

Research Article

A Meta-Synthesis Study: An Investigation of Studies on EFL Teachers' Technological Pedagogical Content Knowledge (TPACK) Competencies in Turkey

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Abstract

Technological advances have brought profound transformations into the education system. This transformation has also made it essential to use technological tools for educational aims in the 21st century. The goal of this study is to analyze a collection of studies on prospective and in-service EFL educators' technological pedagogical content knowledge (TPACK) competencies in Turkey regarding the purpose, method, participants, data collection tools, and findings of certain studies. The study includes meta-synthesis research to present the research tendencies on TPACK competencies of pre-service and in-service EFL teachers in Turkey. In the research, a total of 22 studies were included 11 articles and 11 theses which were published between the years 2017-2022. In light of the obtained results, it can be concluded that the research trend of the remarkable number of reviewed studies is related to the determination or measuring of TPACK perceptions and to examining the effect of demographic traits such as gender, age, and educational background on EFL teachers' TPACK levels. In the last part of the research, practical implications and suggestions for further research were offered in detail.



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Introduction

Social, economic, and technological advances in the 21st century have brought profound transformations in the education system. In this context, learners need to acquire some skills defined as 21st-century skills beyond their basic knowledge and competencies to be able to successfully adapt to these advances (Trilling & Fadel, 2009). Therefore, educators, professionals, and business leaders created the P21 frame for 21st-century learning by expressing the knowledge, expertise, and support systems that students need to acquire at work, in life, and in citizenship.

21st-century skills consist of twelve sub-dimensions under three main categories which are “learning& innovation skills”, “information, media & technology skills”, and “life & career skills”. Learning & innovation skills include “creativity & innovation”, “critical thinking” & “problem-solving”, “communication, and collaboration skills”. The second category, -information, media & technology skills- consists of “information literacy”, “media literacy”, and “ICT literacy”. The last category –life & career skills- consists of “flexibility & adaptability”, “initiative & self-direction”, “social & cross-cultural skills”, “productivity & accountability”, and “leadership & responsibility”. Figure 1 presents three main categories and twelve sub-dimensions:

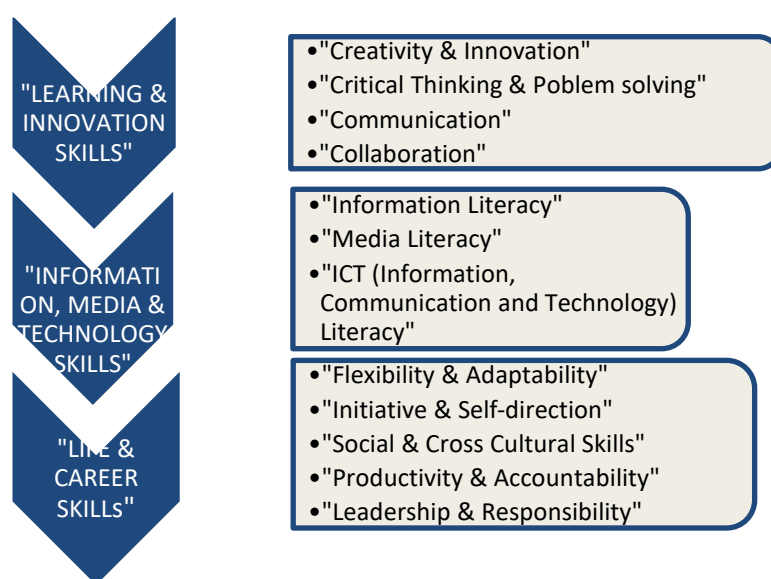


Figure 1. Framework for 21st-century learning (Battelle for Kids, 2019)

All concepts of the framework presented in Figure 1 have a significant role in ensuring every student is ready for the 21st century. Mastery of 21st-century skills is the only way to student achievement. In this context, the emergence of 21st-century skills forces educators to utilize technological materials and multimedia technologies in the field of education (Niess, 2005). Today’s teachers are required to provide learning environments that provide equal access to learning applications, digital technologies, and all kinds of resources and offer innovative learning approaches integrating the use of emerging technologies, inquiry-based learning, and 21st-century skills into their classrooms. Therefore, for educators, the way to provide effective learning environments for students to achieve 21st-century abilities is to own the knowledge and abilities required by the developing technology. Lee and Tsai (2010) stated that teachers should successfully utilize their pedagogical, technological, and content skills so as to replace classrooms from teacher-

centered settings with collaborative and interactive places. In this aspect, this new knowledge base has revealed a new concept in education which is called “Technological Pedagogical Content Knowledge” (TPACK) (Mishra & Koehler, 2006).

