IOJPE
ISSN: 1300 – 915X
www.iojpe.org
International Online Journal of Primary Education 2021, volume 10, issue 2

EXAMINING THE PRESCHOOL AND PRIMARY SCHOOL TEACHERS' PERCEPTION OF SELF-CONFIDENCE ABOUT THEIR TPACK IN TURKEY

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Received: February 22, 2021 **Accepted:** April 17, 2021 **Published:** December 31, 2021

Suggested Citation:
Bay, Y., Bay, D. N., & Hartman, D. K. (2021). Examining the preschool and primary school teachers' perception of self-confidence about their TPACK in Turkey. *International Online Journal of Primary Education (IOJPE), 10*(2), 287-307.

Abstract

The aim of this research is to examine the preschool and primary school teachers' perception of self-confidence about their Technological Pedagogical Content Knowledge (TPACK) and analyze the differences in this perception depending on some variables (gender, type of high school, university, undergraduate program, and grade). Survey model was employed in the research. The research was carried out with the participation of 630 preservice teachers studying at the 2nd, 3rd, and 4th grades of the Preschool and Primary School Education Program of Anadolu University and Eskişehir Osmangazi University in the spring term of the 2019-2020 academic year. The data of the research were collected using "Technological Pedagogical Content Knowledge (TPACK) Self-Confidence Scale" developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009) and adapted to Turkish by Timur and Taşar (2011), and "Personal Information Form" developed by the researchers. As a result of the research, it was found that the preschool and primary school teachers' perception of self-confidence about their TPACK was high. Moreover, their perception of self-confidence about TPACK was found to differ significantly depending on gender, university, and grade, but not depending on undergraduate program and type of high school.

Keywords: TPACK, Self-confidence, preschool teacher, classroom teacher, pre-service teachers.

INTRODUCTION

Today, as technology permeates the human life increasingly day by day, new educational practices are developed in Turkey and other countries. The use and dissemination of technology in educational practices, as in many other fields, are put on the agenda. One of the most important initiatives is the project FATİH carried out by the Ministry of National Education. The objective of this project is to complete the technological infrastructure through smart boards, fiber internet line, and tablet for each student and to ensure active participation of students in education practices from kindergarten to high school (Ministry of Education, 2016). Another important practice is the use of the Education Information Network (EBA), a distance education portal for providing e-learning. Preservice teachers, who will implement technology applications in educational settings, should receive training on technological

knowledge (Choe & Lee, 2015). Getting insights into the preservice teachers' perception of self-confidence about their technological Pedagogical Content Knowledge (TPACK) in Turkey will contribute to the training of preservice teachers who know and apply the technology.

Teachers' qualifications, competencies, and experiences play an important role in the planning and implementation of teaching activities in the classroom (Demir & Bozkurt, 2011). Moreover, it should be kept in mind that the developments that come with technology are one of the main factors that affect teacher roles (Kabakçı Yurdakul, 2011). Teachers must get sufficient technology knowledge from the very beginning of their education lives (Güder, 2018). Teachers can effectively integrate technology into classroom applications using their technological knowledge and skills (Niess, 2011). Moreover, it is necessary for today's teachers to know how to keep up with the rapid changes in science and technology and integrate the reflections of these changes into the teaching-learning environments (Gedik, Sönmez, & Yeşiltaş, 2019). Today, technology is developing rapidly, children are introduced to technology at a very early age starting from preschool period. It is extremely important for preschool and classroom teachers to perceive and direct the children's interests. The present research examined the perception of self-confidence about TPACK in 630 preschool and primary school teachers from two universities in Turkey. To the best of our knowledge, there is a limited number of studies in this cultural context (Tokmak, Konokman, & Yelken, 2013).

Significance of the Research

There are some important reasons why this research was carried out. One of them is the need for improving teachers' TPACK in order to integrate technology into education, considering that new technologies have started to shape education systems more and more and the use of these technologies in educational settings increases every day (Roblyer, 2006). Developing digital technologies are more accessible in terms of applicability in educational programs. However, teachers experience difficulties in how and when to use these technologies in the curriculum (Niess, 2011). Thus, there is a need for conducting researches on what can be done to provide the knowledge and skills required for the use technology in teacher education programs (Canbazoğlu Bilici, 2012; Niess, 2006; Sultan & Aslan, 2017; Uğurlu, 2009) and how preservice teachers understand the relationship between technology and education (Hechter, Phyfe, & Vermette, 2012).

The second important reason is the integration of technology into education and its contribution to students' learning. The use of technology in education allows students to better understand and recall the knowledge (Akgün, Yılmaz, & Seferoğlu, 2011). With the advent of digital technology, students actively participate in the learning process and develop their knowledge generation, thinking, and problem-solving skills (Guzey & Roehring, 2009). In addition, the learning environment created with technology is very important for children to develop their ability of using technology (Uğurlu, 2009). TPACK, which is the subject of the research, explains the realization of permanent learning in children as a result of the combination of teachers' technology knowledge and expertise of technology transfer (Güder, 2018).

In addition, TPACK is one of the important research topics of recent years. In previous studies on teachers' self-confidence level in using technology in the teaching process, it has been reported that teachers' technological and pedagogical beliefs are effective in integrating technology into education (see, e.g., Abbitt 2011; Graham, 2011; Manfra & Hammond, 2006; Moore-Adams, Jones, & Cohen, 2016; Özgün-Koca, 2009; So & Kim 2009). Some studies showed that both teachers and preservice teachers were not sufficiently equipped to use technology (see, e.g., Agyei & Voogt, 2012; Erdoğan & Şahin, 2010; So & Kim 2009; Tondeur, Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich, 2012; Yelken, Tokmak, Özgelen, & İncikabı, 2013) and that technology and education could not be integrated successfully (see, e.g., Çiftçi, Taşkaya, & Alemdar, 2013; Judson, 2006; Usta & Korkmaz, 2010).

Therefore, technology knowledge of teachers is seen as an important predictor of their self-efficacy perceptions about technology (Abbitt, 2011). In this context, the theoretical framework of TPACK provides a guideline for eliminating shortcomings and problems as well as evaluating preservice teachers' beliefs (Koh, Chai, & Lim, 2017). However, there is not enough information about preschool and primary school preservice teachers' perception of their self-confidence about TPACK. Therefore, in this research, preschool and primary school teachers' perceptions of self-confidence about their TPACK and the differences in these perceptions depending on some variables were examined using "TPACK Self-Confidence Survey" developed by Graham, Burgoyne, Cantrell, Smith, Clair, & Harris (2009). Current research results are thought to be an important source for teacher training institutions and educators to train more qualified teachers. Moreover, the evaluation of preschool and primary school teachers' perceptions of their self-confidence about TPACK in a different cultural context will broaden the scope of researches in Turkey.

