






## A technological pedagogical content knowledge (TPACK) assessment of pre-service EFL teachers learning to teach English as a foreign language

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### Abstract

The aim of the present paper is to measure the technological pedagogical content knowledge (TPACK) of pre-service EFL teachers learning to teach English as a foreign language (EFL). In order to collect data, a survey, designed and validated by Başer et al. (2016), was used. The survey consists of five sections which are technological knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK) and a fifth section that combines technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK items. This survey intends to assess pre-service EFL teachers' competencies in pedagogies and technologies. The present study is quantitative in nature. The participants of the study are 77 pre-service EFL teachers. The results indicate that pre-service EFL teachers have a satisfactory level of competence in technological pedagogical content knowledge; yet, there are also some areas in which they need development.

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**Keywords:** English as a foreign language; technology integration; technological pedagogical content knowledge; teacher education; assessment

## 1. Introduction

The introduction of the concept “technological pedagogical content knowledge” (TPACK) to educational research is a recent development. The concept was put forward by Pierson (2001), followed by other researchers who focused on the content-specific nature of technology integration (Angeli & Valanides, 2005; Koehler & Mishra, 2005; Margerum-Leys & Marx, 2004; Wallace, 2004). It was adopted rapidly by researchers as a way of measuring the technology-related competence of teachers. In particular, the influential study of Mishra and Koehler (2006) highly popularized the construct of TPACK.

The concept of TPACK was predicated on Shulman's (1986) model of pedagogical content knowledge (PCK) with the integration of the construct of technological knowledge. There are three

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fundamental knowledge components in TPACK, namely pedagogical knowledge (PK), content knowledge (CK), and technological knowledge (TK). The basic claim of the model is that the proper combination of these fundamental knowledge components give way to four other types of knowledge, which are pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technological pedagogical content knowledge (TPACK) (see figure 1).

In line with the developments in the fields of knowledge and technology, a change in the qualities expected from teachers up until today has also taken place (Rakes, Fields & Cox, 2006: 420). Out of these qualities, integrating technology into classrooms appropriately comes to the forefront (Efe, 2011:230). In addition, teachers are also expected to train individuals who can efficiently use the latest technology. However, in order to realize these duties and expectations, teachers should possess the competence of using technology at a sufficient level.

When the fact that students can use technological devices such as smartphones, computers and tablets at ease is considered, teachers are expected to improve themselves in this field at least as much as their students do. Otherwise, teachers' lack of use of these technological tools, which are seen as a part of ordinary needs, may lead to disharmony among students and teachers.

## 2. Literature Review

Technology has improved tremendously since the invention of the fire or human beings' experiments with agricultural activities in the ancient times and it has transformed into an indispensable part of human beings' daily lives through inventions such as the phone, television, radio and the internet in communication, and planes, trains and automobiles in transportation (Bacanak, Karamustafaoglu, Köse, 2003:194). Accordingly, people should follow technological developments and know how to utilize them in order to make their lives easier in accordance with the changes in societies. They should first develop a passion for technology and as a result of this passion, they should allocate it a place in their lives.

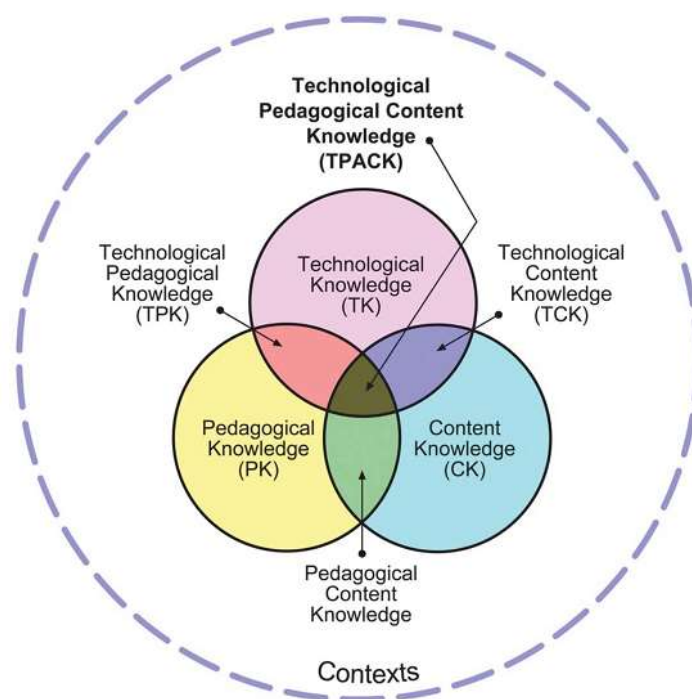
The technological revolution which maintains its effects in each field has made it mandatory to make some amendments to educational settings as a learning environment and their educational policies. In order to catch up with this change, bringing technology into institutions alone is not the only need. There is also the need to integrate technology into education settings appropriately and the learning process should be managed in an efficient and productive way.