Theoretical Considerations

Today’s youth contemplate and process knowledge in a mainly different way than their predecessors as they “are all native speakers of the digital language of computers, video games, and the Internet” (Prensky, 2001). For this reason, a new term comes into existence for this generation: “digital natives”. Prensky (2001) indicated that “Today’s average college grads have spent less than 5,000 hours of their lives reading, but over 10,000 hours playing video games (not to mention 20,000 hours watching TV). Computer games, email, the Internet, cell phones, and instant messaging are integral parts of their lives.” Similarly, Bilgiç, Duman & Seferoğlu (2011) explained the traits of this generation as: “... 21st-century children and youth who have begun their lives with today’s technologies, where online environments and new technologies are at the center of their lives, and who carry out all their daily work with technology”. Therefore, today’s digital native students have higher expectations from their teachers than students who do not have digital native characteristics (Cabi, 2015). For educators, being aware of the characteristics of digital natives is an essential issue in order to offer these students more accurate and more effective teaching environments (Bilgiç et al., 2011).

However, teachers’ abilities, knowledge, and competencies in technology might be insufficient compared to the digital native students (Lim & Khine, 2006). Additionally, some educators may not have relevant experiences in utilizing technology to support their teaching procedure and their efforts to make use of technology might be limited to integrating it into their classrooms efficiently (Koehler, Mishra, Kereluik, Shin, & Graham, 2013). Therefore, teachers should know the subject to be taught well, have pedagogical content knowledge appropriate for the characteristics of the target group, and be able to use technology effectively in their classrooms. Mishra and Koehler explained these requirements in 2006 with the framework of Technological Pedagogical Content Knowledge.

From “Pedagogical Content Knowledge” (PCK), the theoretical concept known as “Technological Pedagogical Content Knowledge” (TPACK) was constructed by Shulman (1986). Shulman (1986) defines PCK as “it represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized,

represented, and adapted to the diverse interests and abilities of learners, and presented for instruction (p. 8)".

Later, due to technological developments in education, Mishra and Koehler (2006) revealed Technological Pedagogical Content Knowledge (TPACK), which is basically a theoretical framework that emerged by adding technological knowledge to PCK developed by Shulman in 1986. Koehler and Mishra (2008) express TPACK as "an understanding that emerges from an understanding of the interaction of content, pedagogy, and technology knowledge". The TPACK framework consists of three main constructs which are "technological knowledge (TK)", "pedagogical knowledge (PK)", and "content knowledge (CK)". In Figure 2, interactions between the main domains are called "Pedagogical Content Knowledge" (PCK), "Technological Pedagogical Knowledge" (TPK), and "Technological Content Knowledge" (TCK). The center signifies "Technological Pedagogical Content Knowledge" (TPACK). The center signifies "Technological Pedagogical Content Knowledge" (TPACK).

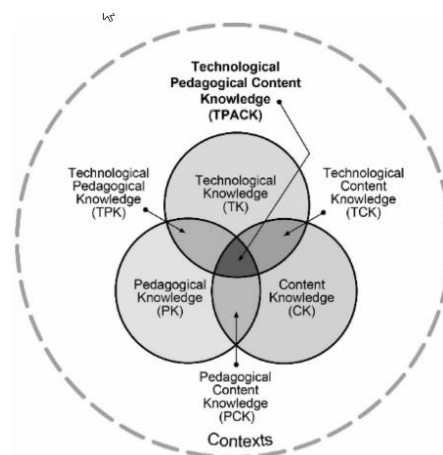


Figure 2. The framework of TPACK (Mishra & Koehler, 2006)

