competency of using technology in the teaching process and in the assessment of how effective that process was (Kabakçı Yurdakul, 2012). Items 11-22 represented skills regarding the exertion factor. The third factor was ethics. This factor reflected both ethics in teaching and technology-related areas such as privacy and safety of technology based information, right of access to technology, etc. (Kabakçı Yurdakul, 2012). Items 23-28 represented skills regarding the ethics

factor. Proficiency was the last factor which referred to being an expert in integrating technology into content and pedagogy, to be able to offer and select solutions to problems in the whole process. Items 29-33 represented skills of the proficiency factor. In this research, along with total TPACK, levels regarding these four factors were also examined in order to see how well pre-service EFL teachers were in planning, implementing, using ethics and were proficient while using technology pedagogically in their content teaching.

3.3.2 Data collection procedures. In the field of English Language Teaching (ELT), there have been a sufficient number of studies which measured pre-service EFL teachers' TPACK level. However, any research which studies pre-service EFL teachers' adopter categories couldn't be found. For that reason, diffusion of innovations theory was included in the study in order to fill a gap. Then the data collection procedure began.

According to Creswell (2002), there are five steps in the procedure of quantitative data collection. Those steps are deciding on the population and sample of the study, getting permissions from individuals or organizations if required, looking over the existing sources so as to collect determined information, choosing the proper data collection instrument that will provide necessary data and lastly carrying out the data collection process to collect data.

In this research, after determining the framework and setting the goals of the research, the target population was decided to be pre-service EFL teachers. Then necessary permissions were taken from the instructors to apply the scale on their courses. Then, the questionnaire which was going to help to collect data was designed online. First, demographic information part was included in the questionnaire. Second, TACI rubric which was obtained from the study of Dugas (2003) was put in the other part. Lastly, after seeing the number of scales in TPACK field, TPACK-deep (Kabakçı Yurdakul et al., 2012), which was thought to be the most applicable one, was selected for the purposes of this study. In order to use that scale, an email about the content of the study was sent to the corresponding author. After receiving the approval required to use the scale, it was included in the questionnaire as the third part. The whole version

of the scale was transferred into the online platform, Google Forms, and sent to the respective lecturers for them to share with the related participants. The process of collecting data took approximately four weeks.

3.3.3 Data analysis procedures. In the present study, quantitative methodology was used in order to demonstrate if there was a relationship between pre-service EFL teachers TACI and TPACK level. For the data analysis, Statistical Package for the Social Sciences (SPSS) 23.0 was used.

In order to answer the first research question, TACI scores were analysed based on a 9 point scale. This rubric reflected participants' degree of comfort with adopting new technology (Kim et al., 2013). Descriptive statistics were carried out in order to get information about participants' frequencies and percentages regarding their distribution in technology adopter categories. Then, independent samples t-test was applied to find out the difference between the mean scores of females and males regarding their TACI. Afterwards, One-Way ANOVA test was administered to determine whether expected GPA scores differed among TACI of pre-service EFL teachers.

Regarding the second research question, TPACK levels were analysed based on a 165 point scale. Descriptive statistics demonstrated participants' TPACK levels. Participants who had mean scores between 33 and 95 possessed low TPACK level. Those who had scores between 96 and 130 held average TPACK level and mean scores between 131 and 165 indicated high level of TPACK. Later on, independent samples t-test analysis was conducted to detect the difference between the TPACK levels of females and males. Moreover, One-Way ANOVA test reflected the difference of TPACK levels based on participants' GPA scores.

Lastly, bivariate Pearson Correlation analysis was conducted to measure the degree of association between pre-service EFL teachers' technology adopter category and their TPACK level.

Table 2

Overview of Research Questions and Corresponding Procedures

Research Questions	Data Collection Instruments	Data Analysis
1. What is pre-service EFL teachers' approach in adopting new technologies? (a) Does gender have an effect on their adoption? (b) Does academic success have an effect on their adoption?	TACI Rubric (Survey, Part 2)	Descriptive Statistics Crosstabulation Independent t-test One-Way Anova
2- What is the TPACK level of pre-service EFL teachers? (a) Does gender have an effect on their TPACK level? (b) Does academic success have an effect on their TPACK level?	TPACK-deep Scale (Survey, Part 3)	Descriptive Statistics Independent t-test One-Way Anova
3- Does the pre-service EFL teachers' technology adoption have an effect on their TPACK level?	TACI Rubric TPACK-deep Scale	Correlation Analysis

3.3.4 Reliability and validity. Reliability analysis was applied for TPACK-deep scale. In order to find out the internal consistency of this scale, Cronbach's alpha coefficient was used. A strong internal consistency was found because the results indicated that values regarding the 33 itemed TPACK scale form were calculated as .97.

3.4. Limitations

The first limitation of this study was the number of participants who volunteered to complete the survey was below expected. 130 pre-service EFL teachers' responses were not sufficient to make a generalization of the findings to the total population. The

reason for this narrow sample size was that some authorities wanted to follow the official procedure although the study required voluntary participation. If more time was allocated to collect the data, this limitation could be eliminated and more participants could fill out the survey.

Secondly, according to the answers obtained from the first part of the questionnaire, 107 female and 23 male participants contributed to the study. The reason why the gender distribution in the total number of this study's participants was not equal may be due to the fact that the total number of students studying in the language department of universities have not been equal in Turkey. For example, looking at the results that are obtained from a website called "YÖK Atlas", it was seen that there were 176 female (63,5%) and 101 male students (36,4%) who were eligible enough to enter the four universities in which the participants of this study attend to in 2018.

Another and last limitation was using only quantitative methodology in this research. The data which were obtained from the questionnaire was seen enough to cover research problems and clarify research questions. However, including qualitative data, such as interview data, could help the researcher to look at the study from many different perspectives for a better understanding of the research problem (Creswell, 2002). It could also help to triangulate and affirm the findings of quantitative data on pre-service EFL teachers' technology adoption and TPACK level.

This chapter delivered a detailed information about the methodological process of the study. The next chapter provides the findings which were obtained from the statistical analysis.

Chapter 4

Findings

The purpose of this study was to find out pre-service EFL teachers' technology adopter categories, and their TPACK level based on gender and academic success, and the relationship between their technology adopter categories and TPACK level. Considering this purpose, three research questions were identified as follows:

1. What is pre-service EFL teachers' approach in adopting new technologies?
   a. Does gender have an effect on their adoption?
   b. Does academic success have an effect on their adoption?
2. What is the TPACK level of pre-service EFL teachers?
   a. Does gender have an effect on their TPACK level?
   b. Does academic success have an effect on their TPACK level?
3. Does the pre-service EFL teachers' technology adoption have an impact on their TPACK level?

Throughout this section, the collected data and the statistical treatment is summarized in detail to explain the conclusions in the light of the research questions mentioned above.

4.1 Findings of the Demographic Inventory

In this study, a questionnaire was used as a data collection instrument. It consisted of three sections both of which respond to two research questions. The first part included some questions which gather information about participants' demography. Gender, expected Grade Point Average (GPA) score, number of possessed technological devices, time spent on the Internet, activities that are spent time on the Internet were the questions which made up the first section. These items were included into the study because it was thought that they would provide some

initial information about the participants' general attitudes towards technology which would help to know them better.

According to the first findings, a total of 130 pre-service EFL teachers participated in the study. As it is shown in Table 3, 107 (82,3%) of the participants were female while 23 (17,7%) of them were male.

