

**Examination of the Studies Made on Technological Pedagogical Content Knowledge in the Years of 2010-2021**

**2010-2021 Yıllarında Teknolojik Pedagojik Alan Bilgisi Üzerine Yapılan Çalışmaların İncelenmesi**

Rumeysa YILMAZ<sup>a</sup> , Ayten Pınar BAL<sup>b</sup> 

**Article Info/Makale Bilgi**

Received/Alındı: 20/07/2022

Revised/Düzeltildi: 04/09/2022

Accepted/Kabul edildi: 29/10/2022

**Keywords:**

Technological pedagogical content knowledge, pedagogical content knowledge, document review

**ABSTRACT**

This research aims to determine the trends of the studies on technological pedagogical content knowledge. The research sample consists of 112 articles published between 2010-2021. Publication Classification Form was used in the research. This form includes descriptive information about the studies examined within the scope of the research, the discipline areas of the study, the subject, the method, the tools used in the data collection process, the sample, and the types of data analysis. As a result of the research; the number of studies varies according to years, the majority of studies are not specific to a certain field, the most preferred subject is the examination of competence, attitudes and perceptions towards TPCK, the quantitative method is mainly preferred, the scales are generally preferred as a data collection tool, It has been revealed that in studies, preservice teachers are frequently studied, and quantitative data analysis methods are preferred as the data analysis method.

**Anahtar kelimeler:**

Teknolojik pedagojik alan bilgisi, pedagojik alan bilgisi, doküman incelemesi

**ÖZ**

Bu araştırmada teknolojik pedagojik alan bilgisi üzerine yapılan çalışmaların eğilimlerinin belirlenmesi amaçlanmaktadır. Araştırmanın örneklemini 2010-2021 yılları arasında yayınlanmış 112 makale oluşturmaktadır. Araştırmada Yayın Sınıflandırma Formu kullanılmıştır. Bu form, araştırma kapsamında incelenen çalışmalar, çalışmanın disiplin alanları, konusu, yöntemi, veri toplama sürecinde kullanılan araçlar, örneklem ve veri analiz türleri hakkında tanımlayıcı bilgileri içerir. İncelenen araştırma sayılarının yıllara göre değiştiği ortaya çıkmıştır. Çalışmaların genellikle belirli bir alana özgü olmadığı görülmüştür. Çalışmalarda çoğunlukla TPAB'ne yönelik tutum ve algılar incelenmiştir. İncelenen araştırmalarda nicel yöntem ve nicel veri analiz yöntemleri kullanılmıştır. Araştırmalarda genellikle ölçekler kullanılarak öğretmen adaylarıyla çalışma yapılmıştır.

<sup>a</sup>Rumeysa Yılmaz, MEB, rumeysyilmaz01@hotmail.com, <https://orcid.org/0000-0002-4056-6792>

<sup>b</sup>Ayten Pınar BAL, Çukurova Üniversitesi, apinar@cu.edu.tr, <https://orcid.org/0000-0003-1695-9876>



## Introduction

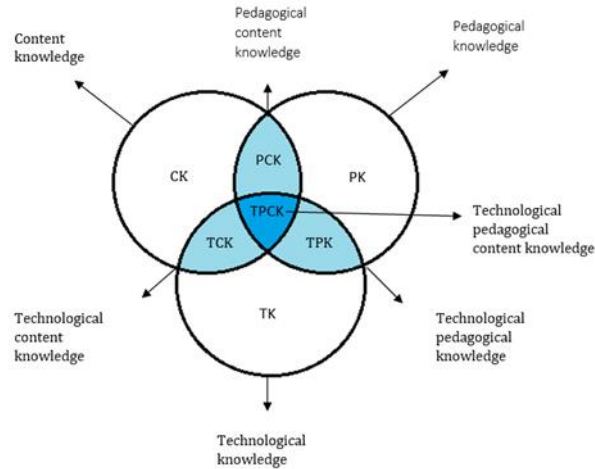
The information and technology age we live in compares people with different changes and developments every day. These developments affect many areas such as political, social, economic, and educational structures of individuals, societies and countries. Education is a significant variable, especially for training developed human resources. All elements in the field of education must be qualified (Dedebali, Kubat, & Dursun, 2018). It is aimed to raise qualified individuals who can reveal their competencies and skills in the education and training process, have 21-st century skills, are productive, problem-solving, and think critically and creatively (Bakirci & Kutlu, 2018; Bozan & Anagun, 2019; Ucak & Erdem, 2020).

Teachers are among the most important factors in reaching students who can adapt to society (Ozturk, 2013). The characteristics that teachers should have are constantly changing (Ozgen, Narli, & Alkan, 2013), and these characteristics have been the focus of many studies. In this context, teachers' characteristics are called Pedagogical Content Knowledge. Shulman introduced the concept of Pedagogical Content Knowledge (PCK) in the 1980s. PCK can be explained as the knowledge of the ways of representing and formulating the most useful forms of representation, analogies, examples, and explanations for the subjects that the teacher will teach in her field, briefly making the subject understandable (Shulman, 1986).