As seen in Figure 2, content knowledge (CK) is teachers' own knowledge of the main subject to be taught (Mishra & Koehler, 2006). Pedagogical knowledge (PK) is "teachers' deep knowledge about the processes and practices or methods of teaching and learning" (Koehler & Mishra, 2009). Technological knowledge (TK) is knowledge about a variety of technologies, from ordinary technologies to advanced digital technologies (Pamuk, Çakır, Ergun, Yılmaz & Ayas, 2013). Pedagogical content knowledge (PCK) consists of the knowledge and competencies educators have with respect to the teaching of content (Shulman, 1986). Technological pedagogical knowledge (TPK) is the ability of digital technologies can be utilized in the procedure of teaching (Schmidt, Baran, Thompson, Mishra, Koehler & Shin, 2009). Technological content knowledge (TCK) is "an understanding

of the technologies that may be utilized in a given discipline and how the use of those technologies transforms the content of that discipline through representation or the generation of new content” (Cox, 2008). Technological pedagogical content knowledge is defined by Koehler and Mishra (2009, p.66) as an understanding that appears as the interaction between these layers of knowledge by simultaneously integrating technology, pedagogy, and content knowledge.

Empowering teachers on technology and its values in education ensures efficient and continuous use of technology during teaching (Rahimi & Pourshahbaz, 2018). Therefore, for language teachers, computer literacy is necessary for an appropriate and efficient teaching procedure. Teachers need to empower themselves with the technology in their classrooms so that they can take on the responsibility of raising their digital native students. It is reported that computer literacy is one of the main factors that helps teachers to teach efficiently and effectively in the digital age (Konan, 2010) and to guarantee professional and personal success (Shapka & Ferrari, 2003). Therefore, ICT tools are an essential component in EFL education because of their skills to reveal new opportunities in the classroom not found in traditional settings. Therefore, undergraduate training is crucial to developing EFL teachers' usage of ICT in their classrooms (Gao, Choy, Wong & Wu, 2009). However, the technology education that teachers receive in their undergraduate education is insufficient (Usta & Korkmaz, 2010). For this reason, EFL teachers might consider themselves inadequate for the students of the 21st century.

In the literature, although there are a variety of studies on pre-service EFL teachers (Baran & Uygun, 2016; Kaçar, 2022) and in-service teachers EFL teachers' (Yıldız, 2020) TPACK competencies in Turkey regarding different factors in recent years, limited research (Arslan, 2021; Ekmekçi, 2018) has been a meta-synthesis analysis that reveals what kind of research tendencies there is in Turkey regarding pre-service and in-service EFL teachers' TPACK competencies.

The study conducted by Arslan (2021) conducted a meta-synthesis analysis on Tpack competencies of pre-and in-service EFL teachers in Turkey in terms of publication years, purposes of the studies, subject groups, data collection tools, findings, and suggestions between 2010-2020 years in order to reveal research tendencies of studies in the field of EFL in Turkey. For this purpose, 24 studies (14 articles and 9 MA, and 1 Ph.D. thesis) published in Turkey were examined between the specific years. The results indicated that most of the

reviewed studies are carried out to find out the status quo with respect to EFL teachers' TPACK and reveal a relationship between their TPACK and some factors such as gender, beliefs, or attitudes.

Another study conducted by Ekmekçi (2018) analyzed the studies on TPACK competencies of EFL teacher candidates in Turkey with respect to the purposes, research designs, subject groups, and conclusions of the reviewed studies. The research included the meta-synthesis research design to examine research trends of specific studies on the TPACK competencies of prospective English language teachers in Turkey. For this purpose, 15 publications between 2005-2018 years were collected for the research. The findings revealed that although the TPACK proficiency of English Language Teacher candidates in Turkey seems to be quite advanced in the studies, it has been concluded that more experimental studies are needed to have an adequate point of view on the current proficiency degrees of the learners. However, this study only investigated the TPACK degrees of prospective teachers between 2005-2018 years. Therefore, when the literature is examined, more meta-synthetic studies including recent years and different subject groups are needed to contribute to the literature in terms of more reliable results to be obtained.

For this reason, the goal of this study is to analyze a collection of studies on pre-service and in-service EFL teachers' TPACK competencies in Turkey regarding the purpose, method, participants, data collection tools, and findings to reveal research tendencies between 2017-2022 years in this field. This study is also crucial in determining deficiencies in the literature and in becoming a guide for further research. Therefore, the current study makes an attempt to respond to the following questions:

1. What are the research tendencies regarding the purposes of EFL teachers' TPACK studies between 2017-2022 years?
2. What are the research tendencies regarding sample groups in EFL teachers' TPACK studies between 2017-2022 years?
3. What are the research tendencies regarding research designs in EFL teachers' TPACK studies between 2017-2022 years?
4. What are the research tendencies regarding data collection tools in EFL teachers' TPACK studies between 2017-2022 years?
5. What are the research tendencies regarding the results of EFL teachers' TPACK studies between 2017-2022 years?