TPACK Framework

TPACK is a framework that allows teachers to think about the knowledge they need in the process of integrating digital technologies into education as learning tools (Niess, 2011). Shulman (1986) was the first to suggest that pedagogy and content knowledge (PCK) should be integrated and used together in teacher training programs. With the development of technology, the necessity of adding technology to the content and pedagogy components has emerged (Koehler & Mishra, 2005; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Niess, 2006; Shin, Koehler, Mishra, Schmidt, Baran, & Thompson, 2009). Mishra and Koehler (2006) added the dimension "technology" to the pedagogical content knowledge (PCK) model, which was created by Shulman (1986), and created TPACK model as a framework that includes the concepts that teachers need to know to integrate technology into education. TPACK, which is the integration of technology knowledge into pedagogy knowledge (Bağdiken & Akgündüz, 2018; Güder, 2018; Günbatar, Boz, & Damar, 2017; Koehler & Mishra, 2005; Saltan & Aslan, 2017), is structured as an innovative and contextual knowledge in which pedagogy, content, and technology are clustered within the same framework (Angeli & Valanides, 2009; Hofer, Blanchard, Grandgenett, Schmidt, van Olphen, & Young, 2010; Koehler & Mishra, 2009). In addition, as a guide for students to think and learn using digital technologies, it is a highly dynamic framework that provides the information that teachers need in planning the educational process (Niess, 2011). In this context, the framework consists of three main sources of knowledge [pedagogical knowledge (PK), content knowledge (CK), technological knowledge (TK)] and four structures resulting from their intersections [pedagogical content knowledge (PCK), technological pedagogic knowledge (TPK), technological content knowledge (TCK), technological pedagogical content knowledge (TPACK)] (Koehler & Mishra, 2009; Mishra & Koehler, 2006). The definitions of these three sources of knowledge and four structures are as follows:

(1) Content knowledge (CK): It is the knowledge that the teachers or preservice teachers possess about their field of teaching (Koehler, Mishra, & Yahya 2007). It is the organization of knowledge in teacher's mind, such as theories, ideas and practices (Shulman, 1986).
(2) Pedagogical knowledge (PK): It is the knowledge of teacher or preservice teacher about the use of teaching methods and strategies for structuring the child's knowledge in the teaching process (Koehler & Mishra, 2009).
(3) Technological knowledge (TK): It is the knowledge of the teacher or preservice teacher about the use of both standard technologies (white board, book, etc.) and advanced technologies (digital video, internet, smart board, educational software, etc.) as teaching tools (Koehler, Mishra, & Yahya, 2007).

(4) Technological content knowledge (TCK): It is the knowledge of the teachers or preservice teachers to decide about the technology that best suits the subject that they will teach (Koehler & Mishra, 2008).
(5) Pedagogical content knowledge (PCK): It is the knowledge of the teacher or preservice teacher to make a subject understandable for children by using the most appropriate illustrations (Shulman, 1986).
(6) Technological pedagogical knowledge (TPK): It is the knowledge of the teacher or preservice teacher about the use of technology tools in the teaching process and the effect of the use of technology on the teaching process (Mishra & Koehler, 2006).
(7) Technological pedagogical content knowledge (TPACK): It is the knowledge of how the teacher or preservice teacher takes into account the three sources of knowledge, that is, technology, pedagogy, and content knowledge together and how learning is realized through the relations between these sources of knowledge (Koehler & Mishra, 2009).

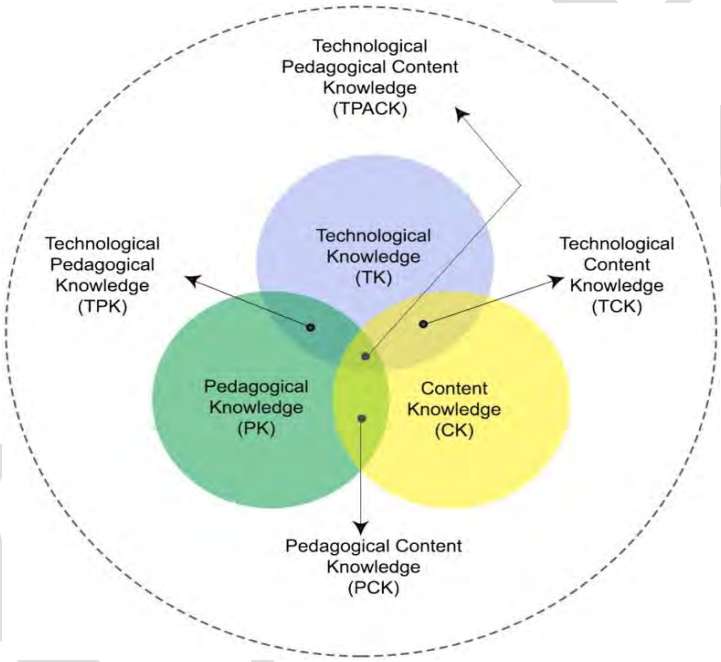

Figure 1. TPACK Framework (Koehler & Mishra, 2008).

As seen in Figure 1, Mishra and Koehler (2008) positioned multi-knowledge fields in the context of teachers' use of theory and practice together in their classrooms. The knowledge of teacher affects the application level in the classroom, while the application affects the degree of using knowledge in the classroom (Doering, Veletsianos, & Scharbe, & Miller, 2009). This framework, which allows teachers to think about the difficulties and subtleties of the context on how to teach the knowledge to children, also facilitates for children to learn (Angeli & Valanides, 2009). It is also an efficient framework for designing teacher education programs and guiding teachers' educators in order to help preservice teachers integrate technology into education (Günbatar, Boz, & Damar, 2017).

Purpose of the Study

In order to clarify what TPACK means and to develop a more robust and mature understanding about it, attention should be paid to what is being questioned in TPACK-related studies (Niess, 2011). The main objective of the current study is to investigate the preschool and primary school teachers' self-confidence

about their TPACK in Turkey. Preservice teachers were from two different universities and two different undergraduate programs. Their self-confidence about TPACK was analyzed through the questionnaires they filled in without any time limit.

The research question and five sub-questions of the research were specified as below:

What are the preschool and primary school teachers' perception of self-confidence about their TPACK?