In today's world, education and technology cannot be considered independent of each other and the integration of technology into education has become a necessity (Dumpit & Fernandez, 2017; Liao, 2007). The integration of technology as a tool is used for enriching students' learning, better understanding of the lesson contents and developing higher order thinking skills. According to Wachira and Keengwe (2011), the integration of technology into education can be defined as the appropriate integration of the procedures of learning and teaching, including the evaluation of lessons and learning outcomes, with the technology that is suitable for the goals.

Teachers who are one of the most significant components of classroom management have important responsibilities in this process. Some of these responsibilities are: having a positive attitude towards technology, being willing to use technology in learning environments and making use of all types of visual and auditory supplementary equipment in addition to textbooks, manuals and being open to all types of support to use the equipment (Adıgüzel & Berk, 2009:66).

## 2.1. The concept of TPACK

This concept has emerged as an efficient way of conceptualizing research and application in classrooms that are rich with regard to technology (Koehler, Mishra, Kereluik, Shin, & Graham, 2014). Researchers frequently used the concept of Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006) as a way to define the knowledge required for learning in the digital age (Chai, Koh & Tsai, 2013). Mishra and Koehler (2006, cited in Öz, 2015) organized the framework of the concept of TPACK in order to explain the dynamic relationship between content knowledge, pedagogical knowledge and technology knowledge. This framework can also be named as the emerging form that goes well beyond these three components and this framework forms the base of the teaching profession of the 21st century (figure 1.).



**Figure 1.** TPACK Model formed by Koehler & Mishra (2009)

When the figure above is analyzed, three main components which are regarded as necessary for the active use of technology in learning and teaching contexts are underlined. These components are “Technology Knowledge”, “Pedagogical Knowledge” and “Content Knowledge” (Konakman et al., 2013:63).

### 2.1.1. Technology knowledge (TK)

In addition to modern technologies such as computers, the internet and videos, technology knowledge includes widely-used overhead projectors, the blackboard and books (Mishra & Koehler, 2005; Koehler & Mishra, 2008: 7; Schmidh, Baran, Thompson, Mishra, Koehler, & Shin, 2009: 125).

This knowledge expresses technological literacy and the efficient use of types of technology and technological tools in both daily life and also education contexts. In comparison to the other types of knowledge in the model, it is more fluid and open to change. Consequently, it constantly renews and

updates itself. Mishra and Koehler (2006: 1024) stated that teachers should get support in this knowledge type as the dynamism of technology causes motion in each field it enters.

### 2.1.2. *Pedagogical knowledge (PK)*

In general terms, pedagogy is the response to the following questions through various views: What is learning and how does it take place? How does knowledge emerge and what is significant knowledge? and How is knowledge realized? (Özmantar, Akkoç & Bingölbali 2008:181).

The methods and techniques that are used pedagogically in TPACK are the tools for teaching contents in various ways considering the context in which students learn.

Moreover, the educational approach that is going to be used in a teaching process is also decided thanks to the pedagogical knowledge possessed (Konakman, Yanpar Yelken & Sancar Tokmak 2013:670). The teachers that do not have in-depth knowledge of pedagogy cannot provide sufficient answers to how students internalize knowledge and how they can have a positive attitude towards learning and science.

### 2.1.3. *Content knowledge (CK)*

All the knowledge a teacher possesses in a certain field, in which s/he has had education and will be teaching, is called content knowledge. This knowledge has a very significant place in educators' teaching life (Koehler & Mishra, 2009:70).

Considering the fact that the content knowledge a teacher has equals to the knowledge s/he will teach to students, it is possible that a teacher who does not have sufficient and sound content knowledge may transfer deficient or wrong knowledge to students. In order to prevent this, teachers should be open to all types of novelties and changes in their field. They should closely follow them and be able to apply them in teaching environments.

According to Shulman (1986:10), teachers must know and follow the frameworks that accommodate and organize all types of realities, concepts, theories, rules and ideas that are related to their field.

### 2.1.4. *Technological pedagogical content knowledge (TPACK)*

It consists of the three main knowledge types in addition to the mutual interaction between these knowledge types.

- a) Content knowledge,
- b) Pedagogical and
- c) Technology knowledge

It is a more different and comprehensive knowledge compared to the definitions of these components and it is at a higher level. Differentiating between the components that form TPACK is both difficult and also it leads to big losses in the process of learning and teaching.