Method

Research Design

This research is a meta-synthesis analysis that synthesizes and critiques the findings of previous research conducted in a particular subject area by forming themes or matrices (Çalış & Sözbilir, 2014). Schreiber, Crooks, and Stern, (1997) define meta-synthesis as “the aggregating of a group of studies for the purpose of discovering the essential elements and translating the results into the end product that transforms the original results into a new conceptualization” (p. 314). Meta-synthesis refers to the process of interpreting and/or comparing and reinterpreting similar studies’ results based on certain criteria on the same subject or area of study (Çalık & Sözbilir, 2014). Dinçer (2018) defines the meta-synthesis method as “...is a study design in which the qualitative findings of previous studies are grouped or categorized based on specific criteria and the obtained findings are re-interpreted by comparing them.” (p.180).

Meta-synthesis research has been adopted as a continuation of the Grounded Theory (Dinçer, 2018). There have been two approaches to meta-synthesis. The first approach (Çalık & Sözbilir, 2014) argues that only qualitative data can be used in this research design. On the other hand, the second approach (Strobel & van Barneveld, 2009) hypothesizes that meta-synthesis research design can be conducted with both quantitative and qualitative data. However, the quantity of studies (sample size) employed in a meta-synthesis is often restricted compared to meta-analysis and descriptive content analysis (Çalık & Sözbilir, 2014).

Data Collection Procedure

The following keywords searched for the current study were “Technological Pedagogical Content Knowledge” and “English as a Foreign Language” which had different abbreviations such as “TPACK”, “TPAB”, “TPCK”, “EFL” “EFL TPACK”, “EFL TPACK in Turkey”. The keywords had different abbreviations in Turkish and English in the literature. The studies to be involved in the current study were obtained through the “Google Academic search engine”, “TÜBİTAK ULAKBİM DergiPark”, “National Dissertation Center of Board of Higher Education”, “EBSCOhost-ERIC” and “SPRINGER” databases.

The search was narrowed down to the search of studies regarding pre-service and in-service EFL teachers’ TPACK in Turkey between 2017-2022 years. Regarding the content of the research, as a result of the research, national and international articles that included

studies in the field of EFL teachers' TPACK were determined and 22 studies (11 articles and 11 MA theses) were identified by scanning the articles published between 2017-2022 years.

Table 1 displays the specific details of the reviewed studies:

Table 1. Data regarding the publication year of reviewed studies

Studies	2017	2018	2019	2020	2021	2022	Total
Articles	2	5	3	-	-	1	11
MA Theses	-	1	1	2	4	3	11
Total	2	6	4	2	4	4	22

According to Table 1, regarding the types of publications, the number of articles in total ($f=11$) is the same as the number of MA theses in total ($f=11$) in the field of EFL teachers' TPACK between the years 2017-2022. When the descriptive statistics of the distribution of studies on EFL TPACK by years are examined, it could be concluded that there has been a gradual augmentation in the total number of MA theses in this field over the years.

Data Analysis

Each study was examined one by one in line with each research question and codes were determined for each theme. Each of the reviewed studies was coded as A1, A2, A3,..., and A23. These codes were utilized in the meta-synthesis analysis. The coding process was carried out by the researcher. In order to ensure the reliability of the coding, it was observed that the coding was 97% consistent within itself after the analysis was re-conducted by the researcher about a month later. In addition, the studies were evaluated by two expert academicians outside the study. In order to ensure reliability among coders, the formula of "reliability=consensus/ (consensus + disagreement)" determined by Miles and Huberman (1994) was utilized, and the coding reliability rates were revealed for the themes over 90% for each theme.

Reliability calculations above 70% are considered adequate for the research to be accepted as reliable (Miles & Huberman, 1994). The articles were coded and grouped according to the "Publication Classification Scale" developed by Göksu, Özcan, Çakır, and Göktaş (2014). In the current research, data from certain studies are presented as tables or graphs for each research question. After the statistical presentation of the collected data, a general interpretation, similarities, and differences among studies were analyzed through content analysis.