Table 3

The Distribution of the Participants Based on Gender

Gender	Frequency	Percent
Female	107	82.3
Male	23	17.7
Total	130	100.0

Participants also reflected their expected GPA scores (Table 4) by selecting one of the given intervals. Those intervals were between 0 and 2,00, between 2,00 and 2,50, between 2,50 and 3,00, between 3,00 and 3,50, and between 3,50 and 4,00. As table 1 displays the frequency of the expected GPA scores, 0,8 percent of the participants (n = 1) marked their expected GPA score as between 0 and 2,00. While 16,2 (n = 21) percent pointed out between 2,00 and 2,50 score, 37,7 percent of them (n = 49) specified that they expect their GPA score to be between 2,50 and 3,00. 30,8 percent (n = 40) expect it between 3,00 and 3,50. The last group which indicated expected GPA score to be between 3,50 and 4,00 was 14,6 percent (n = 19).

Table 4

The Distribution of the Participants Based on Expected GPA Score

Expected GPA Score	Frequency	Percent
Between 0 and 1.99	1	0.8
Between 2.00 and 2.49	21	16.2
Between 2.50 and 2.99	49	37.7
Between 3.00 and 3.49	40	30.8
Between 3.50 and 4.00	19	14.6
Total	130	100

Third question in the survey was about how many technological devices such as computer, tablet, smartphone, smartwatch, VR headset, drone, e-reader, etc. the participants possessed. As it can be seen from the table 5, 103 (79,2%) participants own 1-3 devices, 23 (17,7%) of them have 4-6 devices, 3 (2,3%) possess 6-9, and only 1 (0,8%) person indicated that he/she had more devices.

Table 5

The Distribution of the Participants Based on Technological Devices They Own

Number of the Devices	Frequency	Percent
1-3	103	79.2
4-6	23	17.7
6-9	3	2.3
More	1	0.8
Total	130	100.0

Next question was included into the survey in order to see how much time pre-service EFL teachers spend on the Internet on a daily basis (Table 6). In accordance with the findings, 4 (3,1%) of the participants reflected that they spend less than 1 hour on the Internet. 60 (46,2%) participants indicated they spend time on the Internet between one and three hours, while 45 (34,6) of them reported the time as between 4 and 6 hours. Lastly, 21 (16,2%) said they spend more than 7 hours on the Internet.

Table 6

The Distribution of the Participants Based on the Time They Spend on the Internet

Time	Frequency	Percent
Less than 1 hour	4	3.1
Between 1 and 3 hours	60	46.2
Between 4 and 6 hours	45	34.6
Total	130	100.0

The last question in demographic inventory was about the activities that were done while spending time on the Internet. It was a checkbox type of question which participants ticked the activities they spent time on the Internet. As it can be seen from table 7, there were 11 alternatives that are dealing with email (n = 99), playing games (n = 41), shopping online (n = 58), using social networks (n = 121), reading the news (n = 85), visiting forums (n = 42), academic purposes (n = 90), getting information on a topic (n = 106), and others (n = 11).

Table 7

The Distribution of the Participants Based on the Activities They Spend Time on the Internet

Activities	Frequency	Percent
Dealing with email	99	76.2
Playing games	41	31.5
Shopping online	58	44.6
Using social networks	121	93.1
Reading the news	85	65.4
Visiting forums	42	32.3
Academic purposes	90	69.2
Getting information on a topic	106	81.5
Others	11	8.4

Descriptive statistics of this question demonstrated that there were some common statements under the alternative of "Others". Realizing that those statements could be grouped under some terms, three new alternatives were made (Table 8). Some of the participants' expressions for other activities were about watching films, TV series, videos, etc. (n = 8). They were included into the entertainment category. One of the participants specified that he/she worked online so job purposes category was formed. Lastly, two people stated that they did some activities such as going through online course sites. So those statements were gathered under personal development category.

Table 8

The Categorization of the "Others" Item Based on the Answers of Participants

Other Activities	Frequency	Percent
Entertainment	8	6.1
Job purposes	1	0.8
Personal development	2	1.5

4.2 Findings of the Research Question 1

Findings in this section are related to the first research question of this study which aimed to present pre-service EFL teachers' technology adopter categories. They were obtained via Technology Adopter Category Index rubric in the second part of the questionnaire. In this section of the questionnaire, the participants were asked to choose the item which they thought best explained their approach to new technologies. The item they chose stood for their technology adopter category. As mentioned in the methodology section, there were nine alternatives which each of them corresponds to a technology adopter category. In table 9, all 9 alternatives are paired of with the category they represent.

Table 9

TACI Rubric Items and the Categories They Represent (Dugas,2005)

TACI Rubric Items	Tech. Adopter Category
1. I tend to adopt new technology as soon as it is available to me. My interest lies more with the technology itself than with its application to specific problems	Innovator
2. In between 1 and 3	Early Adopter

Table 9 (cont.d)

TACI Rubric Items	Tech. Adopter Category
3. I explore new technologies for their potential to bring about improvements. I am willing to try new things, and am not averse to occasional failure.	Early Adopter
4. In between 3 and 5	Early Majority
5. I adopt a "wait and see" attitude toward new technology, and want examples of close-to-home successes before adopting. I want to see value in an innovation before adopting it.	Early Majority
6. In between 5 and 7	Late Majority
7. I accept new technology later in the game, once the technology has become established among the majority.	Late Majority
8. In between 7 and 9	Laggard
9. I am usually not interested in adopting new technology.	Laggard

Table 10 reveals the self-reflection descriptive statistics of pre-service EFL teachers' technology adopter category index. 9 participants reflected that they adopted new technologies the time when they come out. 18 people indicated they were in between the first and third choices. 26 of them said they adopted new technologies after testing to see what kind of developments they could provide. 19 said they were in between the third and fifth choices. 35 participants revealed that they waited and saw the success of a new technology. 8 said they were in between five and seven. 7 participants indicated that they adopted new technologies after most of the people adopted it. 3 of them said they felt in between 7 and 9. Finally, 5 of the pre-service EFL teachers said they were not interested in the new technologies.

Table 10

The Distribution of the Participants Based on TACI

TACI	Frequency	Percentage
1. I tend to adopt new technology as soon as it is available to me. My interest lies more with the technology itself than with its application to specific problems.	9	6.9
2. In between 1 and 3	18	13.8
3. I explore new technologies for their potential to bring about improvements. I am willing to try new things, and am not averse to occasional failure.	26	20.0
4. In between 3 and 5	19	14.6
5. I adopt a "wait and see" attitude toward new technology, and want examples of close-to-home successes before adopting. I want to see value in an innovation before adopting it.	35	26.9
6. In between 5 and 7	8	6.2
7. I accept new technology later in the game, once the technology has become established among the majority.	7	5.4
8. In between 7 and 9	3	2.3
9. I am usually not interested in adopting new technology.	5	3.8

Table 11 shows technology adopter categories of pre-service EFL teachers based on the answers they provided. According to the results, 6,9% (*n* = 9) of the participants reflected themselves as innovators. While 33,8% (*n* = 44) said they were early adopters, 41,5% (*n* = 54) indicated they were in early majority group. Finally 11,5% (*n* = 15) of them said they were in late majority group, and 6,2% (*n* = 8) were in laggards.

Table 11

Technology Adopter Categories of Pre-service EFL Teachers

Technology Adopter Categories	Frequency	Percentage
Innovators	9	6.9
Early Adopters	44	33.8
Early Majority	54	41.5
Late Majority	15	11.5
Laggards	8	6.2

Some analyses regarding the relationship between gender and TACI, and academic success and TACI were implemented. In Table 12, results of the crosstabulation analysis between gender and TACI with categories was displayed. Outcomes demonstrated that 7 female and 2 male participants were in innovators group while 35 females and 9 males were in early adopters. 47 females and 7 males belonged to early majority group. Late majority group consisted of 12 females and 3 males. Lastly, there were 6 females and 2 males in laggards group.

Table 12

Crosstabulation of Gender and TACI

Gender	1	2	3	4	5	6	7	8	9
Female	7	11	24	17	30	7	5	2	4
Male	2	7	2	2	5	1	2	1	1
Total	9	18	26	19	35	8	7	3	5

In order to find out whether there would be a statistically significant difference between the mean scores of females and males regarding their TACI, independent samples t-test (Table 13) was applied. This analysis displayed that female group (n = 107) was identified with a TACI score of 4, 19 out of 9 while male group (n = 23) presented score of 4, 00.

