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Social Studies Teacher Candidates' Self-Efficacy Beliefs for Technological Pedagogical Content Knowledge (TPACK)

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ABSTRACT

This study aims at examining social studies teacher candidates' self-efficacy beliefs for technological pedagogical content knowledge through multiple variables and presenting new perspectives for researchers and practitioners. A causal-comparative research design was adopted for this study. Among non-random sampling methods, convenience sampling was used to select participants. The sample of the study consists of 349 3rd and 4th year college students (teacher candidates) studying at three state universities in Turkey's Central Anatolia Region in the 2018–2019 academic year. The Technological Pedagogical Content Knowledge (TPACK) scale was used for collecting data in this study. T-test and one-way analysis of variance (ANOVA) was employed to analyze data. According to the obtained results, the social studies teacher candidates' self-efficacy beliefs for technological pedagogical content knowledge can be considered above average. No significant differences were found between participants' self-efficacy beliefs for TPACK and some independent variables such as gender, year in college, GPA score, personal computer ownership, and Instructional Technology and Material Development course score. On the other hand, it was determined that perceived technology competency and the use of content sharing platforms for professional purposes were important predictors for social studies teacher candidates' self-efficacy beliefs about TPACK.

Key words: Social Studies, Teacher Candidates, TPACK Self-Efficacy Belief, Digital Literacy, Causal-Comparative Research

INTRODUCTION

Today's societies focus on raising ideal individuals through education and also aim to provide individuals with the knowledge and life skills needed to thrive in the modern world as well as to be prepared for the future. The education system includes many factors and stakeholders that affect success such as teachers, students, syllabus, schools, and administrators. Among these, teachers have a critical role since they are responsible for the correct implementation of curricula, textbooks, and other teaching materials in a classroom environment as well as they manage and evaluate students' learning processes.

As a result of technological developments, major changes have occurred in a wide variety of fields such as medicine, engineering, science, banking, tourism, social sciences, and media in recent years. Although education is one of the fields that the impact of technology most obvious, it also stands out as a field that radical changes were not clearly seen after technology integration compared to other fields (Oliver, 2002). Initially, some factors such as insufficient funds allocated to increase the technological equipment in educational environments, low motivation of teachers towards the use of technology and inadequate technology competency were considered as the main reasons for this deficiency (Cox et al., 1999). However, although the lack of technological resources in schools has been met to a great extent and individuals use web technologies such as the internet and apps more intensively in their daily lives, the reasons for the existence of such problems is the fact that the use and teaching of technology in schools are mostly carried out by teachers who specialize in computer and instructional technologies and teachers from other disciplines refrain from using technology in teaching practices due to their lack of knowledge in instructional technologies (Demetriadis et al., 2003; Gür, et al., 2010; Hu et al., 2003).

Continuous innovations in technology inevitably affect the structure of educational environments and the methods and techniques implemented during learning/teaching activities (Kuş, 2005). Although the use of technology in education is considered as an indicator of quality (Çakır & Yıldırım, 2009), technology should be combined with proper pedagogical approaches to use it in education (Şad & Özhan, 2012; Şad & Göktaş, 2014). Successful integration

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of technology into educational practices requires sufficient knowledge of pedagogy, technology, and content (Jang & Tsai, 2012). This process also called technology integration in education, is defined as using technology effectively and efficiently in educational environments including education programs and educational infrastructure (Yalın et al., 2007).

The functional use of technology in education can only be possible if teachers, as the main actors of educational activities, have sufficient technological knowledge and skills and combine this technological knowledge and skills with course content and proper pedagogical approaches. Teachers should know how to integrate recent technological developments into their classrooms. Accordingly, teachers need to appropriately combine technology, pedagogy, and course content (Mishra & Koehler, 2006).

Niess (2005) highlighted that to improve student learning, teacher education programs need to be revised to integrate technology into teaching strategies at the knowledge and practice level and to use it effectively. The "technology integration" term is increasingly considered as "information and communication technologies (ICT) integration" in the literature, the differences in definitions of what the integration process are also stood out. In the literature, it can be seen that, while the focus of some definitions is to enhance and enrich students' learning by technology (Lim et al., 2003), the focus of some other is to being used technology effectively by instructor or making technology an integral part of curriculum (Fluck, 2003). There are different technology integration models and approaches that effectively and efficiently integrate technology into educational practices (Toledo, 2005; Mishra & Koehler, 2006; Wang & Woo, 2007; Wang, 2008; Vanderlinde & Braak, 2010). Systemic Planning Model for ICT Integration (Wang & Woo, 2007), Technological Pedagogical Content Knowledge Model (Mishra & Koehler, 2005), Five Stage Model of Computer Technology Integration (Toledo, 2005), Generic Model of Pedagogy, Social Interaction and Technology (Wang, 2008), E-capacity Model (Vanderlinde & Braak, 2010), Concentric Circles Model (Tondeur et al., 2008), 5W 1H Unified Integration Model (Haşlaman et al., 2008) and Technology Integration Planning Model (Roblyer, 2006) some of these integration models and approaches that draw attention in the literature. Among these approaches, the Technological Pedagogical Content Knowledge (TPACK) introduced by Mishra and Koehler (2006) is a widely accepted model of technology integration in education. Technological Pedagogical Content Knowledge refers to the knowledge of teaching education programs, content, and syllabus. Additionally, it also includes the knowledge of the relationship of the discipline with other disciplines, recent developments in the discipline, key concepts, tools and structures of the discipline as well as integration of content with technology (Turkish Education Association [TED], 2009). In other words, technological pedagogical content knowledge refers to the knowledge of information and communication technologies as well as the proper and purposeful use of this knowledge in classroom activities (Kaya et al., 2010). The TPACK model, also known as the techno-pedagogical education model (Çoklar et al., 2007), consists of three primary components: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). As seen in Figure 1, the techno-pedagogical education approach includes three main components and three sub-components by overlapping main components. And the techno-pedagogical education approach lies at the intersection of all three of these main knowledge components (Mishra & Koehler, 2006) (Figure 1).