Regarding preschool and primary school teachers;

- What is the role of gender in the perception of self-confidence about TPACK?
- What is the role of the type of high school they graduated from in the perception of self-confidence about TPACK?
- What is the role of the university they attend in the perception of self-confidence about TPACK?
- What is the role of the undergraduate program they study in the perception of self-confidence about TPACK?
- What is the role of grade in the perception of self-confidence about TPACK?

METHOD

This section includes the design of the research, participants, data collection, and data analysis.

Research Design

Survey model was used to determine the preschool and classroom teacher candidates' perception of self-confidence about their technological pedagogical content knowledge (TPACK) and to examine the differentiation of these self-confidence depending on some variables. Survey model is a research model that aims to describe a situation that existed in the past or still exists as it is without any intervention (Karasar, 2008). In addition, in survey model (cross-sectional survey technique), variables are measured once to determine whether there is a difference between them (Fraenkle, Wallen, & Hyun, 2006).

Sample

The sample of the study consisted of 630 preservice teachers studying at the 2nd, 3rd, and 4th grades of Preschool and Primary School Education Program of Anadolu University and Eskisehir Osmangazi University (ESOGU). In the selection of the preservice teachers, having taken educational courses was considered as a criterion and, therefore, those studying at the 2nd and higher grades were included in the sample. Some demographic characteristics of the preservice teachers are given in the table below.

Table 1. Demographic characteristics of the pre-service teachers who participated in the research

Variable	Category	f	%
Gender	Female	512	81.3
	Male	118	18.7
University	Anadolu University	315	50
	Eskişehir Osmangazi University	315	50
Undergraduate Program	Preschool Teaching	306	48.6
	Primary School Education Program	324	51.4
High school Type	Science High School	8	1.3
	Anadolu High School	420	66.7
	Anadolu Teacher Training High School	65	10.3
	Social Science High School	11	1.7
	Vocational High School	94	14.9
	Normal High School	32	5.1
Grade	2nd Grade	281	44.6
	3rd Grade	209	33.2
	4th Grade	140	22.2

512 (81.3%) of the preservice teachers were female and 118 (18.7%) of them were male. 315 (50%) preservice teachers were from Anadolu University and 315 (50%) from Eskişehir Osmangazi University (ESOGU). 306 (48.6%) of them were studying at the preschool teaching education program, 324 (51.4%) at the classroom teaching education program. 291 (44.6%) of them were from the 2nd grade, 209 (33.2%) from the 3rd grade, and 140 (22.2%) from the 4th grade. As for the type of high school, 420 (66.7%) of them graduated from Anatolian High School, 94 (14.9%) from Vocational High School, 65 (10.3%) from Anatolian Teacher Training High School, 32 (5.1%) from Normal High School, 11 (1.7%) from Social Sciences High School, and 8 (1.3%) from Science High School.

Data Collection Tools

The data of the research were collected using "Personal Information Form" developed by the researchers and "Technological Pedagogical Content Knowledge Self-Confidence Scale" developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009) and adapted to Turkish by Timur and Taşar (2011).

TPACK Self-Confidence Scale: TPACK Self-Confidence Scale was developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009) and adapted to Turkish by Timur and Taşar (2011). The survey was created as a 5-point Likert scale with five options [(1) Not confident, (2) Somehow confident, (3) Moderately confident, (4) Very Confident, and (5) Completely confident] and an additional option [(0) I don't know this type of technologies] for the items 16, 17, 18, 19, and 20. The scale consists of 31 items and has a 4-factor structure. TPACK was specified as the first factor (items 1-8), TPK as the second factor (items 9-15), TCK as the third factor (items 16-20), and TK as the fourth factor (items 21-31). The lowest score possible for TPACK Self-Confidence Scale is 26 and the highest score possible is 155. The first factor of the scale has a score range of 8-40, the second factor 7-35, the third factor 0-25, and the fourth factor 11-55. Cronbach Alpha values of the original scale for the factors 1, 2, 3, and 4 were found to be .95, .91, .97, and .92, respectively. Cronbach Alpha reliability coefficient of the scale adapted to Turkish was found to be .92 for overall scale , and .89, .87, .89, and .86, for the factors 1, 2, 3, and 4, respectively (Timur and Taşar, 2011). These values show that the Turkish version of the scale is both valid and reliable.

Personal Information Form: Personal Information Form was created by the researchers to collect information such as gender, university, and undergraduate program, type of high school, and grade that may cause a difference in the preschool and primary school teachers' perceptions of self-confidence about their TPACK.

Data Analysis

Prior to the data analysis, the data set was controlled. The data of 630 preschool and primary school teachers were transferred to SPSS 23.0 program and checked for missing/incorrect data entries. Then, the compatibility of the factor structures of the scale with the data was evaluated by Confirmatory Factor Analysis (CFA). Skewness and kurtosis coefficients were calculated to determine the distribution of the data. The results are shown in Table 2.

Table 2. Skewness and Kurtosis coefficients calculated for the answers given to the TPACK scale items

Dimension	n	Skewness	Kurtosis
TPACK	630	- .276	- .076
TPK	630	- .583	.171
TCK	630	- .799	- .119
TK	630	- .475	- .198
TPACK Self-Confidence (Overall)	630	- .262	- .056

TPACK: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As seen in Table 2, the skewness and kurtosis coefficients of the overall scores of the preservice teachers who participated in the research were calculated as -.262 and -.056, respectively. The skewness and kurtosis coefficients calculated for the score distribution of the sub-dimensions and the whole scale were within the range of ± 1. Skewness and kurtosis values within the range of ± 1 indicate that the data is normally distributed (Büyüköztürk, 2018). Accordingly, it can be said that that the preservice teachers' TPACK self-confidence scores have a normal distribution without excessive deviation.

After analyzing the data set, descriptive statistics including minimum, maximum, average, and standard deviation values were calculated in order to determine the preschool and primary school teachers' perceptions of self-confidence about their TPACK. Then, the difference tests were carried out to reveal the differences between the preschool and primary school teachers' perceptions of self-confidence about their TPACK in terms of demographic characteristics. In the interpretation of the tests, the statistical significance was set at $p<.05$.

RESULTS

Confirmatory Factor Analysis (CFA)

The compliance of the factor structures of "TPACK Self-Confidence Scale" with the data obtained after the adaptation was evaluated by CFA.

CFA is carried out to examine the extent that a previously created structure is verified with the obtained data. In other words, CFA tests the hypothesis that the predetermined factor structures will not change in the new application (Sümer, 2000). Figure 3 shows the path diagram of the CFA carried out for the four-factor structure specified in the original TPACK Self-Confidence Scale.