Table 13

Means of Gender Based Adopter Categories

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	23	4.00	2.29	.479
Female	107	4.19	4.19	1.1849

The results of the independent t-test (Table 14) showed that even though the mean of the adopter index of male group was less than the female group, the difference was not statistically different, $t(130) = -,421$, $p = .675$.

Table 14

Independent Samples Test for Gender and TACI

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	3,008	.085	-.421	128	.675	-187	.444

Afterwards, One-Way ANOVA test was administered to determine whether expected GPA scores differ among TACI of pre-service EFL teachers. Likewise, those results (Table 15) indicated that there was no statistically significant differences between the means of groups, $F(8, 121) = 1,97$, $p = .056$.

Table 15

One-Way ANOVA Test for Expected GPA and TACI

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13.568	8	1.696	1.970	.056
Within Groups	104.163	121	.861		
Total	117.731	129			

4.3 Findings of the Research Question 2

Findings in this section are related with the second research question of this study which aimed to determine pre-service EFL teachers' Technological Pedagogical Content Knowledge (TPACK) levels. They were obtained via TPACK-deep, a five point Likert scale, in the third part of the questionnaire. In this part of the questionnaire, there were 33 items which participants were asked to choose one option out of five. The options were five point agreement statements respectively "Strongly Disagree", "Disagree", "Neither Agree nor Disagree", "Agree", "Strongly Agree". Table 16

displays question based descriptive statistics on TPACK. Mean scores and standard deviations of items in TPACK-deep questionnaire were demonstrated below. According to the table, the highest mean score belonged to the item 20 which was "I can use technology to update my knowledge and skills in the area that I will teach". On the other hand, item 23, which was "I can provide each student equal access to technology", had the lowest mean score.

Table 16

Item based TPACK Questionnaire Descriptives

TPACK Items	Mean	Std. Deviation
Updating an instructional material	4.14	.963
Using technology to determine students' needs	4.15	.881
Using technology to develop activities	4.27	.947
Planning the teaching and learning process	4.08	.940
Conducting a needs analysis	3.95	.897
Optimizing the duration of the lesson	3.93	.846
Developing appropriate assessment tools	3.83	1.028
Combining methods and technologies	4.03	.889
Using technology to design materials	4.05	.979
Organizing the educational environment	3.99	.936
Implementing effective classroom management	3.90	.879
Assessing if students have the content knowledge	3.78	.942
Applying instructional approaches and methods	3.78	.998
Using technology for implementing activities	4.11	1.021

Table 16 (cont.d)

TPACK Items	Mean	Std. Deviation
Using technology based communication tools	4.02	1.027
Using technology for evaluating students' achievement	3.94	.921
Being an appropriate model for the students	3.84	.938
Guiding students in the process	3.89	1.066
Using innovative technologies to support the process	4.05	.983
Using technology to update knowledge and skills	4.28	.900
Updating my technological knowledge	4.18	.885
Using technology to keep content knowledge updated	4.21	1.002
Providing each student equal access to technology	3.36	1.049
Behaving ethically in acquiring and using information	4.04	.927
Using technology in every phase	3.65	.939
Following the teaching profession's codes of ethics	3.57	1.041
Leading students to valid and reliable digital sources	3.95	.931
Using technology appropriately in educational context	4.01	.952
Troubleshooting problems of online educational context	3.49	.966
Troubleshooting problems in any phase of the process	3.59	.954
Using technology to find solutions to problems	3.94	.930
Becoming a leader in spreading the use of technology	3.56	1.148
Cooperating with other disciplines	3.86	.938

The scores from TPACK-deep scale that pre-service EFL teachers got were analysed in detail. Mean scores for each four factors of TPACK-deep and total mean scores were calculated. The results suggested that (Table 17) pre-service EFL teachers' lowest TPACK score was 33 and highest TPACK score was 165 while their mean was 3,99. These results implied that pre-service EFL teachers' TPACK level is at the high level.

Table 17

Analysis of Pre-service EFL Teachers' TPACK Levels

TPACK	Min.	Max.	Mean	Std. Deviation
Total	33	165	3.99	.82

According to the results, out of 130 pre-service EFL teachers, 7% (*n* = 9) of them were in low, and 53% (*n* = 69) were in average TPACK category, and 40% (*n* = 52) had high level of TPACK (Figure 6).

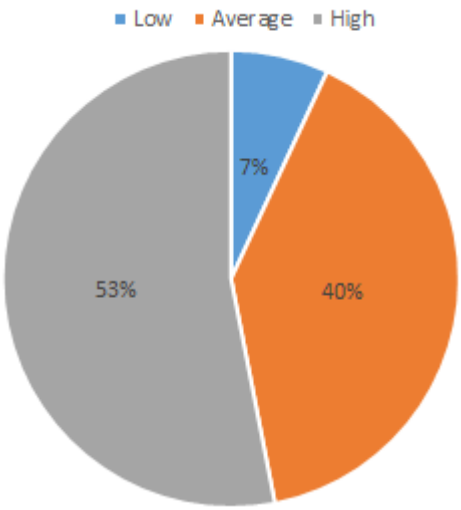


Figure 6. Percentile of pre-service EFL teachers' TPACK levels.

Analysing the four factors of TPACK (Table 18), the ascending sequence of the four factors' mean scores according to the answers obtained from pre-service EFL teachers in order to figure out their competency level was as follows: proficiency (*M*

= 3,67), ethics (*M* = 3,74), exertion (*M* = 3,98), and design (*M* = 4,02). These results meant that the related participants were highly competent in design and exertion factors but reasonably competent in ethics and proficiency factors.

Table 18

Analysis of Pre-service EFL Teachers' Levels for 4 TPACK Factors

TPACK Factors	Min.	Max.	Mean	Std. Deviation
Design	10	50	4.02	.83
Exertion	12	60	3.98	.83
Ethics	6	30	3.74	.81
Proficiency	5	25	3.67	.87

In order to figure out if mean scores of TPACK-deep scale differ according to gender, independent samples t-test was applied (Table 19). Regarding the results, it was observed that mean scores of female (*M* = 4,08) and male (*M* = 3,66) were close to each other. It was revealed that *p* value was bigger than 0,05 so there wasn't statistically significant difference between the two means (*t* = -1,94, *p* = ,06).

Table 19

Independent Samples Test for Gender and TPACK

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances not assumed	5.13	.02	-1.94	26.970	.063	-.426	.219

Following this analysis, the difference between the means of each four factor of TPACK and gender was also tested with independent t-test (Table 20). It was found

that there was a significant difference between the means of female (*M* = 4, 12) and male (*M* = 3, 67) groups regarding the design factor. Results presented that female pre-service EFL teachers' design level was higher than the males (*t* = -1, 99, *p* = ,05). Concerning the t-test analysis of exertion factor and gender, the means of the female (*M* = 4, 05) and the male (*M* = 3,71) was compared, and it was seen that there wasn't statistically significant difference between the two subjects (*t* = -1,90, *p* = ,06). When the independent t-test analysis was conducted for the difference between ethics factor and gender, it was detected that the mean score of female participants (*M* = 3,86) was higher than the male participants (*M* = 3,30). Therefore, results suggested that there was a statistically significant difference between the mean scores of female and male pre-service EFL teachers regarding their ethics skills in TPACK (*t* = -3,22, *p* = ,00). Lastly, another independent t-test analysis was applied for the proficiency factor. It was identified that even though the mean score of the female (*M* = 3,73) was higher than the male (*M* = 3,48), there wasn't a statistically significant difference between the mean scores (*t* = -1,26, *p* = ,209).