The Components of TPACK, its definitions and sample questionnaire items in the scale used in the research are explained in Table 1.

As the process of integration of ICT into education in Turkey is examined, it can be said that there was a changes for CT (Computer Technology) equipments and internet connection in all classrooms with "FATİH Project" which increases opportunities and improves the technology movement from CT classes in 2000s and 2010s. The main objectives of this project are to provide equality of opportunity in the social field in general, to guide the quality of ICT in the country in terms of quality and quantity, and to provide all students with access to information and communication technologies (FATİH Project, 2012; Turkey's Ministry of National Education [MEB], 2014). With the support of the internet infrastructure and smart board provided to schools within the scope of the FATIH Project, the course contents carried out in schools can be accessed in learning object and e-book format both online and offline with the e-content management system called Education Informatics Network [EBA] (Başak & Ayvacı, 2017). Undoubtedly, the ability of teachers to adapt to this integration process in terms of technological and pedagogic competencies was seen as an important factor for this project to reach its goal. It has been one of the most emphasized topics in the last 10 years in Turkey as well that gaining digital competencies to become members of online teacher networks such as EBA, eTwinning, Scientix, FCL (Toker et al., 2021) and to effectively use different technological applications and software such

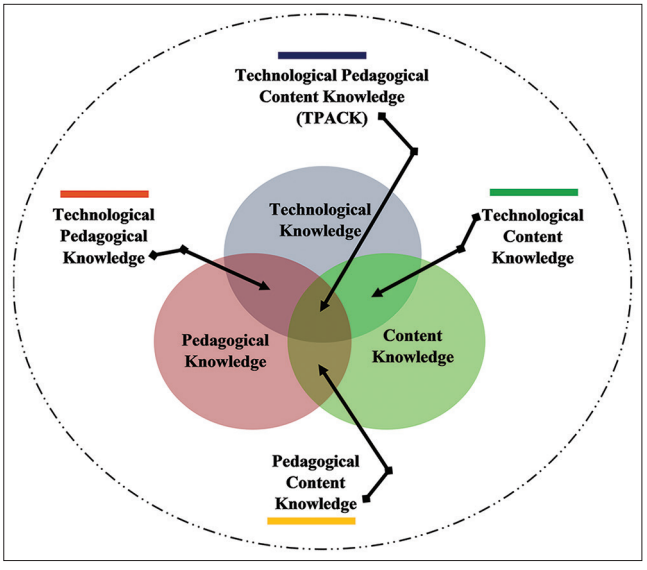

Figure 1. The seven components of TPACK (Mishra & Koehler, 2006)

Table 1. Definitions and sample survey items of TPACK components (Mishra & Koehler, 2006)

Knowledge Types	Definition	Sample Survey Items
Technological Knowledge (TK)	Continually changing and evolving knowledge base that includes knowledge of technology for information processing, communications, and problem solving and focuses on the productive applications of technology in both work and daily life.	I know how to solve my own technical problems when using technology
Pedagogical Knowledge (PK)	Knowledge of nature of teaching and learning, including teaching methods, classroom management, instructional planning, assessment of student learning, etc.	I am able to guide my students to adopt appropriate learning strategies.
Content Knowledge (CK)	Knowledge of the subject matter to be taught (e.g., social science, mathematics, language, arts, etc.).	I have sufficient knowledge about my field.
Technological Content Knowledge (TCK)	Knowledge of the relationship between subject matter and technology including knowledge of technology that has influenced and is used in exploring a given content discipline.	I have knowledge about the technologies for understanding and applying social studies.
Pedagogical Content Knowledge (PCK)	Knowledge of the pedagogies, teaching practices, and planning processes that are applicable and appropriate to teaching a given subject matter.	I can choose effective teaching approaches that will guide the student's thinking and learning in social studies course.
Technological Pedagogical Knowledge (TPK)	Knowledge of the influence of technology on teaching and learning as well as the affordances and constraints of technology with regard to pedagogical designs and strategies.	I think critically about how I will use technology in my classroom.
Technological Pedagogical and Content Knowledge (TPACK)	Knowledge of the complex interaction among the principle knowledge domains (content, pedagogy, technology).	I know how to teach by combining technology, pedagogy and content knowledge domains successfully.

as Web 2.0 applications (Eryilmaz et al., 2015; Bozkuş, & Karacabey, 2019). The fact that the number of academic studies conducted in Turkey on teachers' technological and pedagogical content knowledge has increased in this period also indicates this phenomenon (Akçaoğlu, et al., 2014; Demirer & Dikmen, 2018).

