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Investigation of Technological Pedagogical and Content Knowledge (TPACK) Competencies of University Students

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Abstract

Just as technology has entered every aspect of our lives today, it has significantly changed the fields of art and graphic design as well. Developing technologies and new teaching approaches have also affected fine arts education and therefore the students studying in this field. The aim of this study is to examine the Technological Pedagogical and Content Knowledge (TPACK) competencies of students studying at the Faculty of Fine Arts. The study, which was conducted with the survey model, was conducted with the participation of 212 students studying at the Faculty of Fine Arts of Necmettin Erbakan University and Selçuk University in the 2022-2023 academic year. According to the findings of the study, the TPACK competencies of the students of the Faculty of Fine Arts are at medium level. The technological knowledge of the participant students differs according to their gender. The technological knowledge of male students was found to be significantly higher. In the study, TPACK competencies of the students showed significant differences according to their grade and achievement levels. Students in 3rd and 4th grades were found to have high TPACK competence compared to students in lower grades. Again, students with high achievement level obtained high TPACK scores compared to their middle and low achieving peers.

Introduction

Today's rapidly changing world marks a digital era in which students need a wider range of skills and knowledge. With technology advancing at a dizzying pace, the use of various digital tools and resources has increased in addition to the traditional methods used in fine arts. How technological tools such as artistic learning applications, virtual reality, artificial intelligence supported fine arts learning with online learning platforms, which have become widespread especially in recent years, can contribute to the teaching of fine arts has become an important topic of discussion (Browning, 2011; Bernato et al., 1988). Moreover, the use of 21st century skills and technology in fine arts is an extremely important issue for teachers, students, educational institutions and policy makers. The effective use of these skills and technology in the teaching of fine arts will help students succeed in the global competitive environment and prepare them for the needs of the future (Aktürk & Şahin; Aronson, 2004; Thompson, 2008).

21st century skills refer to the abilities and skills that students need to be successful in everyday life and business

life. These skills have emerged with the rapid developments in information and communication technologies, globalization and the effects of the digital age. These skills require higher level cognitive processes such as understanding, analyzing, synthesizing and thinking critically rather than simply memorizing information (Çuhacı, 2007). At this point, the role of teachers is very important. Unlike the traditional teacher role, teachers who focus on 21st century skills should use various methods to help students acquire these skills. Teachers should create interactive and participatory learning environments that will allow students to develop skills such as critical thinking, problem solving, communication, collaboration, creativity and innovation (Gura, 2008; Kesici, Erdogan, & Sahin, 2010; Williams, 2009).

Especially in the last 30 years, the integration of computer technology into learning and teaching environments has become an inevitable component of many new educational reforms and practices in terms of educational policy, pedagogy, curriculum and teaching resources (Aslan, 2011; Chen, 2010; Sünbül, Gündüz & Yılmaz, 2002). With the increasing use of technology in different areas of education in recent years, people's ability to communicate and collaborate with different cultures in the globalizing world of our age is gaining more and more value today. At the same time, the rapid development of technology has led to great changes in the field of education. At this point, the methods and tools used in teaching fine arts have also gained a new perspective (Kutup, 2010).

In this context, the qualities of a professional fine arts teacher in the digital age can be as follows:

- *Artistic Expertise:* A professional fine arts teacher has a deep expertise in the art discipline they teach. They have a broad *knowledge* of art techniques, history, art theory and different art movements.
- *Technology Skills:* In the digital age, the fine art teacher should be able to use digital tools and technologies effectively. They should have the skills to enable students to do their artistic work in digital environments.
- *Creativity and Problem Solving Skills:* A professional fine arts teacher guides students to develop their creative thinking skills and solve artistic problems. They give students the ability to generate new ideas, find alternative solutions and use innovative approaches in artistic projects.
- *Communication and Presentation Skills:* The fine arts teacher should be able to communicate artistic issues to students in an understandable way and present artistic work effectively. They should be able to communicate clearly and effectively with students and contribute to their artistic development by giving and receiving feedback.
- *Student-Centered Approach:* A professional fine arts teacher takes into account students' individual differences and learning styles. By focusing on students' interests and needs, they motivate them, develop their self-confidence and encourage their active participation in the learning process.
- *Multidisciplinary Approach:* Art often interacts with other disciplines. A professional fine arts teacher emphasizes interdisciplinary connections and offers students knowledge and experiences from different disciplines. By relating to subjects such as science, mathematics and history, students gain a broad perspective.
- *Cultural Awareness:* Art is universal and draws inspiration from different cultures, the past and contemporary art. A professional fine arts teacher offers students the opportunity to explore different

cultural perspectives and forms of artistic expression. He/she values the principle of cultural diversity and inclusion.