Table 20

Independent Samples Test for Gender and 4 TPACK Factors

		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference
Design	Equal variances not assumed	5.22	.02	-1.99	26.76	.056	-.447
Exertion	Equal variances assumed	3.65	.05	-1.90	128	.060	-.344
Ethics	Equal variances assumed	2.42	.12	-3.22	128	.002	-.557

Table 20 (cont'd)

		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference
Proficiency	Equal variances assumed	1.23	.26	-1.26	128	.209	-.245

Another component of the second research question was related with the relationship between the expected GPA scores and TPACK levels of pre-service EFL teachers. One-Way ANOVA test was applied to determine whether expected GPA scores had an effect on TPACK level of pre-service EFL teachers. Likewise, those results (Table 21) indicated that there was no statistically significant differences between the means of groups, $F(2, 127) = ,461$, $p = .632$.

Table 21

One-Way ANOVA Test for Expected GPA and TPACK Level

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.849	2	.424	.461	.632
Within Groups	116.882	127	.920		
Total	117.731	129			

Furthermore, descriptive analysis was used to look at the mean scores of each group in expected GPA variable (Table 22). According to the results, there was only one pre-service EFL teacher who pointed out his/her GPA score to be between 0 and 1,99. Therefore, this participant's results waerenot included in this part of the analysis procedure. Results presented that pre-service EFL teachers who expect their GPA score to be between 3,50 and 4,00 had the highest mean score regarding the design

factor. On the other hand, participants who expect the lowest GPA score displayed the highest mean score in exertion, ethics and proficiency factor.

Table 22

Means of Expected GPA Scores Based on 4 TPACK Factors

Expected GPA Scores	Design		Exertion		Ethics		Proficiency	
	M	SD	M	SD	M	SD	M	SD
Between 2.00 and 2.49	4.22	.439	4.19	.398	3.94	.597	3.81	.568
Between 2.50 and 2.99	3.94	.785	3.91	.774	3.72	.731	3.68	.819
Between 3.00 and 3.49	3.97	.940	3.95	.953	3.70	.892	3.68	.936
Between 3.50 and 4.00	4.25	.766	4.11	.851	3.78	.863	3.61	1.025

4.4 Findings of the Research Question 3

This section provides results of the last research question of this study. A bivariate Pearson Correlation analysis was conducted to measure the degree of association between pre-service EFL teachers' technology adopter category and their TPACK level. In table 23, the correlation coefficient was computed between the technology adopter category index scores and technological pedagogical content knowledge scores with its four factor. Accordingly, no relationship between the two variables was found ($r(130) = .123$, $p = .162$).

Table 23

Correlation Analysis between TACI and TPACK

	N	R	p
Design	130	.114	.196
Exertion	130	.099	.262
Ethics	130	.120	.174
Proficiency	130	-.012	.890
TPACK	130	.123	.162

In conclusion, the findings which were obtained from the statistical analysis to reveal pre-service EFL teachers' general approach towards technology by finding out their adopter categories, their TPACK level, and the relationship between pre-service EFL teachers' adopter categories and their TPACK level were demonstrated in this section. Next chapter consists of the assessments and interpretations of the results in compliance with the research questions.

Chapter 5

Discussion and Conclusion

In this study, pre-service EFL teachers' technology adopter categories, and their TPACK level based on gender and academic success, and the relationship between their technology adopter categories and TPACK level were researched. Analyses of the results obtained from the questionnaire which was prepared based on the research questions were displayed in the previous section. This is the last chapter of this study which assesses and interprets the implications of the results in compliance with the research questions. There are four parts in this section. First, the findings of the research questions are discussed in connections with earlier studies. Then, implications for pedagogical development are given. Later on, conclusions and the importance of the findings of this study is mentioned, and lastly, recommendations are provided for future research.

Within the scope of this study, 130 pre-service EFL teachers from four different universities in Turkey participated in by filling out an online questionnaire. The questionnaire consisted of three sections. There were some questions about demographic information of participants in the first section. The second section included Technology Adopter Category Index (TACI) which was developed by Dugas (2005) in order to define pre-service EFL teachers' technology adoption categories. Lastly, a scale called TPACK-deep which was developed by Kabakçı Yurdakul et al. (2012) was used to find out Technological Pedagogical Content Knowledge (TPACK) levels of the mentioned participants. After participants filled out the questionnaire voluntarily, SPSS was used to obtain analyses. In this section, the discussion of findings that were obtained from the analysis is mentioned in light of the research questions of the study.

5.1 Discussion of the findings for research questions

In this section, findings for each research question is explained in connection with the studies conducted previously.

5.1.1 Discussion of the findings for the first research question. Under this section, findings for the following research questions are discussed: What is pre-service EFL teachers' approach in adopting new technologies? (a) Does gender have an effect on their adoption? (b) Does academic success have an effect on their adoption?

One of the main findings of this research was pre-service EFL teachers' technology adopter categories. In order to find out that, Rogers' (1995) diffusion of innovations theory was taken as one of the frameworks of this study. Adoption of innovations was the centre of this theory (El Shaban, 2017). Rogers defined five adoption categories which were formed based on the time when a person first started using an innovation. Those categories were innovators, early adopters, early majority, late majority and laggards.

When the results of this study were considered, it was found out that most of the pre-service EFL teachers (41,5%) indicated that they belonged to the category of early majority. Early majority was described as "the group of people who begin buying a new product or service after waiting to see if the people who have already bought it are satisfied with it" (early majority, n.d.). Early majority group is called deliberate because it takes a longer time for them to adopt a new idea completely. Belonging to the early majority category indicates that pre-service EFL teachers are good at communicating about innovation but they occasionally take a leading role in the diffusion of innovation which makes them a significant link among the other adopters (Rogers, 1995).

On the other hand, when the findings regarding the TACI were looked over, the number of pre-service EFL teachers who belonged to the early adopters category was also not so small to ignore. 33,8% of prospective teachers indicated that they were

early adopters because they were interested in trying new technology to observe and reveal its likely developments. Rogers (1995) defined early adopters as "the individual to check with" before adopting something new. They own the role of leadership because their duty is to make reasonable decisions and evaluations regarding an innovation. This group of individuals are required to form a network by interacting with the people in their local social system. There are some studies that focus on educators' adopter categories for better learning and teaching environments.

Dugas (2005), for example, used diffusion of innovation theory to look at the TACI differences between the adopter and non-adopter groups of a course management system. The results of his study showed a similarity with this research. He found that the adopter categories of faculty members were early adopters and early majority in both groups. At the end of his research, he suggested that if early adopters were persuaded of the advantages of new educational technology, they could serve as a good model in the decision-making process of the adoption.

Kim et al. (2013) also used TACI to investigate perceptions of students from graduate TESOL classes on the use of mobile technology. The results indicated that the more students were exposed to the mobile learning environment, the less their TACI score was. They implied that language teachers might use technology in their classrooms if they developed positive perspectives about the implementations of integrating technology.

When this study's results regarding the sub questions of this part were examined, it was observed that male participants adopted innovations slightly earlier than female participants. However, the difference was not statistically significant. This finding conflicted with the results of the study by El Shaban (2017). In his study, he revealed that female in-service language teachers were earlier in adopting educational technology than male teachers. Further, this study also found out that the academic success of pre-service EFL teachers didn't determine their TACI scores. These results may suggest that neither gender nor success of a pre-service EFL teachers doesn't affect their technology adopter category.

In conclusion, this study's participants demonstrated an average level of TACI score. However, it would be beneficial to keep in mind that subjects' adoption categories is likely to change in time (Polat, 2017).

5.1.2 Discussion of the findings for the second research question. In this section, findings for the following research questions are discussed: What is TPACK level of pre-service EFL teachers? (a) Does gender have an effect on their TPACK level? (b) Does academic success have an effect on their TPACK level?