In general, the professional competency of teachers is evaluated through the examination of their pedagogical content knowledge. Due to its great importance, the pedagogical content and content knowledge of teachers and teacher candidates have become one of the most heavily researched topics (Işıksal 2006; Karahasan, 2010; Şimşek, 2016; Özbek, 2020). This is particularly important for social studies education. Likewise, it can be argued that among the existing curriculums, the social studies curriculum is the most suitable one to provide students with the knowledge of digital citizenship and its sub-dimensions since its primary aim is to educate active, effective, participatory, democratic, and social citizens (Görmez, 2017). The use of technology in social studies is the most meaningful structural method that can be used to meet the needs of students and increase their interest in the lesson (Braun, 1999). There can be many different ways of integrating technology in social studies (Heafner, 2004). Especially web 2.0 applications can be quite functional in technology integration into social studies courses (Bull et al., 2008; Holcomb & Beal, 2008). For this purpose, for example, social networks such as "Facebook, Twitter, Instagram and Youtube" (Chong, & Xie, 2011), online assessment tools such as "Plickers Kahoot, Socrative and Quiziz" (Holcomb et al., 2011; Çelik, 2020) and Infographic design applications such as "Piktochart and Canva" (Gleason & von Gillern, 2018; Akbaba et al., 2019) can be used.

As the "digital literacy" skills that implying the concept of digital citizenship which refers to the ability to use technology safely, responsibly, critically, productively, and civically (Farmer, 2011) in cluded in the revised curriculum, in particular, it is seen that the number and intensity of the learning outcomes of the "Science, Technology and Society" learning area has been increased even more (MEB, 2018; Aydemir, 2019). Such developments point out the importance of the fact that social studies teachers need to possess digital teaching competence to effectively use digital content in teaching practices. On the other hand, with the emergence of the global Covid-19 pandemic in 2020 and school closures caused by the pandemic, the educational activities are carried out through distance education and accordingly, studies on determining and improving social studies teachers' and teacher candidates' self-efficacy beliefs about their TPACK knowledge have become ever more important.

The purpose of the current paper is to examine social studies teacher candidates' self-efficacy beliefs for their TPACK knowledge according to the multiple variables: gender, year in college, grade point average, owning a personal computer, perceived technology competency, use of content sharing platforms for professional purposes, and instructional technology and material development (ITMD) course score. This study is believed to be important since it presents useful information to researchers and decision-makers about determining the factors affecting teacher candidates' self-efficacy beliefs for TPACK knowledge and the steps

that should be taken to improve teacher candidates' TPACK competencies.

METHOD

Research Design

Among quantitative research models, a causal-comparative research design was adopted for this study. The causal-comparative research model aims to determine whether there is a difference between two or more variables. This type of studies tries to identify the causes and results of differences among groups, without manipulating participants and situations (Karasar, 2012; Büyüköztürk et al., 2014). Accordingly, the current study aims to identify the social studies teacher candidates' self-efficacy beliefs for TPACK knowledge and to determine the relationship between the variables.

Population and Sample

The accessible population of the study includes the social studies teacher education students at three state universities in Turkey's Central Anatolia Region. Among non-random sampling methods, convenience sampling was used for the selection of participants. In the convenience sampling method, the researcher chooses a sampling group that is close and easy to access. This sampling method brings speed and practicality to the research (Yıldırım & Şimşek, 2016). In this context, in order to collect data, universities that are close to each other in terms of distance were determined, taking into account easy accessibility. The sample of the study consists of 349 3rd and 4th year college students (teacher candidates) studying at the relevant college programs in the 2018–2019 academic year. While taking this sample into consideration in the study, the reason why the 1st and 2nd grades were excluded from the sample is that technology-based teaching profession knowledge courses (for example: Instructional Technology and Material Development, Teaching Principles and Methods and Social Studies Teaching I-II) are given starting from the 3rd grade in education faculties in Turkey. It was thought that these courses could be an important factor in shaping the technological pedagogical content knowledge of teacher candidates. This phenomenon was also an important factor when deciding on the independent variables shared below and discussed in the research within the scope of the research. Although they are from different universities, the success of the students who take courses with the same content according to a common program and the possible contributions of these courses to their technological competencies should be considered and discussed. The demographic properties of the teacher candidates who participated in the study are shown in Table 2.

As seen in Table 2, among social studies teacher candidates, the number of male participants was slightly higher than females (53%), the number of 3rd year students (57.6%) was higher than 4th year students (42.4%). It was determined that most of the participants' Grade Point Average [GPA] to a 4.0 scale were varied between 2.51 and 3.00 (51.9%). A majority of the participants owned a personal computer (71.3%) and perceived themselves as technology competent (64.2%). Furthermore, they used content sharing platforms for professional purposes sometimes (42.7%) and their Instructional Technology and Material Development (ITMD) course score was generally varied between 61 and 80 (41.5%).