On the other hand, there is also much criticism directed towards the structure of the TPACK framework (Koehler et al., 2014). Some researchers suggested that it is a difficult and meaningless task to try to define and describe the different knowledge types (Cox & Graham, 2009) and that it is insufficient to differentiate between the categories in a meaningful way (Archambault & Barnett, 2010). Graham (2011) claimed that the TPACK framework is usually implemented without clearly making out the complication it added to the original PCK framework, and Angeli and Valanides (2009) emphasized the need for a clearer definition regarding the nature of the central category of TPACK.

There is also an integrative perspective in which teachers integrate technology, pedagogical and content knowledge and form their own TPACK. In their experimental study, Cavanagh and Koehler

(2013) evaluated the use of the TPACK framework and they made suggestions by which researchers can aim for more valid results. The following table summarizes that basic constructs of TPACK.

**Table 1.** Summary of TPACK construct

TPACK construct	explanation
Content knowledge (CK)	Knowledge about the actual subject matter that is to be learned or taught
Pedagogical knowledge (PK)	Deep knowledge about methods of teaching and learning
Pedagogical content knowledge (PCK)	The blending of content and pedagogy into an understanding of how particular topics are presented for instruction
Technology knowledge (TK)	Knowledge of how to use technological tools such as hardware, software, and the Internet
Technological content knowledge (TCK)	Knowledge about the manner in which technology and content are mutually related
Technological pedagogical and content knowledge (TPACK)	Knowledge required to teach effectively with technology

(Adapted from Redmond & Peled, 2018)

### 3. The significance of the study

As is known, the changes and novelties in technology directly affect teaching processes. Especially, the fact that technology is related to learning-teaching processes is seen as significant for a complete learning to take place (Özgen, Narlı, Alkan, 2013: 44). To be more specific, it can be said that technology has the capacity to improve student comprehension and complex thinking skills (Dreyer & Nel, 2003; Kozma, 2003; Lei & Zhao, 2007), develop student motivation to learn (Papastergiou, 2009), and more importantly enhance students' 21st century skills (Kleiman, 2004).

Studies suggest that the integration of technology into education is beneficial for teachers and students in many respects. Some of these benefits are rapid knowledge transfer to students and creating individual learning environments; to achieve these goals, technology provides the interaction among all the stakeholders in the teaching process and it supports cooperative learning environments (İşman, 2002). The integration of technology is a multifaceted and slow process and it is stated that teachers have one of the most important duties in this process (Wachira & Keengwe, 2011). Excluding teachers from this process, ignoring the pedagogical uses of technology and simply equipping teaching environments with technological devices lead to an inefficient integration of technology (Ellis, Dare, & Roehrig, 2016).

On the other hand, many studies revealed that although teachers and pre-service teachers actively used computers and various technologies in their lives outside schools, they did not use education technologies in their classes at a sufficient level and they did not make an effort for this goal (Akkoyunlu & Kurbanoglu, 2003; Erdemir, Bakırcı & Eyduran, 2009).

There are a number of studies conducted on TPACK in Turkish context. One study, conducted by Kozikoğlu and Babacan (2019), found that the level of Turkish EFL teachers is relatively high and FATİH project contributed to this high level. Their study also found that EFL teachers' TPACK evaluations do not differ in relation to experience. In another study, which focused not only on EFL teachers but also teachers from different branches, was conducted by Durdu and Dag (2017). They found that the instructional process employed within the scope of the study contributed greatly to the TPACK development of teachers. They concluded that more attention should be paid to TPACK in teacher education programs. In another study conducted in Turkish context (Özer, 2018), the researcher found

that pre-service teachers use computers mostly for simple tasks such as sending e-mail and presenting presentations rather than more instructional purposes. The researcher also concludes more attention should be spared for the technology integration in teacher education programs.

TPACK also becomes the focus of a variety of studies. In a study conducted in China by Zhang, Liu, and Cai (2019) on primary school teachers, the results indicated that the teachers engaged in more extensive group collaborations had a rich, organized and flexible knowledge structure of TPACK. In terms of age effects, that study found that younger teachers turned out to be better in terms of pedagogical knowledge and pedagogical content knowledge, while more experienced teachers scored higher in terms of technological knowledge and pedagogical knowledge.