In order to train individuals who can adapt to the changes in the scientific and technological field, teachers with the necessary knowledge and skills are needed (Anderson, 2008; Carr et al., 1998; Koehler and Mishra, 2005). In addition to pedagogical content knowledge, our need for teachers with sufficient knowledge and technology skills is increasing (Anderson, 2008; Tatli & Akbulut, 2017). For countries to increase their level of development, individuals who can produce and use technology effectively are needed (Demirezen & Keles, 2020; Jang & Tsai, 2012). Educational institutions should follow technological developments and ensure technology integration into education (Horzum, 2011). Adapting the content of curricula to developing technologies can increase the quality of teaching (Dogru & Aydin, 2017). It has been observed that with the use of technology in the education process, students' interest in the lesson increased, the liveliness and excitement in the classroom increased, and their attitudes towards the lesson changed positively (Metin, Birisci, & Coskun, 2013). In addition, technology can provide opportunities to increase the level of learning by creating more concrete environments on subjects that students do not understand and cannot learn, and also serves as an additional complement to the tools used in the education process.

While technology has become a part of our lives, Mishra and Koehler (2006) thought that the PCK developed by Shulman should include technology and technology relationships. In this direction, Mishra and Koehler (2006) brought Technological Pedagogical Content Knowledge (TPACK) to the literature by adding technology knowledge to the content knowledge and pedagogical knowledge dimensions that make up PCK (Koehler et al., 2014).

TPACK is a teacher knowledge framework for technology integration (Kabakci-Yurdakul et al., 2012; Koehler & Mishra, 2009). TPACK defines the types of knowledge teachers need to teach with technology and the complex ways these types of knowledge interact with each other (Koehler et al., 2013). Mishra and Koehler (2006) divide TPACK into seven sub-information types. These types of information are shown in Figure 1.



**Figure 1.** TPACK model (Mishra & Koehler, 2006)

The knowledge dimensions that make up the TPACK model are explained below (Schmidt et al., 2009):

- Content Knowledge: The knowledge of the teacher who is an expert on the subject (Koehler & Mishra, 2009).
- Pedagogical Knowledge: The knowledge of the teacher who is an expert on the subject in the learning and teaching process (Koehler & Mishra, 2009).
- Pedagogical Content Knowledge: The knowledge that requires the teacher, who is an expert in the subject, to arrange the subject according to which teaching approaches (Koehler & Mishra, 2006).
- Technological Knowledge: Knowledge of various technologies, from low-tech such as pen and paper, to the Internet, digital video, interactive whiteboards, and software programs (Schmidt et al., 2009).
- Technological Content Knowledge: Knowledge of how technology can create new representations for a particular subject area (Schmidt et al., 2009).
- Technological Pedagogical Knowledge: Knowledge of how teaching and learning can change when certain technologies are used in certain ways (Koehler & Mishra, 2009).

- Technological Pedagogical Content Knowledge: The knowledge process consists of the interaction of content knowledge, pedagogical knowledge and technology knowledge (Koehler & Mishra, 2009).

One of the characteristics of a qualified teacher is to use technology, pedagogy and field knowledge in connection with each other in line with the features mentioned above (Dundar & Unaldi, 2020). In this context, TPACK has been seen as a subject worth researching by researchers, and this issue has gained importance with the introduction of technology into our lives in recent years. In this direction, determining the trends of the studies on TPACK will shed light on the researchers who will work on this subject. Lee, Wu, and Tsai (2009) stated that knowing the information about the current status and trends of studies in their fields is beneficial for researchers' careers and academic publications.

When the literature in the related field is examined, there are studies examining the trends of studies on TPACK (Abbitt, 2011; Baran & Canbazoglu-Bilici, 2015; Chai, Ling Koh, & Tsai, 2013; Dikmen & Demirer, 2016; Kaleli-Yilmaz, 2015; Korucu, Usta, & Atun, 2017; Saykal & Ulucinar-Sagır, 2021; Voogt, Fisser, Pareja, Tondeur & van Braak, 2013; Wu, 2013). Saykal and Ulucinar-Sagır (2021) examined teacher competencies and TPACK research in their study. In this context, they included their research articles, master's theses and doctoral theses. Reexamining the articles on this subject will contribute to the literature because the two issues are handled together, and the scope is wide. In this context, the research aims to examine the articles published on TPACK between 2010-2021 within the scope of the accessible Turkish literature regarding various variables. Within the scope of the research, answers were sought to the following questions: Studies on TPACK,

1. How is the distribution according to years?
2. What is the distribution according to their areas?
3. What is the distribution according to the subjects?
4. What is the distribution according to their methods?
5. What is the distribution according to data collection tools?
6. What is the distribution according to the study groups?
7. What is the distribution of data according to analysis methods?

### **Methodology**

On this subject, a detailed examination from TPACK was made. For this reason, document analysis, which is one of the qualitative data collection methods, was applied in the research. Document analysis is a method used to systematically analyze the written documents obtained following the purpose of the study (Wach, 2013). The documents examined in this research include the articles published on TPACK following the purpose of the research

The Google Scholar database was scanned to determine the articles to be examined in the research. While scanning, a search was made using the keywords Technological Pedagogical Content Knowledge, TPACK. Scanning started in 2010. Afterward, the articles published in 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 and 2020, and 2021 were scanned. Studies carried out until September 2021 were included in the survey. As a result of the search, 112 articles published between 2010-2021 were reached. One hundred twelve articles reached in this direction constitute the sample of the research.