Table 2. Demographic properties of the teacher candidates

Variable		*n*	*%*
Gender	Male	185	53.0
	Female	164	47.0
Year in College	3rd year	201	57.6
	4th year	148	42.4
Grade Point Average	0.00-2.50	101	28.9
	2.51-3.00	181	51.9
	3.01-4.00	67	19.2
Owning a personal computer	Yes	249	71.3
	No	100	28.7
Perceived technology competency	Competent	224	64.2
	Incompetent	125	35.8
Use of content sharing platforms for professional purposes	Never	25	7.2
	Rarely	88	25.2
	Sometimes	149	42.7
	Often	87	24.9
ITMD course score	21-40	42	12.1
	41-60	52	14.9
	61-80	145	41.5
	81-100	110	31.5
Total		*349*	*100*

Data Collection Tool

The Technological Pedagogical Content Knowledge scale developed by Schmidt et al. (2009) for primary school teachers was used for collecting data in this study. The original TPACK scale consists of 46 items and its adaptation into Turkish was conducted by Kaya and Dağ (2013) and factor structure was examined through exploratory and confirmatory factor analysis. A total of 352 primary school teacher candidates from three large state universities participated in that study. Accordingly, it was found that Cronbach's alpha reliability coefficients for sub-scales were varied between 0.77 and 0.88. The results obtained in that study conducted with the Turkish sample indicated that the factor structure of the Turkish version of the scale is similar to the original scale and the scale is suitable for use in Turkey (Kaya & Dağ, 2013). For the current study, the required permissions were obtained for the use of the Turkish version in social studies teacher candidates. In the next stage, expert opinions received from the researcher who conducted the adaptation into Turkish and accordingly, the items belong to Mathematics, Science, and Literacy categories were excluded (since they are not directly related to the social studies course) and the Technological Pedagogical Content Knowledge scale for social studies teacher candidates (TPACK-S) was obtained. The final form

of the survey was a 5-point Likert type scale with 30 items consists of 7 factors. The participants answered the items by marking a scale ranging from 1 to 5: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree. Since the TPACK-S scale did not include negative items, no reverse-coded items were used. TPACK-S scale used in the present study consisted of technological knowledge (6 items), pedagogical knowledge (7 items), content knowledge (3 items), technological content knowledge (2 items), pedagogical content knowledge (2 items), technological pedagogical knowledge (6 items), and technological pedagogical content knowledge (4 items) sub-scales.

Since the number of items changed, the construct validity and consistency coefficients of the TPACK-S scale should be assessed again. Therefore, factor analysis was conducted on the items to assess the construct validity of the TPACK-S scale. As the Kaiser-Meyer-Olkin (KMO) value was 0.953 and the Bartlett test was significant ($p<0.001$), the data was decided as suitable for factor analysis (Büyüköztürk, 2003). The first factor analysis conducted by SPSS software revealed that the items of the scale grouped under 7 factors and these seven factors explained 65.885% of the total variance. Considering these results, it can be considered that the TPACK-S scale has sufficient construct validity. The Cronbach's alpha was calculated for the internal consistency of the scale. Cronbach's alpha value of the total scale was calculated as 0.953; and varied between 0.74 and 0.87 for all sub-scales. Based on these values, the reliability of the scale was considered high. In this process, the expert support was received from the researchers who adapted the scale into Turkish for the applicability of the scale to social studies teacher candidates before data collection.

Analysis of Data

T-test and One-way analysis of variance (ANOVA) were conducted between the components consisting of participants' technological pedagogical content knowledge and independent variables for normally distributed unrelated samples. To evaluate if the data were normally distributed, the Shapiro-Wilk normality test was used for sample sizes below 30 and kurtosis and skewness coefficients were calculated for samples above 30. The results of the normality tests showed that all normality assumptions were met. It was observed that the skewness and kurtosis coefficients ranged from -1,126 to +1.523 in the analyses that were adjusted separately considering all independent variables. "A kurtosis value between ±1.0 is considered excellent for most psychometric purposes, but a value between ±2.0 is in many cases also acceptable, depending on the particular application." (George & Mallery, 2014). This finding showed that parametric tests can be used for data analysis in the study. Levene's test was used to examine the equality of the variances, the precondition for One-way analysis of variance (ANOVA). Accordingly, Levene's test results were found to be at the P>.05 level in all independent variables applied ANOVA test. It were found that Levene's statistic results "0.71; p=.975" for GPA, "1.219; p=.302" for ITMD course score, "1.219; p=.302" for use of content sharing platforms for professional purposes. Scheffe's Post Hoc test was used as the post-hoc test. Scheffe's procedure was developed to examine all possible linear combinations of group means. In general, this method was preferred since it is flexible and can keep α error rate under control (conservative) when there are so many groups to compare and it does not take into account whether each group has the same number of observations (Scheffe, 1953).

FINDINGS

Social Studies Teacher Candidates' Competencies Regarding Overall TPACK and its Sub-components

At first, social studies teacher candidates' average scores on the competencies regarding overall TPACK and its sub-components. The obtained results are presented in Table 3.