Similar to its prevalence in all the subfields of education, the use of technology is highly significant for English teaching as well. It may be thought that the pre-service teachers that do not have education in accordance with technology during undergraduate education will have insufficient skills when they start teaching. However, the teachers who improve themselves in their field, closely follow technology and integrate it into the classroom environment can be sufficient teachers. Consequently, it may be beneficial to compensate for these deficiencies by teachers' own opportunities or by the support of governments. This study aimed to examine pre-service English teachers' perceptions of technological pedagogical content knowledge. For this purpose, the following research questions were formulated:

1. What are the pre-service and in-service EFL teachers' perceptions of TPACK?
2. Do the participants' views on the sub-dimensions of TPACK differ in terms of gender, whether or not they have taken formation, or age?
3. Do the participants' views on the sub-dimensions of TPACK differ in terms of gender, whether or not they have taken formation, their status, or age?

#### **4. Method**

The present study is a quantitative study based on survey method.

##### *4.1. Participants*

The total number of the participants is 77. The number of female participants is 57 (74,0%) and male participants is 19 (24,7%). In terms of age, the number of those in 21-23 age range is 43 (55,8%), 24-28 age range is 20 (26,0%), and 29-over is 12 (15,6%). The number of pre-service teachers in the present study is 67 (87,0%) and in-service teachers is 7 (9,1%). Finally, 24 (31,4%) of the participants have taken teaching formation education and 13 (16,9%) of them haven't taken formation courses. The remaining part are either graduates of teaching departments or still students in teaching departments.

##### *4.2. Data collection tool*

In the present study, the scale which was developed and validated by Baser et al. (2016) was used. The scale consists of 7 sub-dimensions which are: (a) technological knowledge (TK), (b) content knowledge (CK), (c) pedagogical knowledge (PK), (d) pedagogical content knowledge (PCK), (e) technological content knowledge (TCK), (f) technological pedagogical knowledge (TPK), (g) technological pedagogical content knowledge (TPACK). The questionnaire is a 5-point Likert type questionnaire in which the answers range from strongly disagree (1), disagree (2), neutral (3), agree (4), to strongly agree (5). The reliability analysis of the questionnaire is given in Table 1.

**Table 2.** Reliability analysis

sub-dimension	number of items	Cronbach's alpha value
1. Technological knowledge (TK)	9	,843
2. Content knowledge (CK)	5	,836
3. Pedagogical knowledge (PK)	6	,853
4. Pedagogical content knowledge (PCK)	5	,865
5. Technological content knowledge (TCK)	3	,710
6. Technological pedagogical knowledge (TPK)	7	,893
7. Technological pedagogical content knowledge (TPACK)	4	,800
total	39	,946

## 5. Findings

*Research question 1: What are the pre-service and in-service EFL teachers' perceptions of TPACK?*

**Table 3.** Descriptive statistics regarding technological knowledge (TK)

items	N	Min.	Max	Mean	Std.
1. I can use basic technological terms (e.g. operating system, wireless connection, virtual memory, etc.) appropriately.	77	1,00	5,00	4,2597	,76782
2. I can adjust computer settings such as installing software and establishing an Internet connection	77	1,00	5,00	4,0649	,78368
3. I can use computer peripherals such as a printer, a headphone, and a scanner	77	2,00	5,00	4,2208	,77159
4. I can troubleshoot common computer problems (e.g. printer problems, Internet connection problems, etc.) independently.	77	1,00	5,00	3,7662	,94446
5. I can use digital classroom equipment such as projectors and smart boards	77	2,00	5,00	4,3247	,61647
6. I can use Office programs (i.e. Word, PowerPoint, etc.) with a high level of proficiency.	77	1,00	5,00	4,2208	,85260
7. I can create multimedia (e.g. video, web pages, etc.) using text, pictures, sound, video, and animation.	77	1,00	5,00	3,8961	,98120
8. I can use collaboration tools (wiki, edmodo, 3D virtual environments, etc.) in accordance with my objectives	77	1,00	5,00	3,5714	1,06904
9. I can learn software that helps me complete a variety of tasks more efficiently.	77	1,00	5,00	4,0649	,83252
total	77			4,04	

As can be understood from Table 2, the participants seem to agree the items regarding technological knowledge (TK) (M=4,04). The participants reported that they can use digital classroom equipment such as projectors and smart boards (M=4,34), and can use basic technological terms (e.g. operating system, wireless connection, virtual memory, etc.) appropriately (M=4,25), can use computer peripherals such

as a printer, a headphone, and a scanner (4,22). Finally, most of the participants stated that they could use Office programs (i.e. Word, PowerPoint, etc.) with a high level of proficiency (M=4,22).