- *Openness to Learning:* In the digital age, developments in the field of fine arts are advancing rapidly. A professional fine arts teacher constantly keeps himself/herself up-to-date, learns new techniques, trends and digital tools and transfers them to students.
- *Continuous Professional Development:* A professional fine arts teacher constantly participates in professional development opportunities. They follow innovations in the field of art education, attend workshops, conferences and art events. In this way, he/she improves himself/herself and offers the best education to students.

Fine arts teaching is also directly related to 21st century skills. These skills include competencies such as critical thinking, problem solving, communication, collaboration, cultural awareness and global citizenship. Technology offers tools that support the development of these skills. For example, online collaboration platforms allow students to collaborate with people from different cultures and develop cultural awareness and communication skills. At the same time, the ease of access to information enables students to conduct research, analyze data and develop critical thinking skills (Paul, 2008; Bernato et al., 1988).

In fine arts teaching, technology is used to support the process of developing students' artistic skills and gaining cultural awareness. Technological tools such as the Internet, social media, audio and video recordings provide students with real-world communication experiences and help them develop their artistic skills. For example, online learning platforms and applications related to some fine arts disciplines help students develop their artistic skills by providing them with the opportunity to practice in the art disciplines they are interested in. Moreover, the use of technology in fine arts teaching encourages students' active participation in the learning process. An interactive and enjoyable learning environment can be offered to students with tools such as interactive feedback, artistic software, virtual reality and augmented reality. In this way, students can approach the learning process more positively by increasing their motivation and improving their self-confidence (Ünsal, 2010; Liu, 2007).

Technology can make the fine arts learning process more interactive and interesting. The Internet provides students with easy access to fine arts materials and connects them to real-time communication opportunities. However, there are also some challenges associated with the use of technology. For technology to be used effectively in fine arts teaching, it is important for teachers to acquire the skills to integrate technology pedagogically. Furthermore, technology needs to be accessible to every student and infrastructure needs to be provided to reduce the digital divide (Delacruzz, 2009; Dunn, 1996; Mıhçı & Aktürk, 2021; Prensky, 2001).

In the 21st century's dizzyingly fast-changing world, it is of paramount importance to equip students with new and dynamic abilities as well as traditional artistic skills. In this context, fine arts teaching and technology-assisted education offer a powerful combination to develop students' 21st century skills. With globalization and increased communication, fine arts teaching aims to develop not only artistic skills but also cultural awareness, communication skills, critical thinking skills, and the ability to collaborate (Paul, 2008; Aronson, 2004).

Nowadays, utilizing technology in the education process is something we encounter quite frequently. Technology covers a wide range from the process of teaching the course (information texts, audio recordings, animations, educational films, etc.) to the activity part of the course (online activity applications) to the evaluation process of the course such as online exams and e-school. From this point of view, it can be said that teachers who are responsible for education and training should have the competencies to use these technologies appropriately and effectively (Willis, 2003). In this context, it is thought that developments should be monitored not for the use of technology in education, but for the correct use of technology in education. In this study, the relationship between primary school teachers' teaching competencies and their technological pedagogical content knowledge, which includes the field of integrating these competencies into technology in the right way, was thoroughly examined, thus providing an opportunity to have a new idea about the correct use of technology in education. This issue increases the importance of the research (Guzman & Nussbaum, 2012).

Technology-enhanced education provides a powerful tool to support students' acquisition of these skills and to make learning more interactive, engaging and personalized. Therefore, fine arts teaching and technology-assisted education play an important role in ensuring that students are equipped as individuals with the skills required by the 21st century. The active participation and responsibility of students is also important in this process. Students should actively participate in learning, conduct research to solve problems, use critical thinking skills and work collaboratively. At the same time, students should be equipped with self-evaluation and feedback skills (Raob et al., 2012; Vogel & Klassen, 2001; Zang, 2010). Thus, students become individuals who can direct their own learning and continue to learn. In addition, curricula should also be renewed by adapting them to 21st century skills. In addition to traditional subjects, new content that includes skills such as critical thinking, digital literacy, cultural awareness and global perspectives should be integrated into the curriculum. Effective use of technology has also become part of the curriculum. Teaching students to use digital tools and resources is important to increase access to information and enrich learning. In conclusion, 21st century skills is a process in which teachers, students and curriculum are closely interrelated. Teachers should help students acquire these skills by creating effective learning environments. Students should develop these skills through active participation, taking responsibility and continuous learning. The curriculum should also be updated to support these skills and technology should become an integral part of the educational process (Angeli & Valanides, 2009; Herold, 2016).