The Publication Classification Form created by Sozbilir, Guler and Ciltas (2012) was used for the analysis of the studies examined. In this form, general descriptive information about the study to be examined, the discipline area of the study, the subject, the method, the tools used in the data collection process, the sample and the data analysis type consist of sections.

The obtained data were saved in the Excel program and grouped. The grouped data were analyzed with the descriptive analysis method. Descriptive analysis is the processing, summarization and interpretation of the data obtained according to the theme determined before the study (Calık & Sozbilir, 2014; Sozbilir, 2009; Ultay, Akyurt, & Ultay, 2021). Frequency and percentage values were used in the analysis of the data.

All the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" have been complied with in the whole process from the planning of this study to its implementation, from data collection to data analysis. None of the actions specified under the title of "Actions Contrary to Scientific Research and Publication Ethics", which is the second part of the directive, were not carried out. In addition, scientific, ethical and citation rules were followed in the writing process of this study; No falsification has been made on the collected data and this study has not been sent to any other academic media for evaluation. Since the study is a systematic literature review and document review study, it is not included in the group of studies that require Ethics Committee Permission. Therefore, Ethics Committee Permission was not declared.

## Results

The distribution of the studies examined between 2010-2021 by years is given in Table 1.

**Table 1.** Distribution of articles examined between 2010-2021 by years

Year	f	%
2010	-	-
2011	2	% 1.79
2012	2	% 1.79
2013	9	% 8.04
2014	6	% 5.36
2015	11	% 9.82
2016	19	% 16.96
2017	11	% 9.82

2018	17	% 15.18
2019	15	% 13.39
2020	16	% 14.29
2021	4	% 3.57

As seen in Table 1, no article published in 2010 was found. It has been observed that the number of published articles varies according to year, and most studies were published in 2016. Notably, the number of studies published in previous years is quite low. Another result obtained is that there is no continuous increase or decrease between the years.

The distribution of the fields of the articles included in the research is given in Table 2.

**Table 2.** Distribution of articles examined between 2010-2021 by fields of study

Fields of Study	f	%
Non-Field-Specific	39	% 37.50
Science Education	24	% 23.08
Primary School Teaching	13	% 12.50
Math Teaching	11	% 10.58
Turkish Teacher	3	% 2.88
Geography Teaching	3	% 2.88
Visual Arts Teaching	2	% 1.92
Pre-school Teaching	2	% 1.92
Social Sciences Teaching	2	% 1.92
History Teaching	1	% 0.96
Chemistry Teaching	1	% 0.96
Music Teaching	1	% 0.96
Biology Teaching	1	% 0.96
Physical Education and Sports Teaching	1	% 0.96

When Table 2 is examined, the majority of the research that are the subject of the research are not specific to a particular field. Twenty-four of the studies were conducted in the fields of science teaching, 13 in primary school teaching and 11 in the fields of mathematics teaching. The number of studies in other fields is more limited.

The distribution of the studies conducted between 2010-2021 according to their subjects is given in Table 3.

**Table 3.** Distribution of articles examined between 2010-2021 by subject

Subjects	f	%
Competence, Attitude, Perception towards Technological Pedagogical Content Knowledge	57	% 50.89

Interaction of TPACK Components	14	%12.50
Interaction of TPACK and Other	25	%22.32
Knowledge Bases		
Developing the TPACK Scale	10	%8.93
Content Analysis	6	%5.36

When Table 3 is examined, it was seen that the studies within the scope of the research mostly focus on TPACK competency, attitude and perception with 57 items. Later, this topic is followed by 25 articles on the interaction of TPACK and other knowledge bases. The number of studies on the interaction of TPACK components is 14. In these articles, which were brought to the literature between 2015 and 2020, at least scale development was studied. This result is similar to Kaleli-Yılmaz (2015) study. Kaleli-Yılmaz (2015) analyzed 59 studies conducted between 2008-2014 in his study and concluded that TPACK competencies were generally examined in studies. When the TPACK competencies of teachers, prospective teachers or lecturers are known, these results can be viewed as important in terms of filling the weak or missing points with in-service trainings or university courses.

The distribution of the articles included in the research according to their methods is given in Table 4.

**Table 4.** Distribution of studies examined between 2010-2021 by methods

Research Method		f	%
Quantitative	Descriptive	67	%59.82
	Experimental	8	%7.14
	Scale Development	10	%8.93
Qualitative	Case Study	8	%7.14
	Compilation	10	%8.93
Mixed		9	%8.04

When Table 4 is examined, it is seen that quantitative research methods are generally preferred in articles. Among the quantitative research methods, it was determined that the descriptive method was the most preferred with 67 articles and the least number of studies were created with the mixed method. In qualitative research methods, eight articles were designed as case studies and 10 articles were compiled. These results are similar to Baran and Canbazoglu Bilici (2015) studies. Baran and Canbazoglu-Bilici (2015) examined 30 studies on TPACK published between 2005 and 2013 in their study and concluded that the most frequently used method in studies is quantitative methods. This result is not similar to the study of Chai, Ling Koh and Tsai (2013). Chai, Ling Koh, and Tsai (2013) analyzed 74 articles on TPACK in their study and concluded that the qualitative research method was used in most studies.