**Table 4.** Descriptive statistics regarding content knowledge (CK)

items	N	Min.	Max.	Mean	Std.
1. I can express my ideas and feelings by speaking in English.	77	2,00	5,00	4,2078	,69467
2. I can express my ideas and feelings by writing in English.	77	2,00	5,00	4,3506	,68376
3. I can read texts written in English with the correct pronunciation.	76	1,00	5,00	4,0921	,73353
4. I can understand texts written in English.	77	3,00	5,00	4,2727	,57666
5. I can understand the speech of a native English speaker easily.	77	1,00	5,00	3,7922	,87866
Total	77			4,14	

In relation to content knowledge (CK), the participants agreed the items in this category. Most of the participants reported that they can express their ideas and feelings by writing in English (M=4,35), understand texts written in English (M=4,27), and can express their ideas and feelings by speaking in English (M=4,20).

**Table 5.** Descriptive statistics regarding pedagogical knowledge (PK)

items	N	Min.	Max.	Mean	Std.
1. I can use teaching methods and techniques that are appropriate for a learning environment.	77	3,00	5,00	4,0395	,55235
2. I can design a learning experience that is appropriate for the level of students.	77	1,00	5,00	4,0260	,70662
3. I can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences.	77	3,00	5,00	4,1039	,68026
4. I can collaborate with school stakeholders (students, parents, teachers, etc.) to support students' learning.	77	3,00	5,00	4,1169	,62774
5. I can reflect the experiences that I gain from professional development programs to my teaching process.	77	3,00	5,00	4,1299	,63558
6. I can support students' out-of-class work to facilitate their self-regulated learning.	77	3,00	5,00	4,1039	,66063
total	77			4,08	

Table 4 presents the descriptive statistics regarding pedagogical knowledge. As we can understand from Table 4, the participants “agreed” on the issues related to their self-evaluation of pedagogical knowledge. In particular, most of the participants believe that they can reflect the experiences that they gain from professional development programs (M=4,12), collaborate with school stakeholders (students, parents, teachers, etc.) to support students' learning (M=4,11). In addition, they also think that they can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences (M=4,10) and support students' out-of-class work to facilitate their self-regulated learning (M=4,10).

**Table 6.** Descriptive statistics regarding pedagogical content knowledge (PCK)

items	N	Min.	Max.	Mean	Std.
1. I can manage a classroom learning environment.	77	3,00	5,00	4,1688	,57130
2. I can evaluate students' learning processes.	77	3,00	5,00	4,1169	,66834
3. I can use appropriate teaching methods and techniques to support students in developing their language skills.	77	2,00	5,00	4,1169	,62774



4. I can prepare curricular activities that develop students' language skills.	76	3,00	5,00	4,0921	,56986
5. I can adapt a lesson plan in accordance with students' language skill levels	77	3,00	5,00	4,1299	,63558
total	76			4,12	

The next sub-dimension is concerned about pedagogical content knowledge (PCK). The participants seem to have agreed on the items related to this category. Specifically, the participants reported that they can manage a classroom learning environment (M=4,16) and adapt a lesson plan in accordance with students' language skill levels (M= 4,12). In addition, it can be said that the participants can evaluate students' learning processes (M=4,11) and use appropriate teaching methods and techniques to support students in developing their language skills (M=4,11).

**Table 7.** Descriptive statistics regarding technological content knowledge (TCK)

items	N	Min.	Max.	Mean	Std.
1. I can take advantage of multimedia (e.g. video, slideshow, etc.) to express my ideas about various topics in English.	77	3,00	5,00	4,3377	,55275
2. I can benefit from using technology (e.g. web conferencing and discussion forums) to contribute at a distance to multilingual communities.	77	3,00	5,00	4,0260	,72501
3. I can use collaboration tools to work collaboratively with foreign persons (e.g. Second Life, wiki, etc.)	77	2,00	5,00	3,7273	,73693
total	77			4,03	

The mean score for technological content knowledge (TCK) is 4,03, which indicates that the participants agree on the items in this category. Most of the participants stated that they can take advantage of multimedia (e.g. video, slideshow, etc.) in expressing their ideas about various topics in English (M=4,33) and benefit from using technology (e.g. web conferencing and discussion forums) to contribute at a distance to multilingual communities (M= 4,02)