Another main finding of this research was TPACK level of pre-service EFL teachers. TPACK was included in the study because it was an important framework regarding the training of both pre-service and in-service teachers in the matter of integrating technology effectively in the teaching process (Mishra & Koehler, 2006). It also provided detailed information on teacher competencies (Kabakçı Yurdakul et al., 2012). There have been many data collection instruments that analyse TPACK level of teachers. However, most of them approach TPACK separately. This situation contrasts with the nature of TPACK considering the philosophy and structure of it (Kabakçı Yurdakul et al., 2012). The instrument that was used in this research was TPACK-deep scale. TPACK-deep is an instrument which measures participants TPACK level as a whole. Therefore, it was chosen as the scale of this research.

Findings for the second research question revealed that pre-service EFL teachers' TPACK was relatively high. In terms of this result, the present study shares some similarities with other studies. Tunçer (2014) also used TPACK-deep scale in her research in order to determine TPACK level of 110 fourth year students who studied English Language Teaching at four different universities in Turkey. She found out that the participants of her study had a high level of TPACK.

There are four factors which reflect some specific skills of teachers related to their TPACK level on the TPACK-deep scale. They are design, exertion, ethics, and proficiency. Results were also analysed to see at what level pre-service EFL teachers were in each of the four factors. The factor which pre-service EFL teachers saw themselves the most competent was design. When the responses from the participants

for the first 10 items were examined, it was seen that pre-service EFL teachers felt more competent in using technology to develop activities based on student needs to enrich the teaching and learning process than any other skills in the design factor. According to the analyses of the TPACK-deep scale, exertion was the factor that pre-service EFL teachers felt competent after design. Results from the analysis of exertion factor items indicated that pre-service EFL teachers felt better in using technology to update their knowledge and skills in the area that they taught than any other skills in the exertion factor. After exertion, it was found out that ethics was the third factor that participants of this study felt qualified. Results of the item analysis showed that behaving ethically in acquiring and using special/private information - which were used in teaching a subject area - via technology was the skill that pre-service EFL teachers were the most capable. The factor that prospective EFL teachers got the least score was proficiency. When the participants' responses were checked, it was seen that they were more skilled in using technology to find solutions to problems than any other item in the proficiency factor. Looking at the results of the factor analyses, these findings showed some similarities and contrasts with other studies in the field. For example, Albayrak Sarı, Bilici, Baran, and Özbay (2016) conducted a study with the participation of 483 teachers from different departments. They also found out that design, exertion, and ethics were the factors that teachers felt most capable while proficiency was the last factor they were efficient. On the other hand, the results of a study about pre-service German Language teachers' TPACK level presented that their proficiency skill was more developed than the other four TPACK-deep skills (İşigüzel, 2014).

When the results regarding the sub question of this part were examined, it was seen that there was no significant difference between the TPACK competencies of EFL teacher candidates and their gender. In that sense, this study bears a resemblance to some of the previous studies. Polat (2018) conducted a study examining Turkish pre-service foreign language teachers' TPACK level by using the TPACK-deep scale. He also found out that English, French, German and Arabic language teacher candidates had equal or close TPACK competence in terms of their gender.

In this study, four factors of TPACK-deep scale were also compared based on gender. The results represented that there was a significant difference in design and ethics factors regarding participants' gender. Female participants were found to be more competent in designing teaching content thanks to their technological and pedagogical knowledge, and they are more careful about ethics in teaching content with the help of technology.

Another aim of this study was to find out if pre-service EFL teachers' academic success affected their TPACK level. Results revealed that, as in the study of Solak and Çakır (2014), there was no statistically significant difference between participants' GPA scores and their TPACK level.

In conclusion, as results indicated, pre-service EFL teachers had a high level of TPACK and there wasn't any difference in their TPACK level regarding genders and GPA scores.

5.1.3 Discussion of the findings for the third research question. In this section, findings for the following research question is discussed: Does the pre-service EFL teachers' technology adoption have an effect on their TPACK level?

The purpose of the present study was to find out the relationship between pre-service EFL teachers' technology adopter categories and their technological pedagogical content knowledge. Regarding this purpose, diffusion of innovations theory and Technological Pedagogical Content Knowledge framework was used. Diffusion of innovations theory helped to detect participants' technology adopter categories while the TPACK framework brought out how much they were competent in techno-pedagogical content areas of the teaching profession.

This study was conducted in order to see if technology adopter category defined TPACK level of pre-service EFL teachers. Results showed that pre-service EFL teachers belonged to the category of early majority and had a high level of TPACK competency. However, it was found out that there was no relationship between the two variables. These findings contrasted with another study that was

carried out by Özbek (2014). She also looked for the effect of individual innovativeness level on TPACK competence on 421 teachers. According to her results, there was a relationship between teachers' individual innovativeness level and their TPACK competence. This different finding might be reasoned from the fact that the number of participants of Özbek's study was much more than this study, and that the participants of that study were in-service teachers who were already using or not using technology in their teaching actively. As a result, the following interpretation would be appropriate: it is not possible to generalize that technology adopter categories have or haven't got an impact on TPACK competence. The results might show differences based on different variables.

5.2 Pedagogical Implications

Findings of this study suggest some implications for educators who can plan their in-class teaching accordingly or researchers who ground their studies on ICT in language education. To start with, there are actually several studies which outline the importance of integrating technology into lessons because it enhances teaching and learning procedures (Egbert, Herman, & Lee, 2015; Stanley, 2012). Integrating technology into lessons could support "new ways for languages, cultures, and the world to be represented, expressed, and understood" (Chun, Smith, & Kern, 2016, p. 76). How well this procedure is going to be depends on teachers' approach to technology (Huang & Liaw, 2005). Kim et al. (2013) justified that if a teacher had a negative attitude towards technology, it wouldn't be possible to convince them to use it in their classroom no matter how great technological equipment was given them. They suggested that teachers should be persuaded about the ways of how teaching with technology could make the process intriguing, simpler, and more delightful both for themselves and students. Likewise, teachers' comfort level of using technology is important because the more they are comfortable, the more they will be open to new technology. Diffusion of innovations theory was included in this study because it might help to understand teachers' attitudes towards technology. Results of this study showed that pre-service EFL teachers had deliberate attitude towards technology mostly as they were in early majority category (41,5%). However, the number of early

adopter pre-service EFL teachers was also notable (33,8%). This result is important because early adopters are prominent groups of this categorization in diffusion of innovations theory. Rogers state that early adopters are respected in a society so they can act as a role model for others. They have the ability to affect and stimulate other groups. Therefore, it would be beneficial to provide interaction between early adopters and the other late adopter groups. In courses, for example, early adopters can be paired up with other potential adopters. This can help to raise pre-service EFL teachers' attitudes towards adopting new technology by making them more open and feel comfortable while using technology.

Second implication would be about pre-service EFL teacher trainings. Pre-service EFL teachers need to be trained in an environment where all the technological facilities are available with the correct support in order to broaden their mind regarding this issue. Teacher trainers play an important role in the use of educational technology. They can be an example for candidate teachers in the development of technological pedagogical content knowledge competence. Faculty members can also create favourable circumstances where pre-service EFL teachers have a chance to observe and adopt technology in order to make them be prepared for future teaching processes. Knowing about and enhancing pre-service EFL teachers' TPACK level might be possible by helping the authorities to construct settings and provide required resources for the development of successful technology integration.

Another implication would be in line with the suggestions of Ersanlı (2016). He says that courses consisting of TPACK and material development related with digital technologies need to be included in the teacher training programs because prospective teachers should possess the knowledge of how technology, pedagogy, and content affect one another and the skill to make use of a digital tool or application. Especially, as this study's results indicated, pre-service EFL teachers need to be trained specially in proficiency factor. They should gain the knowledge of how to solve problems that are likely to turn up in educational technology. Those above-mentioned courses can provide this opportunity for pre-service EFL teachers. Moreover, there wasn't statistically significant difference between male and female pre-service EFL

teachers' TPACK level. This might suggest that both male and female pre-service EFL teachers should be trained or supported under equal circumstances in integrating technology into lessons.