Table 3. Goodness of fit results of the preservice teachers' perception of self-confidence about TPACK by CFA

Fit Parameter	Fit Parameter Statistics	Acceptable Fit Values	Good Fit Values
RMSEA	.069	.05 ≤ RMSEA ≤ .08	0 ≤ RMSEA ≤ .05
χ^2/s.d.	3.97	0 ≤ χ2 ≤ 2	2 ≤ χ2 ≤ 3
SRMR	.065	.05 ≤ SRMR ≤ .10	0 ≤ SRMR ≤ .05
NFI	.95	.90 ≤ GFI ≤ .95	.95 ≤ GFI ≤ 1.00
GFI	.85	.90 ≤ GFI ≤ .95	.95 ≤ GFI ≤ 1.00
AGFI	.83	.85 ≤ AGFI ≤ .90	.90 ≤ AGFI ≤ 1.00
CFI	.97	.90 ≤ CFI ≤ .95	.95 ≤ CFI ≤ 1.00

RMSEA: Root Mean Square Error of Approximation, **NFI:** Normed Fit Index, **GFI:** Goodness of Fit Index, **AGFI:** Adjusted Goodness of Fit Index, **CFI:** Comparative Fit Index

The following criteria were taken into account when evaluating the indices: 2 DF ≤ χ2 ≤ 3 DF (degree of freedom) acceptable fit, 0 ≤ χ2 ≤ 2 DF good fit; .90 ≤ CFI ≤ .95 acceptable fit, .95 ≤ CFI ≤ 1.00 good fit; .05 ≤ SRMR ≤ .10 acceptable fit, 0 ≤ SRMR ≤ .05 good fit; .05 ≤ RMSEA ≤ .08 acceptable fit, 0 ≤ RMSEA ≤ .05 good fit; .90 ≤ GFI ≤ .95 acceptable fit, .95 ≤ GFI ≤ 1.00 good fit; .85 ≤ AGFI ≤ .90 acceptance fit, .90 ≤ AGFI ≤ 1.00 good fit. The criterion taken into consideration in the evaluation of the standardized factor loads was being equal or higher than .30. The factor loads and goodness of fit values given in the figures showed that the factor loads were fully compatible, and goodness of fit values indicated a good fit. Model-data fit values calculated in the Confirmatory Factor Analysis (X2/DF = 3.97, RMSEA = .069, CFI = .97, NFI = .95, AGFI = .83, GFI = .85) showed that the four-dimension, 31-item structure was verified in the Turkish sample (Timur & Taşar, 2011).

IOJPE
ISSN: 1300 – 915X
www.iojpe.org
International Online Journal of Primary Education
2021, volume 10, issue 2

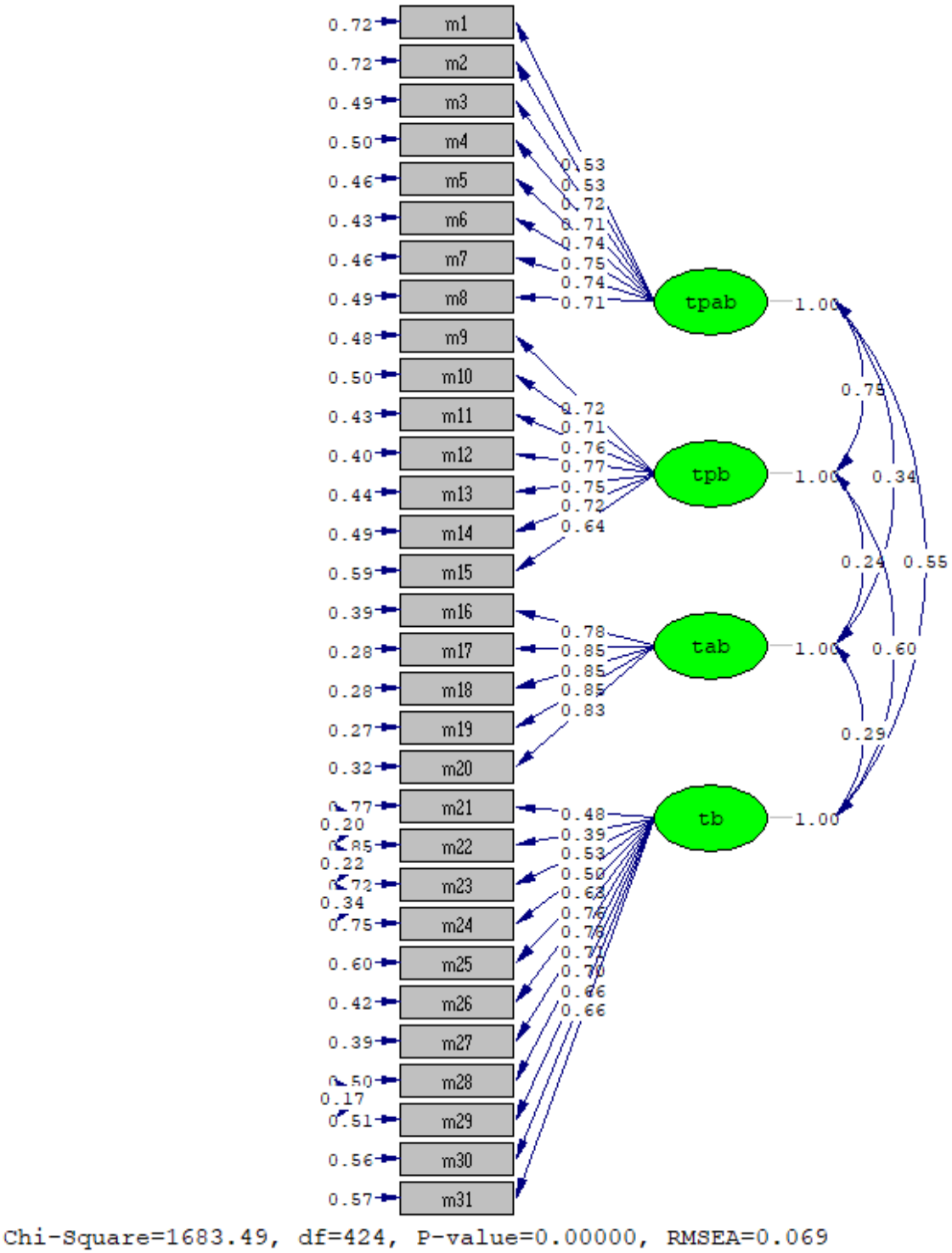

Figure 2. The path diagram of the CFA carried out on the four-factor structure specified in the original "TPACK Self-Confidence Scale"

Within the scope of this research, 630 preservice teachers answered the questions in the TPACK Self-Confidence Scale. Cronbach alpha reliability coefficients were calculated to determine the reliability of the answers given to the scale items.