**Table 8.** Descriptive statistics regarding technological pedagogical knowledge (TPK)

items	N	Min.	Max.	Mean	Std.
1. I can meet students' individualized needs by using information technologies.	77	2,00	5,00	3,9740	,64836
2. I can lead students to use information technologies legally, ethically, safely, and with respect to copyrights.	77	2,00	5,00	3,9481	,68626
3. I can support students as they use technology such as virtual discussion platforms to develop their higher order thinking abilities.	77	2,00	5,00	4,0000	,62828
4. I can manage the classroom learning environment while using technology in the class.	77	3,000	5,000	4,19737	,566150
5. I can decide when technology would benefit my teaching of specific English curricular standards.	77	2,00	5,00	4,2208	,66141
6. I can design learning materials by using technology that supports students' language learning.	77	3,00	5,00	4,2727	,59904
7. I can use multimedia such as videos and websites to support students' language learning.	77	3,00	5,00	4,3896	,56559
total	77			4,14	

As for technological pedagogical knowledge (TPK), the participants agree that they have sufficient proficiency in technological pedagogical knowledge. A big number of the participants stated that they can use multimedia such as videos and websites to support students' language learning (M=4,38) and 6.

design learning materials by using technology that supports students' language learning (M=4,27). Moreover, the participants also reported that they feel sufficient in terms of deciding when technology would benefit my teaching of specific English curricular standards (M=4,22) and managing the classroom learning environment while using technology in the class (M=4,19)

**Table 9.** Descriptive statistics regarding technological pedagogical content knowledge (TPACK)

items	N	Min.	Max.	Mean	Std.
1. I can use collaboration tools (e.g. wiki, 3D virtual environments, etc.) to support students' language learning.	77	2,00	5,00	3,8158	,76089
2. I can support students as they use technology to support their development of language skills in an independent manner.	77	2,00	5,00	4,0533	,63445
3. I can use Web 2.0 tools (animation tools, digital story tools, etc.) to develop students' language skills.	77	1,00	5,00	3,7632	,83056
4. I can support my professional development by using technological tools and resources to continuously improve the language teaching process	77	2,00	5,00	4,0658	,69925
total	77			3,92	

Finally, when it comes to self-evaluation of participants in terms of technological pedagogical content knowledge (TPACK), it can be seen that the participants seem to have almost agreed. They agree that they are supposed to support their professional development by means of technological tools and resources to continuously enhance the language teaching process (M=4,06) and support students as they use technology to support their development of language skills in an independent manner (M=4,05). However, as to Web 2.0 tools, the participants do not seem to have sufficient knowledge or expertise (M=3,76)

*Research question 2: Do the participants' views on the sub-dimensions of TPACK differ in terms of (a) gender, (b) whether or not they have taken formation, (c) their status, or (d) age?*

(a) gender

**Table 10.** The results of Mann Whitney-U test

	gender	N	Mean	Std. Deviation	Std. Error Mean	Asym.Sig (2-tailed)
TK	female	57	3,9805	,53622	,07102	0.015*
	male	19	4,3275	,44363	,10178	
CK	female	57	4,0737	,55887	,07402	0.102
	male	19	4,3263	,53421	,12256	
PK	female	57	4,0760	,48496	,06423	0.757
	male	19	4,1053	,52473	,12038	
PCK	female	57	4,1193	,46730	,06190	0.932
	male	19	4,1474	,58819	,13494	
TCK	female	57	4,0234	,54138	,07171	0.731
	male	19	4,0526	,55847	,12812	
TPK	female	57	4,1328	,48208	,06385	0,450
	male	19	4,1805	,51252	,11758	
TPACK	female	57	3,9123	,60225	,07977	0.976
	male	19	3,8947	,54846	,12582	

\*: significant at  $\alpha=0.05$

Within the scope of the study, the researchers examined whether the participants differ in their self-evaluation based on gender. Mann-Whitney-U test was utilized in order to compare the results of male and female participants. The rest results indicate that there is statistically significant difference in terms of TK sub-dimension ( $p=0.015 < \alpha=0.05$ ). Male participants agreed more on the items compared to female participants. In general, males tend to have more self-confidence in relation to technology use. As for the other sub-dimensions, no statistically significant difference was observed ( $p > \alpha=0.05$ ).

(b) status (in-service or pre-service)

**Table 11.** Mann-Whitney-U test results as to the status of the participants

	status	N	Mean	Std. Deviation	Std. Error Mean	Asym.Sig (2-tailed)
TK	pre-service	67	4,0431	,53600	,06548	0,718
	in-service	7	4,0794	,44312	,16748	
CK	pre-service	67	4,0806	,55165	,06739	0.030*
	in-service	7	4,6000	,50332	,19024	
PK	pre-service	67	4,0597	,50059	,06116	0,195
	in-service	7	4,3095	,44544	,16836	
PCK	pre-service	67	4,0716	,47572	,05812	0,015*
	in-service	7	4,5429	,47208	,17843	
TCK	pre-service	67	4,0199	,55620	,06795	0,870
	in-service	7	4,0000	,33333	,12599	
TPK	pre-service	67	4,1279	,47844	,05845	0,412
	in-service	7	4,2449	,63199	,23887	
TPACK	pre-service	67	3,8955	,60326	,07370	0,925
	in-service	7	3,9286	,47246	,17857	