The data collection tools used in the articles examined in the research are divided into

quantitative data collection tools and qualitative data collection tools. Quantitative data collection tools are given in Table 5.

**Table 5.** Quantitative data collection tools used in studies examined between 2010-2021

Developing the Scale	Name of Scale	Adaptor of the Scale	f	%
Graham & others, 2009	Technological Pedagogical Content Knowledge Self- Confidence Scale	Timur & Tasar, 2011	19	%23.75
Schmidt & others, 2009	Technological Pedagogical Content Knowledge Scale	Bahcekapili, 2011	1	%1.25
		Horzum & Ozturk, 2011	14	%17.50
		Dikkartin, Ovez & Akyuz, 2013	1	%1.25
		Kaya & Dag, 2013	1	%1.25
		Haciomeroğlu, Sahin & Arcagok, 2014	1	%1.25
		Pamuk, Ulken & Sener-Dilek	1	%1.25
		Kaya, Emre & Kaya, 2010	1	%1.25
Sahin, 2011	TPACK Scale		14	%17.50
Jang & Tsai, 2011	Technological Pedagogical Content Knowledge Scale	Bilici & Guler, 2016	2	%2.50
Canbazoglu Bilici, 2012	TPACK Self-Efficacy Scale		4	%5.00
Kabakçı & others, 2012	Technopedagogical Education Sufficiency Scale		8	%10.00
Pamuk & others, 2012	TPACK Scale		3	%3.75
Handal, 2013	TPACK Scale for Mathematics Teachers		1	%1.25
Balçin & Ergun, 2016	TPACK Self-Efficacy Scale		1	%1.25
Kartal, Kartal & Uluay, 2016	Technological Pedagogical Content Knowledge Self- Assessment Scale For Preservice Teachers		3	%3.75
Simsek, 2016	TPACK Self-Efficacy Scale in the Context of International Education Technology Standards		1	%1.25
Hicyilmaz, 2018	TPACK Self-Efficacy Scale for Visual Arts Teachers		1	%1.25
Taflı & Atıcı, 2018	TPACK Self-Efficacy Scale		1	%1.25
Dincer, 2019	TPACK Learning Satisfaction Scale		1	%1.25
Ozdemir & Erduran, 2019	TPACK Scale		1	%1.25

As seen in Table 5, 15 different scales were used in the articles that were the subject of the research. 12 of these scales were produced by Turkish researchers and three were produced



by foreign researchers. The scales developed by foreign researchers were translated into Turkish by Turkish researchers and used. The scale developed by Schmidt et al. (2009) was translated into Turkish by more than one researcher and different forms were created.

The qualitative data collection tools used in the articles are given in Table 6.

**Table 6.** Qualitative data collection tools used in studies examined between 2010-2021

Data Collection Tool		f	%
Interview Form	Semi-Structured	12	%60.00
	Configured	3	%15.00
Observation Form		3	%15.00
Lesson Plan Matrix		2	%10.00

As seen in Table 6, the interview form was mostly preferred as a qualitative data collection tool in the analyzed articles.

The distribution of the articles examined between 2010 and 2021 according to the study groups is given in Table 7.

**Table 7.** Distribution of the study group in studies examined between 2010-2021

Study Group	f	%
Teacher Candidate	59	%55.66
Teacher	44	%41.51
Teaching Staff	3	%2.83

As can be seen in Table 7, 59 of the examined articles consisted of preservice teachers. In 44 articles, the study group was selected from teachers. Among the articles examined, only three studies comprised the teaching staff.

The distribution of sample sizes in the reviewed articles is given in Table 8.

**Table 8.** Distribution of sample sizes of studies examined between 2010-2021

Sample Size	f	%
1-10	-	-
11-30	11	%10.38
31-100	16	%15.09
101-300	45	%42.45
301-1000	33	%31.13
1000+	1	%0.94

As can be seen in Table 8, the number of studies with 11-30 people is 11, the number of studies with 31-100 people is 16, the number of studies with 101-300 people is 45, the number of studies with 301-1000 people is 33, and the number of studies is 1000 people. The number of studies involving more than one person is only one. Among the studies examined, there was no study involving 1-10 people. This result is similar to the study of Willermark (2017). Willermark (2017) examined 107 studies on TPACK published between 2011 and 2016 and concluded that the most studies were conducted with preservice teachers. Kaleli-Yilmaz (2015) explained that the reason why the studies are mostly done with teacher candidates is that it is easier to reach teacher candidates.

The distribution of the analyzed studies according to the data analysis methods is given in Table 9.

**Table 9.** Data analysis methods used in articles examined between 2010-2021

Data Analysis Methods			f	%	
	Descriptive Statistics		53	%23.14	
Quantitative	Predictive Statistics	Non-parametric	Mann Whitney U	14	%6.11
			Kruskal Wallis	15	%6.55
			Independent groups t test	46	%20.09
			One-way ANOVA	41	%17.90
	Parametric	Dependent groups t test	7	%3.06	
		Correlation	15	%6.55	
		Regression	8	%3.49	
		Two-way ANOVA	1	%0.44	
	MANOVA	3	%1.31		
Qualitative	Descriptive Analysis		3	%1.31	
	Content Analysis		23	%10.04	

As seen in Table 9, quantitative data analysis methods were used in the majority of the studies. Descriptive statistics were included in 53 of the studies in which quantitative data analysis methods were used, and predictive statistics were included in 150 in total. Among the predictive statistics, independent groups t-test was used the most. In qualitative data analysis methods, content analysis is generally preferred.