Table 4. Reliability analysis results of the preservice teachers' perception of self-confidence about TPACK

Dimension	Cronbach Alfa	Number of Items
TPACK	*.872*	*8*
TPK	*.883*	*7*
TCK	*.918*	*5*
TK	*.879*	*11*
TPACK Self-confidence	.921	31

TPACK: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 4, the reliability coefficients of the sub-dimensions and the whole scale were as follows: TPACK, .872; TPK, .883; TCK, .918; TK, .879; and the whole Scale, .921. These values show that the answers given to the scale items by the preservice teachers participating in the research were highly reliable (Kalaycı, 2010).

Descriptive Statistics

The descriptive statistics were calculated to determine the preschool and primary school teachers' perceptions of self-confidence about their TPACK. The results are shown in Table 5.

Table 5. Descriptive statistics result of the preservice preschool and primary school teachers' perceptions of self-confidence about TPACK

Scale	Number of Items	n	Min.	Max.	Mean	Std.Dev.
TPACK	8	630	12.00	40.00	30.36	5.29
TPK	7	630	9.00	35.00	28.08	4.94
TCK	5	630	.00	25.00	15.41	6.92
TK	11	630	14.00	55.00	42.26	8.13
TPACK Self-confidence (Overall)	31	630	46.00	155.00	116.11	18.85

TPACK: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 5, the preschool and classroom teacher preservice teachers' scores for the dimension "TPACK" ranged between 12.00 and 40.00, and the mean score was calculated as 30.36 (±5.29). Their scores for the dimension "TPK" ranged from 9.00 to 35.00 with an average of 28.08 (±4.94). Their scores for the dimension "TCK" varied between .00 and 25.00, and their average was calculated as 15.41 (± 6.92). TK scores of the preservice teachers varied between 14.00 and 55.00, and the average was calculated as 42.26 (±8.13). Finally, their scores for the overall scale (31-item TPACK Self-Confidence scale) varied between 46.00 and 155.00, and the average was calculated as 116.11 (±18.85). The average score obtained from the whole scale was 93. The fact that the average score for the whole scale was above 93 ($\bar{X}$=116.11) indicates that the preschool and primary school teachers' perception of self-confidence about their TPACK was high. Since the number of items in each dimensions of the scale is different, the average score for each sub-dimension was divided by the number of items in that sub-dimension to make comparison between the dimensions. Accordingly, preservice teachers were observed to have the highest score in TPK ($\bar{X}$=4.0), whereas they were found to have the lowest score in TCK ($\bar{X}$=3.08).

Difference Statistics

Difference statistics were calculated to reveal the significant differences, if any, between the preschool and primary school teachers' perceptions of self-confidence about TPACK in terms of demographic variables (gender, type of high school, university, undergraduate program, and grade). Before the calculations, the assumptions of normality and homogeneity of variances were tested using non-parametric statistics.

Mann Whitney-U test was used to test the significance of the differentiation between the preschool and primary school teachers' perceptions of self-confidence about TPACK depending on gender. The results are given in Table 6.

Table 6. Mann Whitney-U test results of the preservice teachers' perceptions of self-confidence about TPACK by gender

Dimensions	Gender	n	Mean	Std.Dev.	Z_{calc}	p
TPACK	Female	512	30.29	5.27	- .79	.429
	Male	118	30.67	5.40		
TPK	Female	512	28.03	4.95	- .48	.630
	Male	118	28.30	4.92		
TCK	Female	512	15.03	6.95	-3.18	.001*
	Male	118	17.02	6.58		
TK	Female	512	41.90	8.17	-2.39	.017*
	Male	118	43.82	7.80		
TPACK Self-confidence (Overall)	Female	512	115.26	18.64	-2.65	.008*
	Male	118	119.81	19.40		

*p≤.05 $H_0: \mu_1 = \mu_2$ (The difference between the self-confidence of the female and male preservice teachers is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 6, the zero hypothesis, which claims that the differences between the female and male preservice teachers in terms of TPACK self-confidence, TCK, and TK average scores are statistically insignificant, can be rejected with a confidence of 95% (p=.008≤.05). Statistically significant differences were observed between the self-confidence perceptions of female and male preservice teachers in terms of the sub-dimensions TCK and TK (p=.001≤.05 and p=.017≤.05, respectively). As for the average scores, the male preservice teachers' TCK and TK perception levels (17.02 ± 6.58 and 43.82 ± 7.80, respectively) were significantly higher than those of the female preservice teachers (15.03 ± 6.95 and 41.90 ± 8.17, respectively). Moreover, the preservice teachers' TPACK self-confidence perception also showed a significant difference depending on gender (p=.008≤.05). The perception level of the male preservice teachers (119.81±19.40) was significantly higher than that of the females (115.26±18.64). Therefore, it can be asserted that gender has a statistically significant effect on the perception levels of self-confidence about TCK, TK, and TPACK. No significant difference was observed between the preservice teachers' TPK levels depending on gender (p>.05). In other words, the female and male preservice teachers were found to be similar in terms of TPK.

Mann Whitney-U test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about TPACK in terms of the university they attend. The results are given in Table 7.

As can be seen in Table 7, the zero hypothesis, which claims that the differences between the preservice teachers' average scores for TPACK self-confidence, TPACK and TCK depending on whether they attend Anadolu University or Eskisehir Osmangazi University (ESOGU) are statistically insignificant, can be rejected with a confidence of 95% (p=.031≤.05). It was observed that there was a significant difference between the self-confidence perceptions of the pre-service teachers studying at Anadolu University and

Eskişehir Osmangazi University in terms of the sub-dimensions of technological pedagogical content knowledge (TPACK) and technological content knowledge (TCK) (p=.000≤.05 and p=.038≤.05, respectively).