In order to compare the results based on the status of the participants, Mann-Whitney-U test was utilized. Based on the results, moderately significant difference in CK and PCK between in-service and pre-service teachers ( $p < \alpha=0.05$ ). As for these sub-dimensions, in-service teachers agree with the items more than pre-service teachers. This may be attributed to experience. No statistically significant difference was observed for the other five sub-dimensions ( $p > \alpha=0.05$ ).

(c) whether or not they have taken formation

**Table 12.** Mann-Whitney-U test results as to whether or not the participants have taken formation

	teaching certificate	N	Mean	Std. Deviation	Std. Error Mean	Asym.Sig (2-tailed)
TK	yes	24	4,0926	,45242	,09235	1,000
	no	13	4,1282	,60152	,16683	
CK	yes	24	4,1083	,42520	,08679	0,759
	no	13	4,0000	,71181	,19742	
PK	yes	24	4,0486	,50476	,10303	0,910
	no	13	3,9103	,52974	,14692	
PCK	yes	24	4,1167	,51047	,10420	0,744
	no	13	4,0000	,57735	,16013	
TCK	yes	24	4,0833	,59992	,12246	0,667
	no	13	4,1282	,58592	,16251	
TPK	yes	24	4,1607	,52161	,10647	0,771

	no	13	4,1429	,52812	,14647	
TPACK	yes	24	3,8958	,53118	,10843	0,281
	no	13	4,0192	,57247	,15878	

Table 11 presents the results as to whether participants self-perceptions change based on whether they have taken teacher certificate courses or nor. The results indicate that there are no statistically significant differences in the participants self-evaluation in terms of the sub-dimensions of TPACK ( $p > \alpha = 0.05$ ).

(d) age

**Table 13.** Kruskal Wallis test results for age

		N	Mean	Std. Deviation	Std. Error	Asym.Sig (2-tailed)
TK	21-23	43	4,0258	,52946	,08074	0,469
	24-28	20	4,1556	,62688	,14018	
	29-over	12	4,1389	,31826	,09187	
	Total	75	4,0785	,52808	,06098	
CK	21-23	43	4,0605	,52651	,08029	0,011*
	24-28	20	4,0600	,62945	,14075	
	29-over	12	4,5667	,38925	,11237	
	Total	75	4,1413	,56259	,06496	
PK	21-23	43	4,0426	,47850	,07297	0,198
	24-28	20	4,0417	,56163	,12558	
	29-over	12	4,3056	,40722	,11755	
	Total	75	4,0844	,49500	,05716	
PCK	21-23	43	4,0233	,46845	,07144	0,015*
	24-28	20	4,1300	,49108	,10981	
	29-over	12	4,5000	,47863	,13817	
	Total	75	4,1280	,49934	,05766	
TCK	21-23	43	4,0000	,57275	,08734	0,598
	24-28	20	4,0333	,53966	,12067	
	29-over	12	4,1667	,46057	,13295	
	Total	75	4,0356	,54407	,06282	
TPK	21-23	43	4,0897	,49391	,07532	0,348
	24-28	20	4,1571	,49029	,10963	
	29-over	12	4,3333	,46524	,13430	
	Total	75	4,1467	,48982	,05656	
TPACK	21-23	43	3,8721	,63474	,09680	0,693
	24-28	20	3,9125	,48852	,10924	
	29-over	12	4,0833	,55732	,16088	
	Total	75	3,9167	,58462	,06751	

Finally, Kruskal Wallis test was run in order to see whether the self-evaluations of the participants differ in terms of age. The results indicate that there are statistically significant differences in CK and PCK ( $p < \alpha = 0.05$ ). The “29-over” age group seems to rate themselves higher compared to “21-23” and “24-28” age group. This indicates that as language teachers get older they become more knowledgeable in terms of CK and PCK.

## 6. Discussion and conclusion

The present study was intended to measure the TPACK level of pre-service EFL teachers. TPACK, as is handled in the present study, consists of a number of sub-dimensions which are: (a) technological knowledge (TK), (b) content knowledge (CK), (c) pedagogical knowledge (PK), (d) pedagogical content knowledge (PCK), (e) technological content knowledge (TCK), (f) technological pedagogical knowledge (TPK), (g) technological pedagogical content knowledge (TPACK).