As seen in Table 3, social studies teacher candidates' self-efficacy beliefs for overall TPACK (3.66) were above average. On the other hand, it can be argued that they had higher mean scores for the sub-components of Technological Knowledge (3.47), Pedagogical Knowledge (3.74), Content Knowledge (3.71), Technological Content Knowledge (3.73), Pedagogical Content Knowledge (3.67), Technological Pedagogical Knowledge (3.67), and Technological Pedagogical Content Knowledge (3.76).

Social Studies Teacher Candidates' TPACK Competencies According to Gender

Independent samples t-test was used whether there is a significant difference between female and male teacher candidates' scores for overall TPACK and its sub-components. The results are shown in Table 4.

As seen in Table 4, no significant difference exists between female and male social studies teacher candidates' overall TPACK scores [$t_{(347)}$=.073; p>.05]. Based on these results, it can be argued that female and male social studies teacher candidates had similar levels of overall TPACK. The gender variable was examined for each TPACK sub-component separately. Accordingly, regarding teacher candidates' competencies for all tests were found to be statistically insignificant (p>.05). In other words, social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components did not differ with gender.

Table 3. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components

	n	***M***	***Ss***
General Technological Pedagogical Content Knowledge	349	3.66	.56
Technological Knowledge	349	3.47	.93
Pedagogical Knowledge	349	3.74	.79
Content Knowledge	349	3.71	.93
Technological Content Knowledge	349	3.73	.86
Pedagogical Content Knowledge	349	3.67	.87
Technological Pedagogical Knowledge	349	3.67	.77
Technological Pedagogical Content Knowledge	349	3.76	.80

Table 4. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components according to gender

	Gender	*n*	*M*	*Ss*	*df*	*t*	*p*
General Technological Pedagogical Content Knowledge	Male	185	3.67	.72	347	.073	.942
	Female	164	3.66	.56			
Technological Knowledge	Male	185	3.51	.93	347	1.169	.243
	Female	164	3.40	.77			
Pedagogical Knowledge	Male	185	3.72	.79	347	-.548	.584
	Female	164	3.76	.66			
Content Knowledge	Male	185	3.69	.93	347	-.513	.608
	Female	164	3.74	.68			
Technological Content Knowledge	Male	185	3.71	.86	347	-.555	.579
	Female	164	3.75	.73			
Pedagogical Content Knowledge	Male	185	3.64	.87	347	-.918	.359
	Female	164	3.72	.73			
Technological Pedagogical Knowledge	Male	185	3.67	.77	347	-.050	.961
	Female	164	3.68	.63			
Technological Pedagogical Content Knowledge	Male	185	3.78	.80	347	.339	.735
	Female	164	3.75	.63			

Table 5. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components according to the year in college

	Year in College	*n*	*M*	*Ss*	*df*	*t*	*p*
General Technological Pedagogical Content Knowledge	3rd year	201	3.66	.63	347	-.093	.927
	4th year	148	3.67	.68			
Technological Knowledge	3rd year	201	3.51	.80	347	.983	.326
	4th year	148	3.41	.93			
Pedagogical Knowledge	3rd year	201	3.69	.73	347	-1.393	.165
	4th year	148	3.80	.74			
Content Knowledge	3rd year	201	3.71	.76	347	-.202	.840
	4th year	148	3.72	.88			
Technological Content Knowledge	3rd year	201	3.76	.78	347	.774	.439
	4th year	148	3.69	.83			
Pedagogical Content Knowledge	3rd year	201	3.70	.77	347	.787	.432
	4th year	148	3.64	.85			
Technological Pedagogical Knowledge	3rd year	201	3.69	.70	347	.419	.675
	4th year	148	3.66	.71			
Technological Pedagogical Content Knowledge	3rd year	201	3.74	.75	347	-.773	.440
	4th year	148	3.80	.75			

Social Studies Teacher Candidates' TPACK Competencies According to Year in College

To examine whether there is a significant difference between teacher candidates' overall TPACK and its sub-components scores according to their year in college, independent samples t-test was used. The obtained results are listed in Table 5.

As seen in Table 5, social studies teacher candidates' self-efficacy beliefs for overall TPACK did not vary according to the year in college [$t_{(347)}$= -.093; p>.05]. While 3rd year social studies teacher education students' average overall TPACK score was (M=3.66), it was (M=3.67) for 4th year students. These findings indicate that 3rd year and 4th year social studies teacher education students' self-efficacy beliefs for TPACK were similar. Furthermore, the effect of year in college was examined for all TPACK sub-components. Accordingly, the analysis results showed that social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components did not differ with the year in college.

Social Studies Teacher Candidates' TPACK Competencies According to Personal Computer Ownership

Independent samples t-test was employed to determine if significant differences exist among teacher candidates' scores for overall TPACK and its sub-components according to the variable 'personal computer ownership'. The results are given in Table 6.

Data presented in Table 6 showed that social studies teacher candidates' self-efficacy beliefs for overall TPACK did not significantly vary according to variable 'personal computer ownership' [$t_{(347)}$= 1.382; p>.05]. Based on these findings, it can be stated that social studies teacher candidates' who had a personal computer and those who did not have displayed similar levels of overall technological pedagogical content knowledge. The variable 'personal computer ownership' was analyzed separately for each TPACK sub-component. Accordingly, teacher candidates' self-efficacy beliefs for each TPACK sub-component for all tests were found to be statistically insignificant. On the other hand, the relationship between teacher candidates' self-efficacy beliefs for "Technological Knowledge (TK)" and personal computer ownership status was found to be statistically significant [$t_{(347)}$= 2.984; p<.05].