Teaching students to use digital tools and resources is important to increase access to information and enrich learning. In conclusion, 21st century skills are a process in which teachers, students and curriculum are closely interrelated. Teachers should help students acquire these skills by creating effective learning environments. Students should develop these skills through active participation, taking responsibility and continuous learning. The curriculum should be updated to support these skills and technology should become an integral part of the educational process (Angeli & Valanides, 2009; Herold, 2016).

In conclusion, fine arts teaching is a dynamic process that involves the use of technology along with 21st century skills. Effective use of technology helps students develop their artistic skills and acquire global citizenship competencies. Teachers' ability to integrate technology pedagogically and taking into account technology accessibility issues will enable these innovations in fine arts teaching to reach a wider range of students. With the

increasing impact of digital technologies, it becomes important to create new resources and approaches in fine arts education. In this process, fine arts teachers need to keep an open mind, acquire new knowledge and invest time and energy. It is important not to reject traditional methods completely, but to update and add new ones (Mayo, 2007; Öztürk, 2023).

Content that includes the language of digital art and the use of digital technologies can be included in fine arts education programs, enabling multifaceted, relational and collaborative ideas and productions. In fine arts education departments, the language of digital art and the use of digital technologies can be integrated more comprehensively by improving course content and introducing new courses. Students can be enabled to experience digital art, produce artistic projects using digital tools, and have interactive art experiences with digital technologies (Özdemir, 2022; Wands, 2007). In this transformation process, it is important for fine arts teachers and educators to keep themselves constantly updated, explore the potential of digital technologies in art education, and provide students with new and engaging learning experiences. In this way, fine arts education can support students to develop their creativity and digital skills by adapting to the requirements of the digital age.

TPACK, short for Technology Pedagogy Content Knowledge, is a concept that emphasizes individuals' integration of technology, pedagogy and content knowledge. Although the term is new, the idea of TPACK has been discussed for some time (Shulman, 1986). The pioneer of the idea of TPACK was Mishra (1998) who briefly mentioned the triad of theory and technology as opposed to content and pedagogy in the context of educational software design. Similarly, Pierson (1999), Keating and Evans (2001) and Zhao (2003) also describe the relationships between technology, content and pedagogy. Other researchers have taken up similar ideas, albeit often under different labeling schemes, such as integration literacy; information and communication (ICT)-related PCK; Technological Content Knowledge (Slough & Connell, 2006); and electronic PCK or e-PCK (Franklin, 2004; Tschannen-Moran & Woolfolk-Hoy, 2001). The TPACK model aims to provide teachers or learners with an effective approach to technology-assisted subject matter teaching. This model aims to improve students' learning experiences by combining teachers' knowledge of technology, pedagogy and subject matter.

TPACK skills have three basic components (Schmidt et al., 2009; Tanjung et al, 2022):

1- Technology Knowledge: It refers to the teacher's ability to use technological tools and resources effectively. This requires the teacher to be able to recognize, use and integrate various technological tools such as computers, smart boards, software, applications, and so on for instructional purposes in the classroom.

2- Pedagogical Knowledge: It refers to the teacher's ability to understand teaching and learning processes, to create teaching strategies and to have classroom management skills. Pedagogical knowledge includes effectively transferring knowledge to students, achieving learning objectives and meeting student needs.

3- Content Knowledge: It refers to the teacher's ability to have knowledge and understanding of the subject or discipline they teach. Content knowledge enables the teacher to provide accurate and in-depth content to students. It is important that the teacher supports students to understand the concepts related to the field, develop their skills and use their critical thinking skills.

TPACK emphasizes the interaction of these three components and their effective use in education. Teachers can create an effective teaching environment by combining technology, pedagogy and content knowledge. TPACK skills can enrich students' learning experiences, teach more effectively and increase student achievement. It is important for teachers to develop their TPACK skills to overcome the challenges related to the integration of technology and make their teaching more effective. This can help students learn to use technology properly and make their learning processes more engaging and interesting (Becker et al., 2009; Koehler, et al., 2008).