### Discussion and Conclusion

In this study, the trends of studies published on TPACK between 2010-2021 were investigated. In the first sub-problem of the study, the distribution of the study by years was examined. The data obtained showed that the most studies were in 2016. In addition, it has been shown that the number of published studies varies according to years.

In the second sub-problem, the distribution of the subject areas of the studies was examined. When the number of studies was analyzed according to the subject area, it was seen that they were not specific to a certain field in the first place, and then they were conducted in the fields of science teaching. Since transferring the subjects, visuals, and experimental situations in the sciences to the virtual environment will provide economy in every aspect, it is seen as a normal situation that the number of studies in this field is high.

The data obtained for the third sub-problem showed that the studies generally focused on TPACK competence, attitudes and perceptions. This result is like Kaleli- Yılmaz (2015) study. Kaleli-Yılmaz (2015) analyzed 59 studies conducted between 2008-2014 in his study and concluded that TPACK competencies were generally examined in studies. When the TPACK competencies of teachers, prospective teachers or lectures are known these results can be viewed as important in terms of filling the weak or missing points with in-service trainings or university courses.

Findings from the next sub-problem showed that the quantitative method was generally preferred in the studies examined. These results are similar to Baran and Canbazoglu-Bilici (2015) studies. Baran and Canbazoglu-Bilici (2015) examined 30 studies on TPACK published between 2005 and 2013 and concluded that the most frequently used method in studies is the quantitative method. This result is not similar to the study of Chai, Ling Koh, and Tsai (2013). Chai, Ling Koh, and Tsai (2013) analyzed 74 articles on TPACK in their study and concluded that the qualitative research method was used in most studies.

In the fifth sub-problem of the research, the data collection tools used in the studies were examined. The data obtained showed that different scales were used in the studies.

In the sixth sub-problem, the groups studied in the studies were examined. It was observed that the samples of the studies were generally composed of pre-service teachers. This result is similar to the study of Willermark (2017). Willermark (2017) examined 107 studies on TPACK published between 2011 and 2016 and concluded that the most studies were conducted with preservice teachers. Kaleli-Yılmaz (2015) explained that the reason why the studies are mostly done with teacher candidates is that it is easier to reach teacher candidates.

In the last sub-problem of the research, the distribution of the studies according to the analysis methods was examined. As a result of the data obtained, it was seen that quantitative data analysis methods were generally used in studies. The reason why quantitative data analysis methods are used more is that qualitative analysis is a process that requires much more effort, patience, mental power, creativity and diversity than quantitative analysis (Akbulut, 2013).

Considering the research results, some suggestions were made to the researchers considering working on this subject. It is thought that studies on TPACK to be conducted in line with these recommendations will contribute to the literature.

- As a limitation of this research, it can be shown that the studies examined are only articles published between 2010-2021. In order to reach more comprehensive and broad

results, master's and doctoral theses can be examined in addition to the articles examined.

- It has been seen that the articles generally examine the competencies, attitudes and perceptions towards TPACK, but examining only the competencies, attitudes and perceptions may be insufficient, in this context, the integration of people into their TPACK courses can be examined.
- Quantitative methods were generally used in the studies examined. In this context, in order to reach more detailed information, both qualitative studies and mixed methods in which quantitative and qualitative methods are combined can be given weight.
- It was seen that scales were mostly used in the articles examined within the scope of the research. In this direction, it can be suggested to use qualitative data collection tools such as the observation technique, which has the chance to observe the participants in their natural environment and provides the opportunity to conduct long-term analysis, or the interview technique, which allows the participants to receive instant feedback.
- When the articles are examined, it is seen that the studies are generally conducted with teacher candidates. It can be suggested to carry out studies carried out with teachers who are practitioners of the learning-teaching process and instructors who train teachers.

### References

- Abbitt, J. T. (2011). Measuring technological pedagogical content knowledge in preservice teacher education: A review of current methods and instruments. *Journal of Research on Technology in Education*, 43(4), 281–300. <https://doi.org/10.1080/15391523.2011.10782573>
- Akbulut, Y. (2013). *Analysis of data*. A. Simsek (Ed.). Scientific research methods (139-165). Eskisehir: Anadolu University Press.
- Anderson, T. (2008). *Towards a theory of online learning*, in Anderson, T. (Ed.) Theory and Practice of Online Learning (pp. 45–74). Canada: AU Press.
- Bakirci, H., & Kutlu, E. (2018). Determination of science teachers' views on STEM approach. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 9 (2), 367-389. <https://doi.org/10.16949/turkbilmat.417939>
- Baran, E., & Canbazoglu Bilici, S. (2015). Review of the research on technological pedagogical content knowledge: The case of Turkey. *Hacettepe University Journal of Education*, 30(1), 15-32.
- Bozan, M. A., & Anagün, S. Ş. (2019). STEM focused professional development process of elementary school teachers: An action research. *Anadolu Journal of Educational Sciences International*, 9(1), 279-313. <https://doi.org/10.18039/ajesi.520851>
- Carr, A. A., Jonassen, D. H., Litzinger, M. E., & Marra, R. M. (1998). Good ideas to foment educational revolution: The role of systematic change in advancing situated learning, constructivism, and feminist pedagogy. *Educational Technology*, 38(1), 5–14.