Social Studies Teacher Candidates' TPACK Competencies According to Their Perceived Technology Competency

To examine whether there is a significant difference between teacher candidates' overall TPACK and its sub-components scores according to their perceived technology competency, independent samples t-test was applied. The results are presented in Table 7.

According to the analysis results shown in Table 7, social studies teacher candidates' self-efficacy beliefs for overall TPACK did not significantly vary according to their

Table 6. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components according to personal computer ownership

	Personal Computer Ownership	***n***		***Ss***	***df***	***t***	***p***
General Technological Pedagogical Content Knowledge	Yes	249	3.69	.68	347	1.382	.168
	No	100	3.59	.57			
Technological Knowledge	Yes	249	3.55	.89	347	2.984	.003
	No	100	3.25	.74			
Pedagogical Knowledge	Yes	249	3.73	.75	347	-.190	.849
	No	100	3.75	.69			
Content Knowledge	Yes	249	3.74	.83	347	.571	.568
	No	100	3.67	.77			
Technological Content Knowledge	Yes	249	3.76	.83	347	1.302	.194
	No	100	3.64	.71			
Pedagogical Content Knowledge	Yes	249	3.70	.84	347	.950	.343
	No	100	3.61	.73			
Technological Pedagogical Knowledge	Yes	249	3.71	.71	347	1.385	.167
	No	100	3.59	.69			
Technological Pedagogical Content Knowledge	Yes	249	3.78	.78	347	.718	.473
	No	100	3.72	.65			

Table 7. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components according to perceived technology competency

	Perceived Technology Competency	***n***	***M***	***Ss***	***df***	***t***	***p***
General Technological Pedagogical Content Knowledge	Competent	249	3.78	.67	347	4.890	.000
	Incompetent	100	3.44	.58			
Technological Knowledge	Competent	249	3.71	.87	347	7.567	.000
	Incompetent	100	3.03	.65			
Pedagogical Knowledge	Competent	249	3.79	.83	347	1.557	.120
	Incompetent	100	3.57	.76			
Content Knowledge	Competent	249	3.79	.71	347	2.459	.014
	Incompetent	100	3.66	.76			
Technological Content Knowledge	Competent	249	3.88	.77	347	5.057	.000
	Incompetent	100	3.45	.74			
Pedagogical Content Knowledge	Competent	249	3.80	.82	347	3.856	.000
	Incompetent	100	3.46	.74			
Technological Pedagogical Knowledge	Competent	249	3.79	.69	347	4.178	.000
	Incompetent	100	3.47	.68			
Technological Pedagogical Content Knowledge	Competent	249	3.89	.72	347	4.423	.000
	Incompetent	100	3.53	.75			

perceived technology competency [$t_{(347)}$= 4.890; p=0.00]. This finding points out that social studies teacher candidates' perceived technology competency is a significant variable to explain their levels of technological pedagogical content knowledge. The variable 'perceived technology competency' was examined separately for other TPACK sub-components. Accordingly, teacher candidates' self-efficacy beliefs for Technological Knowledge, Content Knowledge, Technological Content Knowledge, Pedagogical Content Knowledge, Technological Pedagogical Knowledge, and Technological Pedagogical Content Knowledge were found to be statistically significant according to perceived technology competency (p<.05). On the other hand, no statistically significant difference was found among Pedagogical Knowledge (PB) scores [$t_{(347)}$= 1.557; p>.05]. Based on these results, it can be argued that participants' perceived technology competency is an important predictor of social studies teacher candidates' self-efficacy beliefs for TPACK competency.

Social Studies Teacher Candidates' TPACK Competencies According to Grade Point Average

To examine whether there is a significant difference among teacher candidates' scores of overall TPACK and its sub-components according to their grade point average (GPA) scores, one-way analysis of variance (ANOVA) was performed. The obtained results are presented in Table 8.

As seen in Table 8, teacher candidates' mean scores of overall TPACK according to GPA varied between (M=3.67) and (M=3.64). It was found that teacher candidates with lower GPA scores had relatively lower scores of overall TPACK compared to those with higher GPA scores. Statistical analysis showed that no significant difference exists between teacher candidates' GPA scores and their self-efficacy beliefs about TPACK and its sub-components (p>.05). Based on these findings, it can be argued that teacher candidates' self-efficacy beliefs for TPACK and its sub-components did not differ significantly according to their GPA scores.

Social Studies Teacher Candidates' TPACK Competencies According to the Use of Content Sharing Platforms

One-way analysis of variance (ANOVA) was used to examine whether there is a significant difference between teacher candidates' overall TPACK and its sub-components scores and the use of content sharing platforms for professional purposes. The obtained results are shown in Table 9.