In today's technology-driven world, educational processes are becoming increasingly digitalized and the effects of technology are deeply integrated into educational practices. In this context, it is of great importance for teachers to use technology effectively and combine it with their pedagogical approaches (Mishra & Koehler, 2006). Therefore, TPACK is formed by the interaction of the development of teachers' content knowledge, technology knowledge and teaching-learning knowledge, and the aim here is to provide a basic approach to teachers' technology-assisted subject matter teaching by combining these dimensions. The TPACK concept provides a framework that can help teachers develop effective teaching strategies by combining technology, pedagogy and content knowledge (Chaipidech et al., 2022; Joldanova et al., 2022; Niess, 2005).

However, there is a limited research literature on the impact of TPACK skills on students and what the TPACK skill levels of Faculty of Fine Arts students are. Faculties of Fine Arts provide an important educational environment that offers students the opportunity to develop their artistic talents, encourage creativity and expand their aesthetic understanding. Therefore, examining TPACK skills in this field will be an important step in terms of both improving teaching processes and understanding students' competencies regarding technology integration (Franklin, 2004).

The research will use measurement tools to assess students' TPACK skills and analyze the data to reveal how these skills are related to teaching practices. Thus, we will be able to emphasize the importance of TPACK skills in Fine Arts education and offer suggestions for improving teaching processes. First, in the literature review section, an overview of the concept and importance of TPACK will be presented and the limited studies on TPACK skills in the context of Fine Arts education will be mentioned. Then, in the methodology section, the participants of the study, data collection tools and analysis methods will be explained. The findings will be presented in detail in the results section and the impact of TPACK skills on students' teaching practices will be discussed. Finally, the study will conclude with the recommendations section. This study will contribute to the research on TPACK skills in Fine Arts Faculties and provide information and suggestions for improving teaching processes. It also aims to encourage best practices in teaching by emphasizing the importance of technology integration in Fine Arts education. In this context, answers to the following questions were sought in the study:

- What is the level of TPACK competencies of Faculty of Fine Arts students?
- Do TPACK competencies of Faculty of Fine Arts students differ according to gender variable?
- Do the TPACK competencies of Faculty of Fine Arts students differ according to their grade level?
- Do the TPACK competencies of Faculty of Fine Arts students differ according to their achievement levels?

Method

In this study, non-experimental quantitative research methods were used. The survey method was preferred as the method. The survey method is a research approach that aims to describe a past or present situation as it exists, to compare the relationship between variables, and to collect data over a certain period of time (Karasar, 2002).

Students studying at Necmettin Erbakan University and Selçuk University in the 2022-2023 academic year participated in this study. The population of the research consists of students registered in the student affairs system. Representing these students, 212 students were included in the research group with the convenience sampling method.

Technological Pedagogical Content Knowledge Scale

Survey method was preferred as a data collection tool. The basis of the survey method is to obtain information systematically from the units that make up a population or sample. For this purpose, written or oral questions are asked and answers are sought. There is a kind of communication between the interviewer and the respondent with the help of the questionnaire form used as a data collection tool (Özdamar et al. 1999). In the study, questions covering the basic elements of Technological Pedagogical Content Knowledge were asked to the students. Technological Pedagogical Content Knowledge Scale is a 5-point Likert-type scale consisting of seven basic dimensions. Technological Pedagogical Content Knowledge Scale was used as a data collection tool in the study. This scale developed by Schmidt et al. In 2009, it was adapted into Turkish by (Şahin, 2011).

As a result of the analysis, the total variance explained by the scale was 75.80% and the factor loadings of the items ranged between .55 and .88. For the reliability of the scale, Cronbach's alpha internal consistency coefficients were analyzed. Cronbach's alpha value for the whole scale was found to be .95. The first factor of the scale, "Technology Knowledge", had a reliability value of .94; the second factor, "Content Knowledge", had a reliability value of .95; the third factor, "Pedagogical Knowledge", had a reliability value of .96; the fourth factor, "Pedagogical Content Knowledge", had a reliability value of .94; the fifth factor, "Technological Content Knowledge", had a reliability value of .94; the sixth factor, "Technological Pedagogical Knowledge", had a reliability value of .90; and the seventh factor, "Technological Pedagogical Content Knowledge", had a reliability value of .92.