Results

This part offers the findings gathered from the data analysis in accordance with each research question regarding purposes, sample groups, research designs, data collection tools, data analysis methods, and results of the reviewed studies. Table 2 shows the results of the first research question:

Research tendencies regarding the purposes of EFL teachers' TPACK studies

Table 2. Data regarding purposes of the reviewed studies

<i>Purposes</i>	<i>Study</i>	<i>f</i>
Examination of TPACK development through intervention	A1, A4, A9	3
Examination of the connection between TPACK and different variables (attitude, student psychology, student acceptance, beliefs, individual innovativeness, technology adoption levels)	A2,A5, A7, A11, A12, A15, A17	7
Determination /Measurement of TPACK competencies/beliefs/ perceptions and the effect of some demographic characteristics (gender, year level, department, training, digital literacy levels, status, age, experience, educational background) on TPACK levels	A3, A8, A10, A13, A14, A16, A20, A21	8
Comparing TPACK levels among different subject groups	A19	1
Development and validation of the EFL-TPACK scale	A6	1
Development of TPACK skills in a longitudinal process	A18	1
Examination of TPACK Competencies and technology integration	A22	1
	Total	22

As seen in Table 2, the findings revealed that regarding the purposes of studies, the research tendency of the remarkable quantity of reviewed studies (A3, A8, A10, A13, A14, A16, A20, and A21) is related to the determination or measuring TPACK perceptions and to examining the effect of demographic characteristics such as gender, age, educational background on EFL teachers' TPACK levels. Another considerable number of reviewed studies (A2, A5, A7, A11, A12, A15, and A17) was conducted by the researchers with the aim of investigating the correlation between EFL teachers' TPACK competencies and different variables such as attitude, student psychology, and students' acceptance levels.

Another purpose of reviewed studies was related to the impact of the intervention of TPACK development (A1, A4, and A9). Fewer studies were conducted for the purposes of comparing EFL teachers' TPACK levels among different subject groups (A19), developing and validating the EFL-TPACK scale (A6), examining EFL teachers' TPACK competencies

and technology integration (A22), and developing EFL TPACK skills in a longitudinal process (A18) in Turkey in the last five years between 2017 and 2022.

Research tendencies regarding sample groups in EFL teachers' TPACK studies

Regarding the second research question, Table 3 reveals the research tendencies regarding sample groups in EFL teachers' TPACK studies between 2017-2022 years.

Table 3. Data regarding sample groups of the reviewed studies

<i>Sample Groups</i>	<i>Study</i>	<i>f</i>
Pre-service EFL teachers	Freshman students	A4
	Senior students	A1, A8, A15, A16, A20
	all grades (freshman, sophomore, junior, senior students)	A3, A10, A18
In-service EFL teachers	A2, A6, A11, A12, A13, A17	6
Language instructors	A7, A21, A22	3
in-service and prospective EFL teachers	A9, A14	2
High school students	A5	1
Pre-service, in-service EFL teachers, and teacher certificate program students	A19	1
	Total	22

As seen in Table 3, the results indicated that considering sample groups of the reviewed studies, a significant number of the publications (A4, A1, A8, A15, A16, A20, A3, A10, A18) was conducted with pre-service EFL teachers while 6 studies (A2, A6, A11, A12, A13, A17) were conducted with in-service EFL teachers, 3 studies (A7, A21, A22) were conducted with language instructors, and 3 studies were conducted to compare TPACK levels among different subject groups (A9, A14, and A19) and 1 study (A5) was conducted with high schools students.

With respect to the research carried out with prospective EFL teachers, the quantity of the studies conducted with senior groups (A1, A8, A15, A16, A20) was higher than studies carried out with other class levels of prospective EFL teachers (A3, A4, A10, A18). It is concluded that most of the reviewed studies were conducted with EFL teacher candidates ($f=9$) and EFL teachers ($f=6$). Fewer studies were conducted with the sample groups of language instructors and students. Therefore, it can be concluded that there has been a

deficiency in the literature on conducting EFL TPACK studies for academicians and students.

Research tendencies regarding research designs in EFL teachers' TPACK studies

In order to answer the third research question, Table 4 reveals the research tendencies regarding research designs in EFL teachers' TPACK studies between 2017-2022 years.