Table 7. Mann Whitney-U test results of the preservice teachers' perceptions of self-confidence about TPACK by the university they attend

Dimension	University	n	Mean	Std.Dev.	Z_{calc}	p
TPACK	Anadolu	315	31.15	5.17	-3.783	.000*
	ESOGU	315	29.57	5.31		
TPK	Anadolu	315	28.19	5.24	-.974	.330
	ESOGU	315	27.97	4.64		
TCK	Anadolu	315	15.94	6.93	-2.072	.038*
	ESOGU	315	14.87	6.88		
TK	Anadolu	315	42.52	8.31	-.703	.482
	ESOGU	315	42.00	7.94		
TPACK Self-confidence (Overall)	Anadolu	315	117.81	19.46	-2.163	.031*
	ESOGU	315	114.41	18.09		

*p≤.05 $H_0: \mu_1 = \mu_2$ (The difference between the self-confidence of the preservice teachers who attend different universities is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

The preservice teachers from Anadolu University were found to have significantly higher average scores for TPACK and TCK (31.15±5.17 and 15.94±6.93, respectively) than those from ESOGU (29.57±5.31 and 14.87±6.88, respectively). The preservice teachers' perceptions of self-confidence about TPACK also showed a significant difference depending on the university they attend (p=.031≤.05). The preservice teachers from Anadolu University were found to have a significantly higher score for TPACK self-confidence perception (117.81±19.46) than those from ESOGU (114.41±18.09). Therefore, it can be asserted that the university they attend had a statistically significant effect on their TPACK, TCK, and TPACK self-confidence perception levels. No significant difference was observed between their TPK and TK levels depending on the university they attend (p>.05). In other words, the preservice teachers from Anadolu University and Eskisehir Osmangazi University were found to have similar TPK and TK.

Mann Whitney-U test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about TPACK depending on the undergraduate program they study. The results are given in Table 8.

Table 8. Mann Whitney-U test results of the preservice teachers' perceptions of self-confidence about TPACK by the undergraduate program they study.

Dimension	Undergraduate Program	n	Mean	Std.Dev.	Z_{calc}	p
TPACK	Preschool Teaching	306	30.07	5.35	-1.173	.241
	Classroom Teaching	324	30.64	5.23		
TPK	Preschool Teaching	306	27.69	4.98	-2.028	.043*
	Classroom Teaching	324	28.45	4.89		
TCK	Preschool Teaching	306	14.90	7.03	-1.922	.055
	Classroom Teaching	324	15.88	6.80		
TK	Preschool Teaching	306	41.87	8.24	-1.008	.313
	Classroom Teaching	324	42.63	8.02		
TPACK Self-confidence (Overall)	Preschool Teaching	306	114.52	19.13	-1.867	.062
	Classroom Teaching	324	117.61	18.49		

*p≤.05 $H_0: \mu_1 = \mu_2$ (The difference between the self-confidence of the preservice teachers who study different undergraduate programs is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 8, the zero hypothesis, which claims that the difference between the preservice teachers' average scores for the perception of self-confidence about TPK depending on the undergraduate program is statistically insignificant, can be rejected with a confidence of 95% (p=.043≤.05). A statistically significant difference was observed between the preservice teachers studying at the undergraduate programs of preschool and classroom teaching in terms of perception of self-confidence about TPK (p=.043≤.05). The preservice teachers studying at the undergraduate program of classroom teaching were found to have a significantly higher average score for TPK (28.45±4.89) than those studying at the undergraduate program of preschool teaching (27.69±4.98). In other words, it can be asserted that the undergraduate program they study had a statistically significant effect on their perception of self-confidence about TPK. No significant difference was observed between their scores for TPACK, TCK, and TK depending on the undergraduate program they study (p>.05). In other words, the preservice teachers studying at the undergraduate programs of preschool teaching and classroom teaching were found to have similar TPACK, TCK and TK. Moreover, the preservice teachers' scores for the overall scale of TPACK self-confidence did not differ significantly depending on the undergraduate program they study (p=.062>.05).

Kruskal Wallis test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about their TPACK depending on the type of the high school they graduated from. The results are given in Table 9.

Table 9. Kruskal Wallis test results of the preservice teachers' perceptions of self-confidence about TPACK by the type of the high school they graduated from.

Dimension	High school Type	n	Mean	Std.Dev.	p
TPACK	Anatolian High School	420	30.28	5.34	.722
	Anatolian Teacher Training High School	65	31.08	4.99	
	Vocational High School	94	30.33	5.00	
	Other High School	51	30.20	5.86	
	Overall	630	30.36	5.29	
TPK	Anatolian High School	420	28.10	4.86	.809
	Anatolian Teacher Training High School	65	28.52	4.99	
	Vocational High School	94	28.00	4.72	
	Other High School	51	27.51	5.93	
	Overall	630	28.08	4.94	
TCK	Anatolian High School	420	15.30	6.98	.094
	Anatolian Teacher Training High School	65	17.09	6.71	
	Vocational High School	94	15.37	6.22	
	Other High School	51	14.22	7.77	
	Overall	630	15.41	6.92	
TK	Anatolian High School	420	42.03	8.31	.804
	Anatolian Teacher Training High School	65	42.71	8.12	
	Vocational High School	94	42.71	6.99	
	Other High School	51	42.80	8.72	
	Overall	630	42.26	8.13	
TPACK Self-confidence (Overall)	Anatolian High School	420	115.70	19.12	.464
	Anatolian Teacher Training High School	65	119.40	18.12	
	Vocational High School	94	116.42	16.85	
	Other High School	51	114.73	21.08	
	Overall	630	116.11	18.85	

*p≤.05 $H_0: \mu_1 = \mu_2 \ldots \mu_n$ (The difference between the self-confidence levels of the preservice teachers who graduated from different types of high school is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 9, the zero hypothesis, which claims that the difference between the groups in terms of the type of the high school they graduated from is statistically insignificant, cannot be rejected with a confidence of 95% (p=.464≥.05). Therefore, it can be asserted with a reliability of 95% that the type of the high school from which the preservice teachers graduated did not have a statistically significant effect on their perceptions of self-confidence about their TPACK. In other words, the preservice teachers who graduated from different types of high school were found to have similar perceptions of self-confidence about TPACK.

Kruskal Wallis test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about TPACK in terms of grade. The results are given in Table 10.

Table 10. Kruskal Wallis test results of the preservice teachers' perception of self-confidence about TPACK by grade

Dimension	Grade	n	Mean	Std.Dev.	p
TPACK	2nd Grade	281	30.27	5.30	.003*
	3rd Grade	209	29.70	5.03	
	4th Grade	140	31.53	5.50	
	Overall	630	30.36	5.29	
TPK	2nd Grade	281	27.83	5.08	.001*
	3rd Grade	209	27.57	4.67	
	4th Grade	140	29.36	4.86	
	Overall	630	28.08	4.94	
TCK	2nd Grade	281	14.08	7.29	.000*
	3rd Grade	209	16.14	6.24	
	4th Grade	140	16.96	6.68	
	Overall	630	15.41	6.92	
TK	2nd Grade	281	41.41	8.27	.021*
	3rd Grade	209	42.43	7.87	
	4th Grade	140	43.73	8.05	
	Overall	630	42.26	8.13	
TPACK Self-confidence (Overall)	2nd Grade	281	113.59	19.05	.000*
	3rd Grade	209	115.85	17.77	
	4th Grade	140	121.57	19.00	
	Overall	630	116.11	18.85	

*p≤.05 $H_0: \mu_1 = \mu_2 \dots \mu_n$ (The difference between the self-confidence of the preservice teachers who were at different grades is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 10, the zero hypothesis, which claims that the difference between the groups depending on the grade is statistically insignificant, can be rejected (p=.001≤.05). Therefore, it can be asserted with a reliability of 95% that the grade of the preservice teachers creates a statistically significant effect on their perceptions of self-confidence about their TPACK. Post-hoc test results showing the source of the difference in terms of grade are given below.