Data Analysis

Normal distribution analysis, one of the parametric test assumptions, was applied for the variables of the study. Parametric methods were preferred in the analysis of the data. SPSS package program version 26.0 was used for statistical analysis of the data. Independent samples t-test was applied to test whether there is a difference between the gender of the Faculty of Fine Arts students' technological pedagogical content knowledge and TPACK. F-test was applied to test whether there is a difference between TPACK and the grade and achievement levels of the participant students.

Findings

In this section, descriptive analyses of the scores obtained from the TPACK scale by the students of the Faculty of Fine Arts and findings related to TPACK competencies according to gender, grade and achievement are given.

Table 1. Descriptive Analyses of TPACK Scores of Faculty of Fine Arts Students

TPACK Dimensions	N	Minimum	Maximum	Mean	Std. Deviation
TK	212	1.20	5.00	3.49	0.88
PK	212	1.00	5.00	3.31	0.97
CK	212	1.00	5.00	3.31	0.93
TPK	212	1.00	5.00	3.44	1.02
TCK	212	1.00	5.00	3.33	0.97
PCK	212	1.00	5.00	3.39	0.98
TPACK	212	1.00	5.00	3.23	1.01

Table 1 shows the arithmetic mean and standard deviation values of the scores obtained by the fine arts faculty students in the whole and sub-dimensions of the TPACK scale. According to the descriptive analysis, the participant students obtained the values of ($\bar{X}$=3.49) in technological domain knowledge, ($\bar{X}$=3.31) in pedagogy knowledge, ($\bar{X}$=3.31) in domain knowledge, (X=3.31) in technology pedagogy knowledge, ($\bar{X}$=3.44) in technology pedagogy knowledge, ($\bar{X}$=3.33) in technology domain knowledge, ($\bar{X}$=3.39) in pedagogy background knowledge and ($\bar{X}$=3.49) in technology pedagogy domain knowledge. According to these findings, we can say that the TPACK competencies of fine arts faculty students are at a medium level.

Table 2. Table of TPACK Variation of Faculty of Fine Arts Students According to Gender

TPACK Dimensions	Gender	N	Mean	Std. Deviation	t	p
TK	Female	132	3.30	0.79	-4.32	0.00
	Male	79	3.82	0.93		
PK	Female	132	3.31	0.89	-0.02	0.99
	Male	79	3.31	1.09		
CK	Female	132	3.33	0.86	0.40	0.69
	Male	79	3.28	1.05		
TPK	Female	132	3.35	0.95	-1.57	0.12
	Male	79	3.58	1.12		
TCK	Female	132	3.30	0.91	-0.70	0.48
	Male	79	3.39	1.07		
PCK	Female	132	3.39	0.90	-0.09	0.92
	Male	79	3.41	1.13		
TPACK	Female	132	3.24	0.99	0.16	0.87
	Male	79	3.22	1.06		

Pedagogical knowledge (t=-0.02), field knowledge (t=0.40), technological pedagogical knowledge (t=-1.57), technological field knowledge (t=-0.70), pedagogical field knowledge (t=-0.09) and technological pedagogical field knowledge (t=0.16) were not found to have a statistically significant (p.>.05) difference according to the gender of fine arts faculty students. In addition, it was found that there was a statistically significant difference (p<0.05) in students' technology knowledge (t= -4.32) in terms of their gender. It was found that male students (=3.82) had higher technological knowledge than female students (=3.30).

Table 3. Table of Variation of TPACK of Faculty of Fine Arts Students According to Class Level

TPACK Dimensions	Class Level	N	Mean	Std. Deviation	F	p
TK	1	50	3.45	0.52	3.69	0.01
	2	60	3.24	1.02		
	3	32	3.81	0.87		
	4	70	3.65	0.91		
	Total	212	3.49	0.88		
PK	1	50	3.23	0.76	3.89	0.01
	2	60	3.04	0.95		
	3	32	3.71	0.84		
	4	70	3.40	1.10		
	Total	212	3.31	0.97		
CK	1	50	3.20	0.82	6.95	0.00
	2	60	2.94	0.82		
	3	32	3.63	0.96		
	4	70	3.56	0.97		
	Total	212	3.31	0.93		
TPK	1	50	3.15	0.89	3.15	0.03
	2	60	3.39	1.06		
	3	32	3.77	1.13		
	4	70	3.55	0.96		
	Total	212	3.44	1.02		
TCK	1	50	3.16	0.81	3.38	0.02
	2	60	3.11	0.99		
	3	32	3.60	0.93		
	4	70	3.52	1.02		
	Total	212	3.33	0.97		
PCK	1	50	3.23	0.86	5.88	0.00
	2	60	3.08	0.99		
	3	32	3.85	1.00		
	4	70	3.57	0.95		
	Total	212	3.39	0.98		