Lastly, even though all the necessary resources are provided or the perfect environment is created for pre-service EFL teachers, it would not be possible to observe an effective technology integration as long as they are not given opportunities to practice what they learn (Niess, 2008). For this reason, blending coursework with fieldwork is important (İşler & Yıldırım, 2018). Pre-service EFL teachers can start their school experience in earlier years. They could be provided with specific programs or curriculums that they are made to integrate technology in their teaching experiences. In this way, teacher trainers or faculty members could understand future teachers' strengths and weaknesses in adopting new technologies or in TPACK, and they could still have time to empower those strengths or recover the weaknesses in faculty courses before they actually start their in-service teaching.

5.3 Conclusions

The purpose of this study was to find out the relationship between pre-service EFL teachers' technology adopter categories and their technological pedagogical content knowledge. Along with this purpose, the study also revealed some detailed information about pre-service EFL teachers' general attitude towards technology. For example, results indicated that the number of technological devices that prospective EFL teachers had are between one and three. They also spent time on the internet between one and three hours. They spent their time on the Internet mostly by using social network sites or getting information on a topic.

Results also indicated that the participants of this study belonged to the category of early majority and there was not any statistically significant difference regarding their gender and academic success. It was also found out that pre-service EFL teachers had a high level of TPACK and they were more competent in design factor than any other three factors meaning they were good at planning teaching to improve the teaching process with the help of technological and pedagogical

knowledge about the content that they were going to teach. Any statistically significant difference regarding their gender and academic success was not detected for TPACK, too. Lastly, correlation analysis revealed no significant relationship between pre-service EFL teachers' technology adopter category and their TPACK level.

Consequently, this study was important in the way it related TACI framework with TPACK for pre-service EFL teachers for the first time in this field. It didn't only reflect detailed information of pre-service EFL teachers' attitudes towards technology, it also emphasized the importance of teacher training programs in bringing up successful teachers who were able to use technology effectively.

5.4 Recommendations

Because the results of this study may not be generalized over all the pre-service EFL teachers, the present study offers some suggestions future research.

Firstly, this study can be replicated by using different scales because there have been many scales especially in TPACK framework which are completely different from the ones that are used in this present study. Alternatively, an experimental study can be done in pre and post-intervention way. After detecting pre-service EFL teachers' TACI and TPACK levels, some specific technological training can be implemented and results after the implementation procedure can be evaluated in order to see if there is a change in pre-service EFL teachers' levels.

Only quantitative methodology was used in this research because it was presumed that it would be sufficient to reach the results for the specific purpose of it. Qualitative part can also be included in further studies in order to obtain a deeper understanding of pre-service EFL teachers' adopter category and TPACK level.

Lastly, a study which compares the situation between in-service and pre-service EFL teachers can also be applied within the same frameworks.

REFERENCES

Akcay, A. O., Mancilla, R., & Polat, N. (2015, March). *An examination of EFL teachers' technological pedagogical content knowledge (TPACK).* Paper presented at the Society for Information Technology & Teacher Education International Conference. Association for the Advancement of Computing in Education (AACE).

Aksin, A. (2014). *Sosyal bilgiler öğretmenlerinin teknolojik pedagojik alan bilgisi (tab) yeterlilikleri: Amasya ili örneği* (Doctoral dissertation). Atatürk Üniversitesi, Erzurum.

Albayrak Sarı, A., Canbazoğlu Bilici, S., Baran, E., & Özbay, U. (2016). Farklı branşlardaki öğretmenlerin teknolojik pedagojik alan bilgisi (TPAB) yeterlikleri ile bilgi ve iletişim teknolojilerine yönelik tutumları arasındaki ilişkinin incelenmesi. Eğitim Teknolojisi Kuram ve Uygulama, *6*(1).

Altun, M. (2015). The integration of technology into foreign language teaching. *International Journal on New Trends in Education and Their Implications*, *6*(1), 22-27.

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT–TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, *52*(1), 154-168. doi:10.1016/j.compedu.2008.07.006

Angeli, C., & Valanides, N. (Eds.). (2014). Technological pedagogical content knowledge: Exploring, developing, and assessing TPCK. Springer.

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States. *Contemporary Issues in Technology and Teacher Education*, *9*(1), 71-88.

Arıcan, H. (2014). *Tablet bilgisayarların ortaöğretimde kullanımı: FATİH projesi örneği* (Unpublished master's thesis). İstanbul Ticaret University İstanbul.

Aydin, S. (2013). Teachers' perceptions about the use of computers in EFL teaching and learning: the case of Turkey. *Computer Assisted Language Learning*, *26*(3), 214-233. doi:10.1080/09588221.2012.654495

Cox, S., & Graham, C. R. (2009). Diagramming TPACK in practice: Using an elaborated model of the TPACK Framework to analyze and depict teacher knowledge. *TechTrends*, *53*(5), 60-69. doi:10.1007/s11528-009-0327-1

Delen, K. (2016). *The investigation of technological pedagogical and content knowledge level by Turkish teachers of English* (Master's thesis). Çağ University, Mersin.

Dikmen, C. H., & Demirer, V. (2016). Türkiye'de teknolojik pedagojik alan bilgisi üzerine 2009-2013 yılları arasında yapılan çalışmalardaki eğilimler. *Turkish Journal of Education*, *5*(1), 33-46. doi:10.19128/turje.77632

Dugas, C. A. (2005). *Adopter characteristics and teaching styles of faculty adopters and nonadopters of a course management system*. (Unpublished doctoral dissertation). Indiana State University, Terre Haute, IN.

Early Majority. (n.d.). Retrieved from https://dictionary.cambridge.org/dictionary/english/early-majority

Egbert, J., Paulus, T. M., & Nakamichi, Y. (2002). The impact of CALL instruction on classroom computer use: A foundation for rethinking technology in teacher education. Language Learning & Technology, 6(3), 108-126.

El Shaban, A. R. (2017). In-Service ELL teachers and technology adoption: exploring diffusion of innovations in language education (Doctoral dissertation). Retrieved from http://hdl.handle.net/2376/13005

Ersanli, C. Y. (2016). Improving technological pedagogical content knowledge (TPACK) of pre-service English language teachers. *International Education Studies, 9*(5), 18-27.

FATİH education project hailed in Europe. (2016, March 15). Retrieved from http://www.dailysabah.com/education/2016/03/16/fatih-education-project-hailed-in-europe

Guerriero, S. (2013). Teachers' pedagogical knowledge and the teaching profession. *OECD, 17*, 2018.

Guerrero, S. (2010). Technological pedagogical content knowledge in the mathematics classroom. *Journal of Computing in Teacher Education, 26*(4), 132-139.

Haddad, W. D., & Jurich, S. (2002). ICT for education: prerequisites and constraints. In *Technologies for education: potentials, parameters, and prospects* (pp. 42-57). Washington, DC: Unesco.

Hammond, T. C., & Manfra, M. M. (2009). Giving, prompting, making: Aligning technology and pedagogy within TPACK for social studies instruction. *Contemporary Issues in Technology and Teacher Education*, *9*(2), 160-185.

Hlas, A. C., Conroy, K., & Hildebrandt, S. A. (2017). Student teachers and CALL: Personal and pedagogical uses and beliefs. *calico journal*, *34*(3), 336.

Hsu, L. (2016). Examining EFL teachers' technological pedagogical content knowledge and the adoption of mobile-assisted language learning: a partial least square approach. *Computer Assisted Language Learning*, *29*(8), 1287-1297.

ICT. (n.d.). Retrieved from https://dictionary.cambridge.org/dictionary/english/ict?q=ICT.