Table 11 shows that the senior (4th grade) students were the source of the difference in the overall scale of TPACK self-confidence and in the sub-dimensions of TPACK, TPK, TCK, and TK (*p≤.05*). In other words, it can be asserted that the variation in the preservice teachers' scores for TPACK self-confidence dimensions depending on grade was caused by the seniors, and the self-confidence perceptions of the seniors were significantly higher than those at other grades.

Table 11. Least significant differences (LSD) test results f the preservice teachers' perception of self-confidence about TPACK

Dependent Variable	(I) Grade	(J) Grade	Mean Difference (I-J)	Standard Error	p
TPACK	**2nd Grade**	3rd Grade	.58	.48	.231
		4th Grade	**-1.25***	**.54**	**.021**
	3rd Grade	2nd Grade	-.58	.48	.231
		4th Grade	**-1.83***	**.57**	**.002**
	4th Grade	2nd Grade	1.25*	.54	.021
		3rd Grade	1.83*	.57	.002
TPK	**2nd Grade**	3rd Grade	.25	.45	.575
		4th Grade	**-1.53***	**.51**	**.003**
	3rd Grade	2nd Grade	-.25	.45	.575
		4th Grade	**-1.78***	**.54**	**.001**
	4th Grade	2nd Grade	1.53*	.51	.003
		3rd Grade	1.78*	.54	.001
TCK	**2nd Grade**	3rd Grade	-2.06*	.62	.001
		4th Grade	**-2.88***	**.71**	**.000**
	3rd Grade	**2nd Grade**	**2.06***	**.62**	**.001**
		4th Grade	-.81	.75	.275
	4th Grade	2nd Grade	2.88*	.71	.000
		3rd Grade	.81	.75	.275
TK	**2nd Grade**	3rd Grade	-1.03	.73897	.166
		4th Grade	**-2.32***	**.83691**	**.006**
	3rd Grade	2nd Grade	1.0	.74	.166
		4th Grade	-1.30	.88	.142
	4th Grade	**2nd Grade**	**2.32***	**.84**	**.006**
		3rd Grade	1.30	.88	.142
TPACK Self-confidence (Overall)	**2nd Grade**	3rd Grade	-2.26	1.70	.185
		4th Grade	**-7.98***	**1.93**	**.000**
	3rd Grade	2nd Grade	2.26	1.70	.185
		4th Grade	**-5.72***	**2.03**	**.005**
	4th Grade	2nd Grade	7.98*	1.93	.000
		3rd Grade	5.72*	2.03	.005

TPACK: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

DISCUSSION and CONCLUSION

In this study, the preschool and primary school teacher candidates' level of self-confidence about their TPACK was analyzed according to some demographic characteristics. Overall TPACK self-confidence of the preservice teachers was found to be high. As for the sub-dimensions of TPACK self-confidence scale, the preservice teachers were found to have the highest mean score in TPK and the lowest mean score in TCK. In their study examining the preservice teachers' perceptions of self-confidence about TPACK, Tokmak, Konakman and Yelken (2013) also reported that the preservice teachers had a high self-confidence perception. They also reported that the preservice teachers had the highest average score in TPK and the lowest in TK. In their study examining the TPACK self-confidence perceptions of the preservice and in-service teachers from four different teaching fields (science, math, ICT, classroom), Saltan and Arslan (2017) reported that the preservice teachers had the highest average score in TPK and the lowest in TPACK. As for the previous studies carried out with the participation of teachers, Güder (2018) and Bağdiken and Akgündüz (2018) focused on classroom teachers' and science teachers' TPACK

self-confidence, respectively. In both studies, the teachers' self-confidence was found to be high, and the highest average score was observed in the sub-dimension TPK, while the lowest average scores differed. The results of these studies support the finding of our study that the preservice teachers' self-confidence perception was high, the sub-dimension with the highest average score was TPK, even though they reported a different result in terms of the sub-dimension with the lowest average score. In the research conducted by Emre, Atıcı and Ayaz (2020) to determine the classroom teachers' levels of technological pedagogical content knowledge in the context of learning outcomes, it was asserted that the usage levels were not sufficient. In this context, it can be thought that preschool and primary school teachers should be supported more in all the sub-dimensions except TPK. On the other hand, in their research carried out with the participation of preservice teachers from 13 different undergraduate programs, Tatlı, Akbulut ve Altınışık (2016) examined the effects of the use of Web 2.0 tools for educational purposes on the preservice teachers' self-confidence. They reported that the preservice teachers achieved the highest average score in TCK, and the lowest in TPK. This study, which was carried out with a broad sample in terms of undergraduate programs, shows that the results may change due to the differences between undergraduate programs. In the research, it was reported that an increase was observed in the preservice teachers' scores for TPACK self-confidence and its sub-dimensions after web 2.0 tools were used for educational purposes. This result is important in that it shows the effects of the applications that teacher educators provided in the teaching process on the preservice teachers' TPACK self-confidence.

In order to examine the preservice teachers' TPACK self-confidence in more detail, the scores were analyzed according to gender, university, undergraduate program, high school type, and grade. Among these variables, the type of the high school from which the preservice teachers graduated was observed to have no effect on their scores for TPACK self-confidence and its sub-dimensions. The male preservice teachers were found to have significantly higher scores for overall TPACK self-confidence, TCK, and TK than the females. This result might be due to the fact that men are more interested in learning digital games and using technical knowledge (Hsu, Tsai, Chang, & Lia, 2017). In the research carried out by Koh, Chai and Tsai (2010), the technology knowledge of the male preservice teachers was found to be higher than that of the females, which also supports this interpretation. Similarly, the studies conducted with the participation of teachers also reported that TK level of the male teachers was higher (see, e.g., Bal & Kandemir, 2013; Karadeniz & Vatanartleyen, 2015). Cheng (2017) investigated the TPK level of mother-tongue teachers and concluded that the male teachers had more self-confidence about their TK than the female teachers. Creating settings such as workshops where male teachers can share their technology knowledge with female teachers may positively contribute to females' TK level. Çetin (2019) examined the technological pedagogical field knowledge of teacher candidates and reported results similar to those of Cheng. Çetin (2019) reported that TPACK of the male pre-service teachers was higher than that of the females, except for the sub-dimensions PC and PCK. Based on the current research results, it is thought that educational settings where male teachers can share their TCK and TK with females can be beneficial. However, some studies concluded that preservice teachers' TPACK self-confidence did not differ depending on gender (see, e.g., Bozkurt, 2016; Doğan, 2019; Koh & Sing, 2011; Tokmak, Konokman, & Yelken, 2013). Therefore, there is a need for conducting in-depth analysis on gender with further researches on TPACK self-confidence.