TPACK Dimensions	Class Level	N	Mean	Std. Deviation	F	p
TPACK	1	50	3.08	0.86	7.24	0.00
	2	60	2.83	1.05		
	3	32	3.61	0.83		
	4	70	3.51	1.03		
	Total	212	3.23	1.01		

Thirdly, it was examined whether there was a difference between students' grade levels and TPACK. The data obtained as a result of the F test are given in Table 3. According to the grade levels of fine arts faculty students, technological knowledge (F=3.69), pedagogical knowledge (F=3.89), field knowledge (F=6.95), technological pedagogical knowledge (F=3.15), technological field knowledge (F=3.38), pedagogical field knowledge (F=5.88) and technology pedagogy field knowledge (F=7.24) were found to have a statistically significant ($p<.05$) difference. According to Sheffe's test analysis, 3rd and 4th grade students obtained higher averages in the whole TPACK scale and its sub-dimensions compared to 1st and 2nd grade students.

Table 4. Table of Variation of Faculty of Fine Arts Students According to TPACK Achievement Level

TPACK Dimensions	Achievement level	N	Mean	Std. Deviation	F	p
TK	High	63	4.22	0.71	45.07	0.00
	Middle	121	3.24	0.69		
	Low	26	2.93	1.01		
	Total	210	3.50	0.88		
PK	High	63	4.03	0.81	33.96	0.00
	Middle	121	3.02	0.83		
	Low	26	2.85	0.97		
	Total	210	3.30	0.97		
AK	High	63	3.99	0.84	30.99	0.00
	Middle	121	3.06	0.78		
	Low	26	2.83	0.97		
	Total	210	3.31	0.93		
TPK	High	63	4.23	0.81	38.07	0.00
	Middle	121	3.17	0.85		
	Low	26	2.80	1.12		
	Total	210	3.44	1.02		
TCK	High	63	4.11	0.81	40.12	0.00
	Middle	121	3.05	0.79		
	Low	26	2.79	1.05		
	Total	210	3.33	0.97		
PCK	High	63	4.18	0.78	40.92	0.00
	Middle	121	3.13	0.84		

TPACK Dimensions	Achievement level	N	Mean	Std. Deviation	F	p
	Low	26	2.75	0.98		
	Total	210	3.40	0.99		
TPACK	High	63	3.92	0.83	28.38	0.00
	Middle	121	3.01	0.91		
	Low	26	2.59	1.04		
	Total	210	3.23	1.01		

Fourthly, it was examined whether there was a difference between students' achievement levels and TPACK. The data obtained as a result of the F test are given in Table 4. According to the achievement levels of fine arts faculty students, technological knowledge (F=45.37), pedagogical knowledge (F=33.96), field knowledge (F=30.99), technological pedagogical knowledge (F=38.07), technological field knowledge (F=40.12), pedagogical field knowledge (F=40.92) and technology pedagogy field knowledge (F=28.32) were found to have a statistically significant ($p<.05$) difference. According to Sheffe's test analysis, students with high achievement level had higher averages in the whole TPACK scale and its sub-dimensions compared to students with medium and low achievement level.

Discussion and Conclusion

In this study, TPACK competencies of the students studying at the Faculty of Fine Arts were examined comparatively in terms of gender, class and achievement levels. According to the research findings, TPACK competencies of the participants were found to be at a medium level in general. The fact that the scores of the Faculty of Fine Arts students in the sample group in the whole and the dimensions of the TPACK scale are at a medium level can be considered as a situation that needs to be improved. However, there are courses that support TPACK competencies such as computer, art and technology in the curriculum of Fine Arts faculties in Turkey. In addition, students studying in these faculties gain the right to become teacher candidates by taking pedagogical formation courses. In this respect, it is thought that for effective technology use and teaching processes, Fine Arts Faculty students should have high levels of TK, PK, CK, TPK, TCK, PCK and TPACK.