Table 4. Data regarding research designs of the reviewed studies

<i>Research Designs</i>		<i>Study</i>	<i>f</i>	
Quantitative	Survey Design	A3,A5, A6, A10, A14, A16, A20,A21	8	
	Correlational Design	A2, A7, A11, A15, A17, A22	6	
Qualitative	Case study	A9	1	
Mixed Method	Quantitative	Survey Design	A8, A18, A19	
		Correlational Design	A12, A13	
		Experimental Design	A1, A4	
	Qualitative	Phenomenological Study	A8,A12, A13, A18, A19	7
		Grounded Study	A1, A4	
Total			22	

According to Table 4, in a remarkable number of the reviewed studies, quantitative research methods: the survey design (A3, A5, A6, A10, A14, A16, A20, A21) and correlational design (A2, A7, A11, A15, A17, A22) were the most frequently used methods in the field of EFL teachers' TPACK in the last five years. Therefore, the quantitative research design (f=14) was applied in more than half of the reviewed studies of EFL TPACK in Turkey. The studies using the quantitative research design either focused on measuring the TPACK competencies of EFL teachers in terms of some demographic variables by using a survey design or focused on examining the relationship between TPACK levels and different variables by using a correlational design.

Another considerable number of reviewed studies included mixed-method design (f=7). Within the mixed-method design, three studies were conducted with survey design (A8, A18, and A19); two studies were conducted with correlational design (A12, A13); two studies with experimental design (A1, A4); five studies with qualitative phenomenological study (A8, A12, A13, A18, A19); and two studies with grounded theory (A1, A4). Regarding the qualitative research design, only one study (A9) was conducted with a case study design.

Therefore, it can be concluded, that there has been a deficiency in the literature regarding studies that employ qualitative studies in the area of EFL teachers' TPACK competencies.

Research tendencies regarding data collection tools in EFL teachers' TPACK studies

With respect to the fourth research question, Table 5 displays the research tendencies regarding research designs in EFL teachers' TPACK studies between 2017-2022 years.

Table 5. Data regarding data collection tools of the reviewed studies

Data Collection Tools	Study	f
Scale/ survey/ questionnaire	"A1, A2, A3, A4, A5, A6, A7, A8, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20, A21, A22"	21
Reflective Discussion form	A1	1
Interviews (focus-group, semi-structured)	A1, A4, A8, A12, A13,	5
Reflective journals	A9	1
Observation	A9, A19	2
Rubric	A15	1
Open-ended question form	A18, A19	2

As seen in Table 5, it is seen that scales/questionnaires were are mostly preferred data collection tools ($f= 21$) in the reviewed studies (A1, A2, A3, A4, A5, A6, A7, A8, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20, A21, A22). As a result of reviews, it has been observed that these studies illustrated the general framework of TPACK self-efficacy levels of EFL teachers or the correlation between these levels and different variables using some scales such as EFL-TPACK scales, attitude scales or individual innovativeness scales, etc.

Moreover, interviews that included either focus-group interviews or semi-structured interviews were applied in some studies (A1, A4, A8, A12, and A13). Reflective discussion forms (A1), reflective journals (A9), observations (A9, A19), rubrics (A15), and open-ended question forms (A18, A19) were applied in fewer publications.

Research tendencies regarding the results of EFL teachers' TPACK studies

In order to answer the last research question, Table 6 displays the research tendencies regarding findings in EFL teachers' TPACK studies between 2017-2022 years:

Table 6. Data regarding the results of the reviewed studies

Results	Study	f
A remarkable difference in the development of TPACK-EFL levels after the intervention	A1, A4, A9	3
No significant gender differences were observed in TPACK levels	A2, A3, A10, A15	4
Negative correlation between TPACK sub-dimensions and overall	A2	1