- Chai, C.-S., Koh, J. H.-L., & Tsai, C.-C. (2013). A review of technological pedagogical content knowledge. *Educational Technology & Society*, 16(2), 31–51.
- Calık, M., & Sözbilir, M. (2014). Parameters of content analysis. *Education and Science*, 39(174), 33-38. <http://dx.doi.org/10.15390/EB.2014.3412>
- Dedebali, N. C., Ulaş, K., & Dursun, F. (2018). The quality of any educational system cannot exceed the quality of the teacher. *Turkish Studies*, 13(27), 531-546. <http://dx.doi.org/10.7827/TurkishStudies.14582>
- Demirezen, S., & Keleş, H. (2020). Examination of social studies teachers' technological pedagogical content knowledge competencies according to various variables. *International Journal of New Approaches in Social Studies*, 4(1), 131-150. <https://doi.org/10.38015/sbyy.750007>
- Dikmen, C., & Demirer, V. (2016). Trends in studies on technological pedagogical content knowledge in Turkey between 2009 and 2013 years. *Turkish Journal of Education*, 5(1), 33-46. <https://doi.org/10.19128/turje.77632>
- Dogru, E., & Aydın, F. (2017). Examining the skills of geography teachers' technological pedagogical content knowledge. *Journal of History Culture and Art Research*, 6(2), 485-506. <https://doi.org/10.7596/taksad.v6i2.686>
- Dundar, E. & Unaldi Eser, U. (2020). Developing an achievement test prepared to measure the TPACK (TPACK) competencies of geography teachers. *Anatolian Journal of Cultural Studies*, 4(3), 215-232. <https://doi.org/10.15659/ankad.v4i3.107>
- Horzum, M. B. (2011). Adaptation of web pedagogical content knowledge survey to Turkish. *Elementary Education Online*, 10(1), 257-272.
- Jang, S. J., & Tsai, M. F. (2012). Exploring the TPACK of Taiwanese elementary mathematics and science teachers with respect to use of interactive whiteboards. *Computers & Education*, 59(2), 327-338.
- Kabakci-Yurdakul, I., Odabasi, H. F., Kiliçer, 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. <https://www.learntechlib.org/p/66817/>
- Kaleli- Yılmaz, G. (2015). Türkiye'deki TPAB çalışmalarının analizi *Education and Science*, 40(178), 103-122. <http://dx.doi.org/10.15390/EB.2017.6444>
- Kaya, Z., Emre, I., & Kaya, O. N. (2010). Determination of self-confidence levels of classroom teacher candidates in terms of TPACK. *9th Grade Teacher Education Symposium*, 643-651, Elazığ.
- Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, 32(2), 131-152.
- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge?. *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
- Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK). *Journal of Education*, 193(3), 13–19. <https://doi.org/10.1177/002205741319300303>
- Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. (2014). The technological pedagogical content knowledge (TPACK) framework. In J. M. Spector, M. D. Merrill, J.

- Ellen, & M. Derya Aygün, Mihriban Hacısalihođu Karadeniz & Suphi Önder Bütüner 213 J. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 101–111). New York, NY: Springer.
- Korucu, A, Usta, E., & Atun, H. (2017). Trends in research on TPACK for the period 2010-2016. *Journal of Amasya University Faculty of Education*, 6(1), 104-133. <http://dx.doi.org/10.31704/ijocis.2020.001>
- Lee, M. H., Wu, Y. T., & Tsai, C. C. (2009). Research trends in science education from 2003 to 2007: A content analysis of publications in selected journals. *International Journal of Science Education*, 31(15), 1999-2020.
- Metin, M., Birisci, S., & Coskun, K. (2013). Examination of teacher candidates' attitudes towards instructional technologies in terms of different variables. *Kastamonu Journal of Education*, 21(4), 1345-1364.
- Mishra, P., & M. J. Koehler. (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.
- Ozgen, K., Narli, S., & Alkan, H. (2013). Examination of preservice mathematics teachers' perceptions of technological pedagogical content knowledge and frequency of technology use. *Electronic Journal of Social Sciences*, 12(44), 31-51.
- Oztürk, E. (2013). Evaluation of the technological pedagogical content knowledge of primary school teacher candidates in terms of some variables. *Uşak University Journal of Social Sciences*, 6(2), 223-238. doi:10.12780/UUSB163
- Sancar Tokmak, H., Yavuz Konokman, G., & Yanpar Yelken, T. (2013). Examining TPACK (TPACK) self-confidence perceptions of Mersin University pre-school teacher candidates. *Journal of Ahi Evran University Kirsehir Education Faculty*, 14(1), 35-51.
- Saykal, A., & Ulucinar Sagir Ş. (2021). Teacher competences and technological pedagogical content knowledge researches in Turkey. *Gazi Journal of Educational Science*, 7(2), 115-137, <https://dx.doi.org/10.30855/gjes.2021.07.02.001>
- Schmidt, D., Baran, E., Thompson, A., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, 42(3), 123-149
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.
- Sozbilir, M. (2009). Qualitative data analysis. Retrieved May 6, 2021, from <https://fenitay.files.wordpress.com/2009/02/1112-nitel-arac59ftc4b1rmada-veri-analizi.pdf>
- Sozbilir, M., Güler, G., & Ciltas, A. (2012). Mathematics education research in Turkey: A content analysis study. *Educational Sciences: Theory & Practice*, 12(1), 565-580.
- Tatli, Z., & Akbulut, H. (2017). Teacher candidates technology using competence in the field. *Ege Education Journal*, 18(1), 31-55. <https://doi.org/10.12984/eeefd.328375>
- Ucak, S., & Erdem, H. (2020). On the skills of 21st century and philosophy of education in terms of searching a new aspect in education. *Uşak Üniversitesi Journal of Educational Research*, 6(1), 76-93. <https://doi.org/10.29065/usakead.690205>
- Ultay, E, Akyurt, H., & Ultay, N. (2021). Descriptive content analysis in social sciences. *IBAD*