As for the effect of university on TPACK self-confidence of the preservice teachers from two universities in the same province, the preservice teachers from Anadolu University were found to have a significantly higher average score in overall TPACK self-confidence and the sub-dimensions TPK and TK. Teacher training institutions are expected to provide preservice teachers with competence in technology integration and improve their self-confidence perception (Mishra & Koehler, 2006). In Turkey, the competences that preservice teachers should possess are specified by the Council of Higher Education (CoHE), which is

affiliated to the Ministry of Education. In the report on teacher qualifications, it was stated that teachers should have all the necessary knowledge and skills for the integration of education and technology (Ministry of Education, 2006). Universities and educators who train teachers are responsible for providing these qualifications to preservice teachers. In the process of adapting students to the integration of technology into the educational process, it is very important to make more planning starting from technical support (Baxter & Lederman, 1999). However, the relevant researches in the literature did not include the variable "university". The current research shows that the educational setting offered by the university has an effect on the TPACK self-confidence of preservice teachers.

Both preschool and primary school teacher candidates participated in the study, and their undergraduate program was included in the study as a variable. As a result of the research, TPACK self-confidence of the preservice teachers studying in both programs was found to be high; however, the primary school teacher candidates were found to have significantly higher average scores in the sub-dimension TPK. It was concluded that the technological pedagogical content knowledge (TPACK) levels of the pre-service teachers differed significantly depending on their department (Doğan, 2019). The knowledge and competencies of teachers are very important in using technology in preschool education. However, it is a very sensitive issue how to use technology in preschool education. If education and technology cannot be fully integrated, they may have some negative effects on children's creativity (Haughland, 1999). Therefore, preschool teachers need training for using and applying technology tools (NAEYC, 2012).

Finally, it was found that the senior (4^{th} grade) preservice teachers had higher scores in TPACK self-confidence and all sub-dimensions than those at other grades. Similarly, in the studies examining TPACK self-confidence of preservice teachers, it was reported that senior preservice teachers' self-confidence was higher than those of the other grades (Bozkurt, 2016; Kartal & Afacan, 2017). The review of the studies on teachers' TPACK self-confidence revealed that self-confidence decreases as the professional seniority increases (Avcı & Ateş, 2018; Bal & Kandemir, 2013; Bilici & Güler, 2016; Doğru & Aydın, 2017; Güder, 2018). This can be explained by the fact that teachers are introduced to the development of technology early in their faculty life, and in later periods, they use technology more intensively in their daily lives (Bal & Kandemir, 2013). In the study examining teachers' TPACK levels, Chuang and Ho (2011) reported that the teachers in the lowest age group (20-30 years old) had a significantly higher knowledge level than other age groups. Considering the results reported in these studies, it can be thought that TPACK self-confidence is higher in the senior students who increased their knowledge level during their education in the undergraduate program and the new teachers who are in the similar age group.

Conclusion

This study examining the preschool and primary school teacher candidates' TPACK self-confidence provides important information to educators. As preservice teachers' levels of technology usage increase, they develop a positive attitude towards the use of technology when they become a teacher (Usta & Korkmaz, 2010). The data obtained in this study will also help preservice teachers develop their TPACK self-confidence. Although the preservice teachers' TPACK self-confidence was high, they had a low score in TCK. This indicates that they should be supported in this dimension. In addition, there is a need to support the female preservice teachers and the preservice teachers at the 2^{nd} and 3^{rd} grades in terms of TPACK self-confidence. In addition, another result of the study was the significance of technology-integrated education opportunities provided to preservice teachers in education faculties, which explained the difference between universities. Finally, the preschool teacher candidates were observed to need more support in undergraduate education regarding TPK. More empirical research can be carried out to improve the TPACK levels of prospective teachers. More measurement tools can produce more qualified and comprehensive results in future studies. More applications associated with TPACK can be included in the lessons in the undergraduate program of Preschool Education and Classroom Teaching.

Limitations and Directions for Future Research

This research, which was conducted with the participation of preschool and primary school teachers in Turkey, expanded the scope of the studies on TPACK self-confidence. However, the research has some limitations. The data of the study were collected from 630 preservice teachers from two universities in the same province in Turkey. It should be noted that preservice teachers' TPACK self-confidence may change depending on the participant's demographic characteristics or their cultural differences. Considering that the preservice teachers were trained by similar education programs in the same province, it can be thought that the research results may not fully reflect the TPACK self-confidence of preservice teachers.

In addition, this is the first research examining preschool and primary school teachers' TPACK self-confidence in Turkey. Therefore, the results of the research should be supported and verified by other studies.

Future research should include different samples that allow the evaluation of different provinces and regions of Turkey. In addition to the quantitative analysis, qualitative methods can be used in future studies to examine other variables that may affect preservice teachers' TPACK self-confidence. Comparison of quantitative and qualitative research results may be helpful in understanding preschool and primary school teachers' attitudes towards TPACK. Moreover, since different results were obtained depending on the gender of the preservice teachers in Turkey, it is recommended to monitor their TPACK self-confidence by longitudinal studies in future. In addition, the impact of the educational settings offered by universities on preservice teachers' TPACK self-confidence should be examined.

Future researches may investigate the impact of the technologically improved instruction provided by teacher educators on preservice teachers, and this may provide insights about more effective applications in undergraduate programs. In this way, education programs focusing on the use of developing technologies such as web technology, augmented reality, and virtual reality for educational purposes can be designed to increase the preservice teachers' TPACK self-confidence in the future (Cheng, 2017).

Acknowledgments

This research was conducted in 2019. Data related to the research were collected in accordance with ethical principles. There is no conflict of interest between the authors. We thank the pre-school and classroom teacher candidates who participated in the research.

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