Based on the self-evaluation of the participants, it was seen that they view themselves sufficient in terms almost all sub-dimensions of TPACK. In terms of technological knowledge (TK), they were found to be particularly efficient in using digital classroom equipment such as projectors and smart boards in addition to being able to use office programs and other technological gadgets. In relation to content knowledge (CK), it was found that they can express their feelings in written English and understand texts. As for pedagogical knowledge, they reported that they can reflect on the experiences that they gained from their practicum process, they can collaborate with their friends, and can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences.

As for pedagogical content knowledge (PCK), the study found that the participants feel themselves competent in terms of managing a classroom environment, adapting a lesson plan in accordance with students' skills, and evaluate students' learning process. When it comes to technological content knowledge (TCK), it was observed that the participants are good at using multimedia (e.g. video, slideshow, etc.) in expressing their ideas about various topics in English and benefit from using technology (e.g. web conferencing and discussion forums) to contribute at a distance to multilingual communities. Finally, regarding self-evaluation, the participants reported that they can support their professional development by using technological tools and resources to continuously improve the language teaching process and support students as they use technology to support their development of language skills in an independent manner. However, as to Web 2.0 tools, the participants do not seem to have sufficient knowledge or expertise.

Another focus of the study was to compare and contrast male and female participants in terms of the sub-dimensions of TPACK. The results of the tests indicated that male participants seem to be better in technological knowledge. Finally, age was another important factor that determine the participants' views on TPACK. Most of the time, in technology-related studies age negatively correlates with technology-related knowledge domains (Cheng & Xie, 2018; Koh et al., 2014). However, the results of the present study showed that the older the participants are the more likely to agree with statements.

In general, the present study indicates that teachers have from moderate to high levels of TPACK. It is accepted literature that teacher knowledge affects teachers' actions in the classroom in addition to affecting student learning. As such, a sound TPACK implies that teachers can utilize technology in the classroom and enhance student learning. However, in cases where teachers have relatively low level of TPACK, it may be difficult to mobilize their knowledge and move them beyond their knowledge, as indicated in literature (McDougall, 2008). Hence, extensive in-service training is needed to mobilize the means of teachers in terms of TPACK.

A number of suggestions can be drawn from the present study. In the first place, the present study did not include year of experiment as a variable on the premise that the participants of the present study were all pre-service teachers and therefore do not have any experience. Another important dimension of TPACK can be the correlations between personality characteristics and TPACK, which is indicated in the literature (Inan & Lowther, 2010; Cheng & Xie, 2018; Koh, Chai, & Tay, 2014; Scherer et al., 2018). Future studies can be designed to investigate personality types and TPACK. Another important dimension can be school type. From the literature, it can be understood that primary school teachers seem to have lower levels of TPACK (Koh, Chai, & Tsai, 2014). The reasons behind this can be examined. Finally, teachers' academic background can also be taken into consideration in relation to TPACK (Cheng & Xie, 2018; Erdogan & Sahin, 2010).

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## İngilizce’yi yabancı dil olarak öğretecek öğretmen adaylarının teknopedagojik eğitim bilgilerinin bir değerlendirilmesi

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### Öz

Bu çalışmanın amacı, İngilizce öğretimi üzerine eğitim alan İngiliz Dili Eğitimi (İDE) öğretmen adaylarının teknopedagojik eğitim bilgilerini ölçmektir. Veri toplamak amacıyla Başer et al. (2016) tarafından tasarlanan ve güvenilirliği kanıtlanan bir sormaca kullanılmıştır. Sormaca, beş bölümden oluşmaktadır: teknolojik yeterlik, içerik bilgisi, pedagojik yeterlik, pedagojik içerik bilgisi, ve bunları bir araya getiren teknolojik içerik bilgisi, teknolojik pedagojik yeterlik ve teknopedagojik eğitim bilgisi maddeleri. Sormaca, İDE öğrencilerinin pedagojik ve teknolojik olarak yeterliklerini ölçmeyi hedeflemektedir. Çalışma nicel bir çalışmadır. Çalışmanın katılımcıları, 77 İngilizce öğretmen adayıdır. Sonuçlar, İngilizce öğretmeni adaylarının yeterli derecede teknolojik ve pedagojik yeterliğe sahip olduğunu göstermektedir; ancak, gelişmeye ihtiyacı olan alanlar da vardır.

*Anahtar sözcükler:* İngilizce’nin yabancı dil olarak öğretimi; teknoloji entegrasyonu; teknopedagojik eğitim bilgileri; öğretmen yetiştirme; değerlendirme

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