As seen in Table 9, social studies teacher candidates' mean scores of self-efficacy beliefs for overall TPACK were varied between (M=3.40) and (M=3.86) according to the use of content sharing platforms. While the lowest mean score

Table 8. Social Studies Teacher Candidates' Self-Efficacy Beliefs for Overall TPACK and Its Sub-Components According to Their GPA Scores

	GPA	*n*	*M*	*Ss*	*F*	*p*	*Difference*
General Technological Pedagogical Content Knowledge	0.00-2.50	101	3.64	.67	.079	.924	-
	2.51-3.00	181	3.67	.65			
	3.01-4.00	67	3.66	.63			
Technological Knowledge	0.00-2.50	101	3.48	.93	.071	.931	-
	2.51-3.00	181	3.47	.83			
	3.01-4.00	67	3.43	.83			
Pedagogical Knowledge	0.00-2.50	101	3.69	.74	.405	.668	-
	2.51-3.00	181	3.77	.74			
	3.01-4.00	67	3.73	.72			
Content Knowledge	0.00-2.50	101	3.68	.79	.244	.784	-
	2.51-3.00	181	3.71	.83			
	3.01-4.00	67	3.77	.79			
Technological Content Knowledge	0.00-2.50	101	3.72	.82	.203	.817	-
	2.51-3.00	181	3.71	.79			
	3.01-4.00	67	3.78	.80			
Pedagogical Content Knowledge	0.00-2.50	101	3.66	.81	.057	.944	-
	2.51-3.00	181	3.67	.81			
	3.01-4.00	67	3.70	.82			
Technological Pedagogical Knowledge	0.00-2.50	101	3.68	.74	.117	.889	-
	2.51-3.00	181	3.69	.70			
	3.01-4.00	67	3.64	.69			
Technological Pedagogical Content Knowledge	0.00-2.50	101	3.72	.76	.320	.726	-
	2.51-3.00	181	3.77	.76			
	3.01-4.00	67	3.81	.71			

belongs to the teacher candidates' who never used content sharing platforms for professional purposes, the highest mean score was displayed by those who often use content sharing platforms for professional purposes. This difference was found to be statistically significant [$F_{(3\text{-}345)}$= 5.785; p<.05]. Furthermore, it was found that teacher candidates' mean scores of all TPACK sub-components except 'Content Knowledge' statistically differ according to the use of content sharing platforms for professional purposes (p<.05).

Social Studies Teacher Candidates' TPACK Competencies According to ITMD Course Scores

To examine whether there is a significant difference among teacher candidates' scores of overall TPACK and its sub-components according to their Instructional Technology and Material Development ITMD course scores, one-way analysis of variance (ANOVA) was applied. The results are listed in Table 10.

As seen in Table 10, social studies teacher candidates' mean scores of self-efficacy beliefs for overall TPACK were varied between (M=3.55) and (M=3.70) according to their scores in the ITMD course they took in the 3rd year, semester. It was determined that teacher candidates with lower course scores displayed lower self-efficacy beliefs for overall TPACK compared to those who had higher course scores. In other words, as teacher candidates' ITMD course scores increase their overall TPACK scores increase. Moreover, similar results were obtained for all sub-components. However, statistical analysis showed that these differences were not significant (p>.05). Therefore, it can be argued that social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components did not significantly differ by their ITMD course scores.

DISCUSSION AND CONCLUSION

Research findings revealed that social studies teacher candidates' self-efficacy beliefs for overall TPACK is generally at a sufficient level (3.66). Regarding the sub-dimensions of the TPACK-S scale, it was determined that the teacher candidates displayed generally sufficient levels self-efficacy beliefs for sub-dimensions of TK (3.46), PK (3.74), CK (3.71), PCK (3.67), TCK (3.73), TPK (3.67), and TPACK (3.76). When the mean scores of the TPACK sub-components are examined; while teacher candidates' lowest mean score was obtained in technological knowledge (3.46) sub-dimension, they displayed the highest scores in pedagogical knowledge (3.74) and content knowledge (3.71) sub-components. Compared with the results reported in previous studies, our findings were consistent with many studies (Lee & Tsai, 2010; Dereli, 2017; Ünlü et al., 2017; Çifçi & Dikmenli, 2018; Kaya & Yazıcı, 2019; Aydoğmuş & Karadağ, 2020). For example, Ünlü et al. (2017) found that social studies teacher candidates had sufficient levels of TPACK competencies (3.88). Furthermore, the results obtained in a study by Kaya and Yazıcı (2019) revealed that social studies teachers exhibited relatively high mean scores for techno-pedagogical education (3.74). On the other hand, similar to our findings, Ünlü et al. (2017) also found that teacher candidates' technological knowledge competencies was the lowest (3.14) compared to other knowledge categories and the authors stated that the reason for this deficiency could be explained by the statement of the teacher candidates, "we cannot follow technology sufficiently and we use technology only as much as we need". While TPACK self-efficacy beliefs of teacher candidates were found to be high in almost most of the studies conducted in Turkey, it is quite significant that the TK self-efficacy beliefs, which point to the perception of technology competence in the sub-components of the scale, were relatively low. The emergence of such a result in our study can be explained by the fact that teacher candidates' belief in technology efficacy and their level of using technology for educational purposes may be relatively low despite their positive perspectives on technology (Sahin et al., 2009; Aksoğan. & Bulut Özek, 2020). In other words, potentially, to an increase in technology use in the classroom as well as an increased likelihood that this technology use will be based on knowledge of pedagogy and content (Abbitt, 2011).