In another finding of the study, TPACK competencies of Faculty of Fine Arts students were analyzed according to gender variable. According to the analysis, a significant difference was found only in the technology knowledge (TK) dimension according to gender. In this dimension, it was observed that male students had higher technological knowledge compared to their female peers. These findings are similar to the findings of the studies conducted by Kara (2021), Koyuncuoğlu (2021), Linn, Tsai, and Lee (2013), Tajibayeva et al. This situation may change in future studies with different sample groups. In the related literature, significant differences were found in the studies conducted with teachers and pre-service teachers on technological pedagogical content knowledge based on gender variable (Koyuncuoğlu, 2021; Lin, Tsai, Chai, & Lee, 2013). Koyuncuoğlu (2021) examined TPACK knowledge of graduate students with a descriptive approach. In this study, in which TPACK competencies of graduate students were investigated according to gender, graduate education level and field variables, it was seen that domain knowledge, pedagogical knowledge and technology knowledge among TPACK

sub-dimensions were high, while other sub-dimensions were at medium level. According to gender, it was seen that technology knowledge, one of the TPACK sub-dimensions, was high in males, while pedagogical knowledge was high in females.

However, no significant difference was found in content knowledge, pedagogical knowledge, pedagogical content knowledge, technology pedagogical knowledge and TPACK as a whole according to gender. As a matter of fact, in Demir, Güder, and Akgün's (2020) study, the effect of gender on technological pedagogical content knowledge (TPACK) was examined by meta-analysis method. In the study, 37 thesis studies published in the YOK thesis database and meeting the specified criteria were analyzed. As a result of the random effects model collected in line with the data of male and female individuals from the 37 studies included in the research, the q statistic was statistically significant according to the level of technological pedagogical content knowledge of male and female teachers, while the effect sizes of the studies according to the type of thesis were not statistically significant, and therefore, it was seen that gender did not change the effect size of TPACK, regardless of whether the type of thesis was doctoral or master's degree.

In another finding of the study, TPACK competencies of Faculty of Fine Arts students were analyzed according to their grade and achievement levels. According to the analysis, TPACK competencies of the students showed significant differences in terms of both grade level and achievement level. In the study, students studying in 3rd and 4th grades exhibited high TPACK competencies compared to students in 1st and 2nd grades. It was also observed that students with high achievement level exhibited high TPACK competencies compared to students with medium and low achievement levels. These findings are supported by the findings of the studies conducted by Kara (2021) and Tajibayeva et al (2023). As the grade level increases, the knowledge possessed by the individual increases in direct proportion. The fact that 3rd and 4th graders have a higher level of these dimensions can be attributed to the increase in the student's knowledge about the field as a result of the fine arts courses taken at the end of each year, and about teaching methods and techniques with the formation courses. As a natural consequence of these, it can be concluded that the 3rd and 4th graders, who are ready to graduate, have a higher level of learning and teaching of knowledge, integration of the development of technology and the development of subject knowledge than the lower grades. According to Schunk and Zimmerman (2006), the development of cognitive and psychomotor competencies of individuals during the development of competencies specific to a field affects self-efficacy in different fields. In this respect, the development of students' awareness and competencies in domain-specific competencies and basic skills in upper grades enabled them to have higher TPACK competencies. According to NAEA (1999), in terms of visual arts teaching, fine arts faculties have a comprehensive approach that includes cognitive, affective and psychomotor learning products for teaching and learning in art. In these aspects, it is understood that successful students studying in these faculties reflect the competencies in their fields to their TPACK competencies.

Considering the developing and changing educational technologies, it is unthinkable for the students of the Faculty of Fine Arts to stay away from them. The fact that individuals who grow up in the age of information and technology stay away from it in the educational environment may cause them not to get efficiency from their educational life. When the results of the research are examined, it is seen that the students of the Faculty of Fine

Arts are not very sufficient in terms of pedagogical, technological and field knowledge. Although their TPACK competence is at a medium level, it is seen that they cannot carry it to the classroom environment. Windschitl and Sahl (2002) found in their study that although learners stated that technologies such as computers contribute to learning and should be used for this purpose, they did not use technology based on constructivism or in a way that would contribute to students' learning. When we look from these perspectives, it is seen that the students of the Faculty of Fine Arts should perform more instructional practices in order to reflect or transfer the TPACK competencies they have/acquired to their classroom practices. For this reason, it is recommended to include more TPACK competencies in the programs of the Faculty of Fine Arts. In order to improve students' TPACK competencies, curricula based on 21st century skills can be put into practice. In future studies, experimental and mixed model researches can be conducted to improve TPACK competencies.

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