techno-stress levels		
Prospective teachers had a high degree of TPACK	A3, A8, A10, A13, A14, A15, A20, A21	8
No significant differences between other demographic variables (age, year level, the daily amount of time on social networks, professional experience, technology utilization level, educational background) and TPACK levels	A2, A3, A10, A11, A16, A21	6
remarkable differences were found between the teachers' TPACK levels and some demographic variables (their educational level, teaching experience school type, and digital literacy levels,)	A13, A17	2
Positive correlations were found between acceptance of mobile tools and student-perceived TPACK knowledge of their EFL teachers	A5	1
Developing a confidential instrument for the evaluation of TPACK among English language teachers	A6	1
In-service English language instructors have a high degree of TPACK	A7, A22	2
A positive relationship was found between TPACK levels and different variables (their technology integration self-efficacy beliefs, their individual innovativeness, their Web 2.0 self-perceptions, attitudes toward technology / EBA, taking formation education)	A7, A11, A12, A13, A16, A17, A22	7
Significant gender differences were observed in TPACK levels	A11,14, A16, A20, A21	5
Age differences were found in sub-dimensions of TPACK.	A14, A16, A21	3
No significant relationship between academic success, technology adoption levels, and TPACK levels	A15, A20	2
A nonlinear pattern of TPACK development over time	A18	1
Remarkable differences in self-perceived TPACK levels among different subject groups	A19	1

Table 6 demonstrates that regarding the findings of the reviewed studies, some studies illustrated that there has been a statistically remarkable augmentation in the development of TPACK levels of EFL teachers and teacher candidates after the intervention (A1, A4, and A9). Some studies showed that both prospective EFL teachers (A3, A8, A10, A13, A14, A15, A20, and A21) and in-service English language instructors (A7, A22) had a high level of TPACK.

While some studies concluded that gender did not play a significant role in TPACK levels of EFL teachers (A2, A3, A10, A15), other studies illustrated that significant gender differences were observed in TPACK levels (A11,14, A16, A20, A21). Some studies concluded that significant differences were observed between the TPACK competencies of EFL teachers and some demographic variables such as their educational level, school type, perceived digital literacy levels, and teaching experience (A13, A17). On the other hand, some research revealed that no remarkable differences were revealed between TPACK levels and other demographic factors such as age, year level, the daily amount of time on social networks, professional experience, technology utilization level, educational background (A2, A3, A10, A11, A16, and A21).

According to a remarkable number of reviewed studies that a positive correlation was found between participants' TPACK levels and different variables such as their technology integration self-efficacy beliefs, their individual innovativeness, their Web 2.0 self-perceptions, attitudes toward technology / EBA, taking formation education (A7, A11, A12, A13, A16, A17, A22). One study highlights the development of a more reliable instrument for the evaluation of TPACK among English language teachers (A6). According to some studies, no significant relationship was revealed between academic success, technology adoption levels, and TPACK levels of participants (A15, A20). In the review of studies, studies displayed significant differences in the sub-dimensions of TPACK regarding the demographic variable of age (A14, A16, and A21).

One study (A2) concluded that there was a negative correlation between TPACK sub-dimensions and overall techno-stress degrees of in-service EFL teachers. The research found that three domains of knowledge – (TCK, PCK, and TPACK) were respectively found to be the significant factors in predicting the participants' techno stress levels. While one study (A18) revealed a nonlinear pattern of TPACK development over time, another study (A19) compared different subject groups including pre-service, in-service, and formation program students, and found remarkable differences among the participants.

Discussion and Conclusion

The goal of this current research was to analyze a collection of studies on pre-service and in-service EFL teachers' TPACK competencies in Turkey in terms of the purposes, methods, participants, data collection tools, and findings of certain studies between 2017-2022 to reveal research tendencies in this field. Regarding the purposes of the reviewed studies, it can be concluded that the research trend of the remarkable number of reviewed studies is related to the determination or measuring of TPACK perceptions and to examining the effect of demographic characteristics such as gender, age, educational background on EFL teachers' TPACK levels. Some of the reviewed studies were carried out to examine the correlations between EFL teachers' TPACK levels and different factors such as attitude, student psychology, and students' acceptance levels. However, few studies included experimental research designs investigating the effect of the treatment on the TPACK improvement of EFL teachers. Moreover, fewer studies were conducted for the purposes of comparing EFL teachers' TPACK levels among different subject groups and developing EFL TPACK skills in a longitudinal process. For this reason, more experimental studies should be

conducted in further research instead of only measuring the TPACK levels of participants, which is thought to contribute to the literature. Moreover, as the effects of the development of TPACK levels of the participants could be observed in the long run, more longitudinal studies comparing different subject groups should be conducted in future studies.