- Journal of Social Sciences*, 10, 188-201. <https://doi.org/10.33710/sduijes.895160>
- Voogt, J., Fisser, P., Pareja-Roblin, N., Tondeur, J., & Braak, J. (2013). Technological pedagogical content knowledge: A review of the literature. *Journal of Computer Assisted Learning*, 29, 109-121. <https://doi.org/10.1111/j.1365-2729.2012.00487.x>
- Wach, E. (2013). *Learning about qualitative document analysis*. Retrieved May 6, 2021, from <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/2989>
- Willermark S. (2018). Technological pedagogical and content knowledge: a review of empirical studies published from 2011 to 2016. *Journal of Educational Computing Research*. 56(3), 315-343. <https://doi.org/10.1177%2F0735633117713114>
- Wu, Y.-T. (2013). Research trends in technological pedagogical content knowledge research: A review of empirical studies published in selected journals from 2002 to 2011. *British Journal of Educational Technology*, 44(3), 73-76. <https://doi.org/10.1111/j.1467-8535.2012.01349.x>.

### Genişletilmiş özet

#### Giriş

İçinde bulunduğumuz bilgi ve teknoloji çağı her yeni gün insanları farklı değişim ve gelişimlerle karşılaştırmaktadır. Bu gelişimler kişilerin, toplumların, ülkelerin siyasi yapıları, sosyal yapıları, ekonomik yapıları, eğitim-öğretim yapıları gibi birçok alanı etkilemektedir. Ülkelerin kalkınması ve gelişmiş standartlara sahip olmaları için teknolojiyi etkin kullanabilen, bilimsel bilgi birikimi olan ve teknoloji üreten bireylere ihtiyaç duyulmaktadır (Demirezen ve Keleş, 2020; Jang ve Tsai, 2012). Nitelikli öğrenme çıktılarına sahip öğrencilere ulaşılmasında öğretmen niteliği önemli bir etkiye sahiptir (Öztürk, 2013). Öğretmenlerin neleri bilmesi ve neleri yapabilmesi gerektiği uluslararası araştırmaların da odağı olmuş ve öğretmenlerin sahip olması gereken yeterlikler literatürde Pedagojik Alan Bilgisi (PAB) adı altında ele alınmıştır. PAB Shulman tarafından 80’li yıllarda ortaya atılmıştır. Hızla gelişen teknolojinin çevrelediği bir toplumda yetişen yeni nesil, eğitimde kullanılan araçların, yöntemlerin ve dolayısıyla onları kullanacak olan öğretmenlerin yeterliklerinin değişmesini gerekli kılmıştır (Anderson, 2008; Carr ve diğerleri, 1998; Koehler ve Mishra, 2005). Teknoloji hayatımızın bir parçası haline gelmişken Mishra ve Koehler (2006) Shulman’ın geliştirdiği PAB’nin teknolojiyi ve teknoloji ilişkisini içermesi gerektiğini düşünmüşlerdir. Bu yüzden Mishra ve Koehler (2006) PAB’ni oluşturan alan bilgisi ve pedagojik bilgi boyutlarına teknoloji bilgisini ekleyerek Teknolojik Pedagojik Alan Bilgisini (TPAB) literatüre kazandırmışlardır (Koehler vd., 2014). TPAB temel olarak teknoloji entegrasyonu için öğretmen bilgisi çerçevesi olarak tanımlanır (Kabakçı-Yurdakul ve diğerleri, 2012; Koehler ve Mishra, 2009). Teknoloji, pedagoji ve alan bilgisini birbirleriyle bağlantılı olarak amaca hizmet edecek şekilde kullanabilmek, nitelikli öğretmenin özelliklerindedir (Dündar ve Ünaldı, 2020). Bu kapsamda TPAB araştırmacılar tarafından araştırılmaya değer bir konu olarak görülmüş son yıllarda teknolojinin hayatımızın içine daha fazla girmesiyle de bu konu oldukça önem kazanmıştır. Bu doğrultuda da TPAB konusunda yapılmış olan çalışmaların eğilimlerinin belirlenmesi bu konuda çalışma yapacak olan araştırmacılara ışık tutacaktır.