İşigüzel, B. (2014). Almanca öğretmen adaylarının teknopedagojik eğitime yönelik yeterlikdüzeylerinin incelenmesi. Journal of International Social Research, 7(34), 768-778.

İşler, C., & Yıldırım, Ö. (2018). Perceptions of Turkish pre-Service EFL teachers on their technological pedagogical content knowledge. Journal of Education and Future, (13), 145-160.

Jang, S., & Tsai, M. (2012). Exploring the TPACK of Taiwanese elementary mathematics and science teachers with respect to use of interactive whiteboards. *Computers & Education*, *59*(2), 327-338. doi:10.1016/j.compedu.2012.02.003

Jhurre, V. (2005). Technology integration in education in developing countries: Guidelines to policy makers. *International Education Journal*, *6*(4), 467-483.

Jimoyiannis, A. (2010). Developing a technological pedagogical content knowledge framework for science education: Implications of a teacher trainers' preparation program. In *Proceedings of Informing Science & IT Education Conference (InSITE)* (Vol. 597, p. 607). FL: InSITE.

Jimoyiannis, A., & Komis, V. (2007). Examining teachers' beliefs about ICT in education: implications of a teacher preparation programme. *Teacher Development*, *11*(2), 149-173. doi:10.1080/13664530701414779

Kabakci Yurdakul, I., Odabasi, H. F., Kilicer, K., Coklar, A. N., Birinci, G., & Kurt, A. A. (2012). The development, validity and reliability of TPACK-deep: A technological pedagogical content knowledge scale. Computers & Education, 58(3), 964-977. doi:10.1016/j.compedu.2011.10.012

Kessler, G., & Hubbard, P. (2017). Language teacher education and technology. In *The handbook of technology and second language teaching and learning* (1st ed.). doi:10.1002/9781118914069.ch19

Koehler, M., & Mishra, P. (2008). Introducing TPCK. In AACTE Committee on Innovation and Technology (Ed.), *Handbook of technological pedagogical content knowledge (TPCK)* (pp.3-30). New York: Routledge.

Köse, N. K. (2016). Technological pedagogical content knowledge (TPACK) of English language instructors. *Journal of Educational and Instructional Studies in the World*, *6*(2), 12-19.

Kukulska-Hulme, A. (2012). Mobile-Assisted Language Learning. *The Encyclopedia of Applied Linguistics*. doi:10.1002/9781405198431.wbeal0768

Kwangsawad, T. (2016). Examining EFL Pre-service Teachers' TPACK trough Self-report, Lesson Plans and Actual Practice. *Journal of Education and Learning (EduLearn)*, *10*(2), 103. doi:10.11591/edulearn.v10i2.3575

Liu, S., Liu, H., Yu, Y., Li, Y., & Wen, T. (2014). TPACK: A new dimension to EFL teachers' PCK. *Journal of Education and Human Development*, *3*(2), 681-693.

Mathews-Aydinli, J., & Elaziz, F. (2010). Turkish students' and teachers' attitudes toward the use of interactive whiteboards in EFL classrooms. *Computer Assisted Language Learning*, *23*(3), 235-252.

McManis, L. D., & Gunnewig, S. B. (2012). Finding the education in educational technology with early learners. *Young Children*, *67*(3), 14-24.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record*, *108*(6), 1017-1054. doi:10.1111/j.1467-9620.2006.00684.x

Moeller, A. K., & Park, H. (2003). Foreign language teacher education and technology: Bridging the gap.

Mustafina, A. (2016). Teachers' attitudes toward technology integration in a Kazakhstani secondary school. International Journal of Research in Education and Science (IJRES), 2(2), 322-332.

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. *Teaching and teacher education*, *21*(5), 509-523.

Niess, M. (2006, March). Preparing Preservice Teachers to Teach Mathematics With Technology-Developing a TPCK. In *Society for Information Technology & Teacher Education International Conference* (pp. 3788-3795). Association for the Advancement of Computing in Education (AACE).

Öz, H. (2015). Assessing Pre-service English as a Foreign Language Teachers' Technological Pedagogical Content Knowledge. *International Education Studies*, *8*(5). doi:10.5539/ies.v8n5p119

Özbek, A. (2014). Öğretmenlerin yenilikçilik düzeylerinin TPAB yeterlikleri üzerindeki etkisinin incelenmesi (Master's thesis, Necmettin Erbakan University, Konya, Turkey).

Parisot, A. H. (1995). *Technology and teaching: The adoption and diffusion of technological innovations by a community college faculty* (Doctoral dissertation, Montana State University-Bozeman, College of Education, Health & Human Development).

Pierson, M. E. (2001). Technology Integration Practice as a Function of Pedagogical Expertise. *Journal of Research on Computing in Education*, *33*(4), 413-430. doi:10.1080/08886504.2001.10782325

Polat, M. (2016). Emerging technologies in language pedagogy: Language learners' perceptions through the lenses of innovation diffusion and user intention theories.

Polat, T. (2018). Türkiye'deki yabancı dil öğretmen adaylarının teknopedagojik eğitim yeterliklerinin incelenmesi (Master's thesis, Gazi University, Ankara, Turkey).

Rogers, E. M. (1983). *Diffusion of innovation* (3rd ed.).

Rogers, E. M. (1995). *Diffusion of innovation* (4th ed.).

Rubadeau, Z. K. (2016). *An exploration of English language teacher educators' conginitions and practices in relation to the pedagogical purposes and efficacies of 21st-century digital technologies* (Doctoral dissertation, Durham University, Durham, England). Retrieved from http://etheses.dur.ac.uk/11506/

Sahin, I. (2006). Detailed review of Rogers' diffusion of theory and educational technology-related studies based on Rogers' theory. *The Turkish Online Journal of Educational Technology*, *5*(2).

Salehi, H., & Salehi, Z. (2012). Integration of ICT in language teaching: Challenges and barriers. In *Proceedings of the 3rd International Conference on e-Education, e-Business, e-Management and e-Learning (IC4E, 2012), IPEDR* (Vol. 27, pp. 215-219).

Shulman, L. S. (1986). Those Who Understand: Knowledge Growth in Teaching. *Educational Researcher*, *15*(2), 4-14. doi:10.3102/0013189x015002004

Silvernail, D. L., & Gritter, A. K. (2007). Maine's middle school laptop program: Creating better writers. Gorham, ME: Maine Educational Policy Research Institute, University of Southern Maine.

Solak, E., & Çakır, R. (2014). Examining Preservice EFT Teachers' TPACK Competencies in Turkey. *The Journal of Educators Online*, *11*(2). doi:10.9743/jeo.2014.2.2

Tinio, V. L. (2003). *ICT in education*.

Tunçer, M. (2014). *The relationship between teacher efficacy and technological pedagogical content knowledge within the scope of EFL Pre-Service teachers*(Unpublished master's thesis). Anadolu University, Eskişehir, Turkey.

Umayahara, M. (2014, June 20). UNESCO Office in Bangkok: Benefits and risks of ICT use in early childhood. Retrieved from

http://www.unescobkk.org/education/ict/online-resources/databases/ict-in-education-database/item/article/benefits-and-risks-of-ict-use-in-early-childhood/

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & Van Braak, J. (2012). Technological pedagogical content knowledge - a review of the literature. *Journal of Computer Assisted Learning*, *29*(2), 109-121. doi:10.1111/j.1365-2729.2012.00487.x

Walker, A., & White, G. (2013). *Technology enhanced language learning: Connecting theory and practice*. Johanneshov: MTM.

Warschauer, M., & Healey, D. (1998). Computers and language learning: an overview. *Language Teaching*, *31*(02), 57. doi:10.1017/s0261444800012970

Yüksel, G., & Kavanoz, S. (2011). In search of pre-service EFL certificate teachers' attitudes towards technology. *Procedia Computer Science*, *3*, 666-671. doi:10.1016/j.procs.2010.12.111

Zhelezovskaia, I. (2016). A case study of the English language teachers' attitudes towards use of information and communication technology (ICT) in Finland.