When the reviewed studies are analyzed in detail, the results also indicated that a significant number of the publications were conducted with pre-service EFL teachers (Baran & Uygun, 2016; Kaçar, 2022) while some of the studies were conducted with in-service EFL teachers (Yıldız, 2020), and only 3 studies were conducted with language instructors, and with different subject groups to compare TPACK levels and one study was conducted with high schools students. Wu (2013), in his research examining the experimental studies on TPACK, indicated that studies with pre-service teachers were more than those with teachers. It can be said that the easy accessibility of teacher candidates as a sample group or the relative difficulty of working with teachers are among the reasons why studies on TPACK are directed toward teacher candidates rather than teachers. However, in the context of technology integration into education, the relative scarcity of studies on teachers' TPACK levels is seen as a deficiency in the literature (Dikmen & Demirer, 2016). For this reason, considering the context of technology integration into EFL classrooms, it is crucial to conduct studies with the purpose of enhancing the TPACK levels of in-service educators and language instructors as much as those of prospective teachers.

Regarding another finding of the current study, the survey design and correlational design within the quantitative research methods were the most widely used methods in the field of EFL teachers' TPACK in the last five years. Therefore, the quantitative research design was applied in more than half of the reviewed studies of EFL TPACK in Turkey. This research design either measured the TPACK competencies of EFL teachers in terms of some demographic variables by using a survey design or examined the relationship between TPACK levels and different variables by using a correlational design. The mixed method design was another research design that was widely preferred in reviewed studies. However, in terms of the qualitative research design, only one study was conducted with a case study design (Kaçar, 2022). Therefore, it can be concluded that there has been a deficiency in the literature regarding studies that employ qualitative and case studies in the area of EFL teachers' TPACK competencies. It can be suggested that more case studies and

qualitative studies are needed for in-depth analysis and for supporting the quantitative data as the quantitative designs might not solely reveal TPACK competencies in some cases.

In terms of the fourth research question, it is seen that questionnaires were mostly the preferred data collection tools in the reviewed studies. As a result of these reviews, it has been observed that these studies illustrated the identification of TPACK self-efficacy levels of EFL teachers or the relationship between these levels and different variables. Moreover, interviews that included either focus-group interviews or semi-structured interviews were applied in some studies. The number of reflective discussion forms, reflective journals, observations, rubrics, and open-ended question forms was rather low. Therefore, it can be recommended that more qualitative data collection could be used for more reliable and valid results to be obtained.

Regarding the conclusions of the reviewed studies, the intervention had a significant effect on the development of TPACK levels of EFL teachers and teacher candidates. Prospective EFL teachers had a high level of TPACK. Gender did not play a remarkable role in TPACK levels of EFL teachers in some reviewed studies while significant gender differences were observed in TPACK levels in other reviewed studies. While educational level, school type, perceived digital literacy levels, and teaching experience had a positive impact on TPACK self-efficacy levels, age, year level, the daily amount of time on social networks, professional experience, technology utilization level, the educational background did not make significant differences in the levels of EFL teachers' TPACK. However, fewer studies made an attempt to reveal significant factors in predicting the participants' TPACK levels, examine the nonlinear pattern of TPACK development over time, compare different subject groups, and find remarkable differences among the participants. Therefore, studies focusing on longitudinal processes, comparing different subject groups, and revealing predictive factors of EFL TPACK levels could be conducted in order to contribute to the literature.

Suggestions for Further Research

Regarding the results of this study, the following suggestions can be summarized:

- More experimental research designs that are relevant to the development of TPACK levels should be conducted in further research rather than merely measuring the TPACK levels of participants.

- Since the impacts of the development of TPACK levels of the participants could be observed in the long run, more longitudinal studies comparing different subject groups should be conducted to enhance the TPACK levels of the participants.
- As it is crucial to conduct studies with the purpose of enhancing the TPACK levels of in-service teachers and language instructors as much as those of prospective teachers, more studies should focus on in-service EFL teachers and instructors.
- More case studies and qualitative studies are needed for in-depth analysis and for supporting the quantitative data as the quantitative designs might not solely reveal TPACK competencies for more reliable and valid results to be obtained.
- Studies focusing on longitudinal processes, comparing different subject groups, and revealing predictive factors of EFL TPACK levels could be conducted in further studies.

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Author Contribution Statement

Serpil UÇAR: *Literature review, is collecting data, analyzing data, conclusion and discussion sections, reporting, writing, auditing, and editing processes.*

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