## Yöntem

Bu araştırmada, TPAB konusunda yapılmış olan çalışmaların detaylı bir incelemesi yapılmıştır. Bu sebeple araştırmada nitel veri toplama yöntemlerinden biri olan doküman analizi kullanılmıştır. Doküman analizi, yazılı belgelerin içeriğini titizlikle ve sistematik olarak analiz etmek için kullanılan bir araştırma yöntemidir (Wach, 2013). Araştırmada incelenecek makaleleri belirlemek için Google Scholar veri tabanı taranmıştır. Tarama yapılırken “Teknolojik Pedagojik Alan Bilgisi”, “TPAB”, “Teknolojik Pedagojik İçerik Bilgisi” ve “TPİB” anahtar kelimeleri kullanılarak arama yapılmıştır. Tarama yapılmaya 2010 yılından başlanmıştır. Sonrasında 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 ve 2020 ve 2021 yılları içinde yayınlanan makaleler taranmıştır. Araştırma kapsamında 2010-2021 yılları arasında yazılmış olan 112 makale incelenmiştir. İncelenen araştırmaların analizi için Sözbilir, Güler ve Çiltaş (2012) tarafından oluşturulan “Yayın Sınıflama Formu” kullanılmıştır. Yayın sınıflama formu; makalenin kimliği hakkında tanımlayıcı bilgi, disiplin alanı, makalenin konusu, yöntemi, veri toplama araçları, örnekleme ve veri analiz yöntemleri olarak yedi bölümden oluşmaktadır. Elde edilen veriler Excel programına kaydedilerek gruplandırılmıştır. Gruplandırılan veriler betimsel analiz yöntemiyle analiz edilmiştir. Verilerin analizinde frekans ve yüzde değerleri kullanılmıştır. Bu araştırma sırasında kavramsal çerçeve oluşturulurken, veriler toplanıp analiz edilirken ve raporlaştırılırken etik kurallara dikkat edilmiş ve kurallara uyulmaya özen gösterilmiştir.

## Bulgular

Araştırmanın birinci alt probleminde makalelerin yıllara göre dağılımı incelenmiştir. Yayınlanan makalelerin sayısının yıllara göre farklılık gösterdiği, en çok çalışmanın ise 2016 yılında yayınlandığı görülmüştür. İkinci alt problemde araştırma kapsamında yer alan makalelerin çalışma alanları incelenmiş ve çalışmaların büyük bir çoğunluğunun belirli bir alana ait olmadığı belirlenmiştir ayrıca çalışmaların 24 tanesi fen bilimleri öğretmenliği, 13 tanesi sınıf öğretmenliği ve 11 tanesi matematik öğretmenliği alanlarında yapılmıştır. Üçüncü alt probleme ait bulgular makalelerin konu dağılımında en çok TPAB’ ne yönelik yeterlik, tutum ve algıların incelendiğini göstermiştir. Araştırmanın dördüncü alt probleminde incelenen makalelerin yöntemlerine göre dağılımları incelenmiştir. Elde edilen bulgular makalelerde çoğunlukla nicel araştırma yönteminin kullanıldığını, nicel yöntem tercih edilen makalelerde ise genellikle betimsel yöntemin tercih edildiğini göstermiştir. Beşinci alt problemde makalelerde kullanılan nicel ve nitel veri toplama araçları incelenmiştir. Nicel veri toplama araçları olarak farklı ölçeklerden yararlanıldığı nitel veri toplama aracı olarak ise en çok görüşme tekniğinin tercih edildiği görülmüştür. Araştırmanın altıncı alt probleminde makalelerin araştırma örnekleme incelenmiştir. Araştırmaların genellikle öğretmen adaylarıyla yapıldığı tespit edilmiştir ayrıca bu alt problemde çalışmaların örneklem büyükleri de incelenmiştir. Elde edilen veriler çalışma gruplarının genellikle 101-300 kişiyle yapıldığını göstermiştir. Yedinci alt problemde makalelerde nicel veri analiz yöntemlerinin tercih edildiği görülmüştür. Nicel veri analiz yöntemlerinin kullanıldığı çalışmaların 53 tanesinde betimsel istatistikler, toplamda 150 tane ise kestirimsel istatistiklere yer verilmiştir. Kestirimsel istatistikler içerisinde en fazla bağımsız gruplar t testi kullanılmıştır. Nitel veri analiz yöntemlerinde ise genelde içerik analizi tercih edilmiştir.



## **Sonuç**

Araştırmamız TPAB'ne yönelik araştırma yapacak araştırmacılara yardımcı olacağını düşünmekteyiz. Bu araştırmanın sınırlılığı olarak incelenen çalışmaların sadece 2010-2021 yılları arasında yayınlanan makaleler olması gösterilebilir. Daha kapsamlı ve geniş sonuçlara ulaşabilmek için incelenen makalelere ek olarak yüksek lisans ve doktora tezleri de incelenebilir. Makalelerde genellikle TPAB'sine yönelik yeterlik, tutum ve algılarının incelendiği görülmüş ancak sadece yeterlik, tutum ve algıların incelenmesi yetersiz kalabilir bu kapsamda kişilerin TPAB kendi derslerine entegre etme durumları incelenebilir.