APPENDICES

A. Technology Adoption and TPACK Questionnaire

Dear Participant,

I'm a Master's Degree student at Bahçeşehir University, English Language and Teaching Department. Together with my advisor Prof. Mustafa Polat, we are conducting a research titled "The relationship between pre-service EFL teachers' technology adoption and their Technological, Pedagogical, and Content Knowledge (TPACK) competency." The aim of this study is to find out how much pre-service EFL teachers use and adopt technology in their life, and what TPACK competency level they have and if there is a relation between the two. The survey consists of questions for your personal data, a rubric to determine your technology adopter category index, and a likert-scale questionnaire to obtain information about your technological, pedagogical and content knowledge competency.

To be able to collect my data, I'm in need of your sincere and honest contribution. The participation is voluntary. It will take approximately 15 minutes to complete. Your answers will only be used for the purpose of this study. If you don't like to participate, you can leave it whenever you want. I feel really grateful and thank you for your valuable time and statements.

If you have any questions or would like to have more information about the study, don't hesitate to get into touch with us.

Merve ŞENEN senenmerve@gmail.com
Assist. Prof. Mustafa POLAT mustafa.polat@es.bau.edu.tr

PART I

Demographic Information

1. What is your gender? *

☐ Female

☐ Male

2. What is your expected GPA score? *

☐ Between 0 and 1,99

☐ Between 2,00 and 2,49

☐ Between 2,50 and 2,99

☐ Between 3,00 and 3,49

☐ Between 3,50 and 4,00

3. How many technological devices do you have? (Computer, tablet, smartphone, smartwatch, VR headset, drone, e-reader etc.) *

☐ None

☐ 1-3

☐ 4-6

☐ 6-9

☐ More

4. How much time do you spend on the Internet on a daily basis? *

☐ Less than 1 hour

☐ Between 1 and 3 hours

☐ Between 4 and 6 hours

☐ More than 7 hours

5. How do you spend your time on the Internet? Please check the activities that you do. *

☐ Dealing with e-mail

☐ Playing games

- ☐ Shopping online
- ☐ Using social networks
- ☐ Reading the news
- ☐ Visiting forums
- ☐ Academic purposes
- ☐ Getting information on a topic
- ☐ Others: _____

PART II

TACI

How do you approach to new technology? Please choose the statement that best describes you about your adoption of new technology. *

- ☐ I tend to latch onto new technology as soon as it is available to me. My interest lies more with the technology itself than with its application to specific problems.
- ☐ In between 1 and 3
- ☐ I explore new technologies for their potential to bring about improvements. I am willing to try new things, and am not averse to occasional failure.
- ☐ In between 3 and 5
- ☐ I adopt a “wait and see” attitude toward new technology, and want examples of close-to-home successes before adopting. I want to see value in an innovation before adopting it.
- ☐ In between 5 and 7
- ☐ I accept new technology later in the game, once the technology has become established among the majority.
- ☐ In between 7 and 9
- ☐ I am usually not interested in adopting new technology.

PART III

TPACK-Deep Scale

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1. I can update an instructional material (paper based, electronic, or multimedia materials, etc.) based on the needs (students, environment, duration, etc.) by using technology.	◯	◯	◯	◯	◯
2. I can use technology to determine students' needs related to a content area in the pre-teaching process.	◯	◯	◯	◯	◯
3. I can use technology to develop activities based on student needs to enrich the teaching and learning process.	◯	◯	◯	◯	◯
4. I can plan the teaching and learning process according to available technological resources.	◯	◯	◯	◯	◯
5. I can conduct a needs analysis for technologies to be used in the teaching and learning process to increase the quality of teaching.	◯	◯	◯	◯	◯
6. I can optimize the duration of the lesson by using technologies (educational software, virtual labs, etc.)	◯	◯	◯	◯	◯
7. I can develop appropriate assessment tools by using technology.	◯	◯	◯	◯	◯
8. I can combine appropriate methods, techniques and technologies by evaluating their attributes in order to present the content effectively.	◯	◯	◯	◯	◯
9. I can use technology to appropriately design materials to the needs for an effective teaching and learning process.	◯	◯	◯	◯	◯
10. I can organize the educational environment in an appropriate way to use technology.	◯	◯	◯	◯	◯
11. I can implement effective classroom management in the teaching and learning process in which technology is used.	◯	◯	◯	◯	◯

12. I can assess whether students have the appropriate content knowledge by using technology.	◯	◯	◯	◯	◯
13. I can apply instructional approaches and methods appropriate to individual differences with the help of technology.	◯	◯	◯	◯	◯
14. I can use technology for implementing educational activities such as homework, projects, etc.	◯	◯	◯	◯	◯
15. I can use technology based communication tools (blog, forum, chat, e-mail, etc.) in the teaching process.	◯	◯	◯	◯	◯
16. I can use technology for evaluating students' achievement in related content areas.	◯	◯	◯	◯	◯
17. I can be an appropriate model for the students in following codes of ethics for the use of technology in my teaching.	◯	◯	◯	◯	◯
18. I can guide students in the process of designing technology based products (presentations, games, films, etc.).	◯	◯	◯	◯	◯
19. I can use innovative technologies (Facebook, blogs, twitter, podcasting, etc.) to support the teaching and learning process.	◯	◯	◯	◯	◯
20. I can use technology to update my knowledge and skills in the area that I will teach.	◯	◯	◯	◯	◯
21. I can update my technological knowledge for the teaching process.	◯	◯	◯	◯	◯
22. I can use technology to keep my content knowledge updated.	◯	◯	◯	◯	◯
23. I can provide each student equal access to technology.	◯	◯	◯	◯	◯
24. I can behave ethically in acquiring and using special/private information-which will be used in teaching a subject area-via technology (audio records, video records, documents, etc.).	◯	◯	◯	◯	◯
25. I can use technology in every phase of teaching and learning process by considering the copyright issues (e.g. license).	◯	◯	◯	◯	◯

26. I can follow the teaching profession's codes of ethics in online educational environments (WebCT, Moodle, etc.).	◯	◯	◯	◯	◯
27. I can provide guidance to students by leading them to valid and reliable digital sources.	◯	◯	◯	◯	◯
28. I can behave ethically regarding the appropriate use of technology in educational environments.	◯	◯	◯	◯	◯
29. I can troubleshoot problems that could be encountered with online educational environments (WebCT, Moodle, etc.).	◯	◯	◯	◯	◯
30. I can troubleshoot any kind of problem that may occur while using technology in any phase of the teaching-learning process.	◯	◯	◯	◯	◯
31. I can use technology to find solutions to problems (structuring, updating and relating the content to real life, etc.).	◯	◯	◯	◯	◯
32. I can become a leader in spreading the use of technological innovations in my future teaching community.	◯	◯	◯	◯	◯
33. I can cooperate with other disciplines regarding the use of technology to solve problems encountered in the process of presenting content.	◯	◯	◯	◯	◯

- If you prefer being informed about the results of the study, please provide your contact information.

  _____

B. Curriculum Vitae

PERSONAL INFORMATION

Surname, Name: Şenen, Merve

Nationality: Turkish (T.C.)

Date and Place of Birth: 10 January 1993, Sivas

Marital Status: Single

E-mail: senenmerve@gmail.com

EDUCATION

Degree	Institution	Year of Graduation
BS	Uludağ University	2015
High School	Halil Rıfat Paşa Lisesi	2011

WORK EXPERIENCE

Year	Place	Enrollment
2015-2017	Private Beykent Schools	English Teacher
2017- …	Kavram Vocational College	Preparation Class Instructor

FOREIGN LANGUAGES

Advanced English, Basic Spanish

HOBBIES

Tennis, Handcrafting, Movies and Series, Travelling