Moreover, social studies teacher candidates' self-efficacy beliefs regarding TPACK were also examined according

Table 9. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and Its sub-components according to the use of content sharing platforms

	Using Content Sharing Platforms for Professional Purposes	***n***	***M***	***Ss***	***F***	***p***	***Difference***
General Technological Pedagogical Content Knowledge	Never	25	3.40	.76	5.785	.001	1-4
	Rarely	88	3.51	.66			2-4
	Sometimes	149	3.68	.61			
	Often	87	3.86	.63			
Technological Knowledge	Never	25	3.13	.91	7.674	.000	1-4
	Rarely	88	3.23	.82			2-4
	Sometimes	149	3.48	.82			
	Often	87	3.77	.86			
Pedagogical Knowledge	Never	25	3.46	.88	2.986	.031	1-4
	Rarely	88	3.62	.74			
	Sometimes	149	3.79	.69			
	Often	87	3.86	.72			
Content Knowledge	Never	25	3.41	1.06	1.444	.230	-
	Rarely	88	3.68	.75			
	Sometimes	149	3.76	.75			
	Often	87	3.73	.88			
Technological Content Knowledge	Never	25	3.52	.88	4.171	.006	1-4
	Rarely	88	3.57	.86			2-4
	Sometimes	149	3.72	.77			
	Often	87	3.95	.72			
Pedagogical Content Knowledge	Never	25	3.36	.87	8.118	.000	1-3
	Rarely	88	3.42	.83			1-4
	Sometimes	149	3.72	.76			2-3
	Often	87	3.95	.75			2-4
Technological Pedagogical Knowledge	Never	25	3.40	.86	5.646	.001	1-4
	Rarely	88	3.53	.74			2-4
	Sometimes	149	3.67	.67			
	Often	87	3.90	.61			
Technological Pedagogical Content Knowledge	Never	25	3.73	.84	3.829	.010	1-4
	Rarely	88	3.65	.76			2-4
	Sometimes	149	3.70	.75			
	Often	87	3.99	.67			

to multiple variables. The obtained results pointed out that gender differences were not significant in social studies teacher candidates' self-efficacy beliefs for TPACK. Similar results were also obtained for the sub-components of TPACK and accordingly, it was determined that social studies teacher candidates' competencies regarding TPACK and its sub-components did not differ by gender. Similar findings were reported in previous studies (Koh et al., 2010; Yağcı, 2015; Kaya et al., 2011; Tokmak et al., 2013; Aydoğmuş & Karadağ, 2020). Furthermore, Kaya et al. (2011) found that teacher candidates' self-efficacy beliefs for Web-TPACK did not significantly differ by gender. Additionally, the study conducted by Tokmak et al. (2013) indicated that there were no significant gender differences in TPACK. However, some studies reported opposite results. For instance, Yağcı (2015) and Karadeniz and Vatanartıran (2015) reported gender-related differences in favor of male participants regarding pedagogical knowledge. Similarly, Chai et al. (2010) conducted a study in Singapore with 1185 teacher candidates and they determined gender differences in perceptions of TPACK in favor of female students. This results should be considered usual. Today, both male and female teacher candidates are able to easily access technological tools. Therefore, no difference is expected in terms of gender when teacher/teacher candidates are integrating technological tools into their lessons and using them. In addition, this finding related to gender can be explained by the inclusion of teacher candidates into the same training in the education faculties in terms of General Qualifications for Teaching Profession. Otherwise, some differences may occur due to

Table 10. Social studies teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components according to ITMD course scores

	ITMD course score	*n*	*M*	*Ss*	*F*	*p*	*Difference*
General Technological Pedagogical Content Knowledge	21-40	42	3.55	.67	.731	.534	-
	41-60	52	3.60	.60			
	61-80	145	3.68	.62			
	81-100	110	3.70	.70			
Technological Knowledge	21-40	42	3.35	.84	1.103	.348	-
	41-60	52	3.32	.71			
	61-80	145	3.53	.87			
	81-100	110	3.49	.92			
Pedagogical Knowledge	21-40	42	3.68	.79	.300	.825	-
	41-60	52	3.70	.66			
	61-80	145	3.73	.71			
	81-100	110	3.79	.77			
Content Knowledge	21-40	42	3.67	.76	.119	.949	-
	41-60	52	3.74	.78			
	61-80	145	3.70	.85			
	81-100	110	3.74	.80			
Technological Content Knowledge	21-40	42	3.62	.72	.691	.558	-
	41-60	52	3.63	.89			
	61-80	145	3.76	.76			
	81-100	110	3.79	.83			
Pedagogical Content Knowledge	21-40	42	3.43	.85	2.237	.084	-
	41-60	52	3.56	.81			
	61-80	145	3.74	.72			
	81-100	110	3.73	.88			
Technological Pedagogical Knowledge	21-40	42	3.53	.75	.821	.483	-
	41-60	52	3.64	.72			
	61-80	145	3.70	.67			
	81-100	110	3.72	.72			
Technological Pedagogical Content Knowledge	21-40	42	3.66	.77	.461	.710	-
	41-60	52	3.72	.72			
	61-80	145	3.77	.71			
	81-100	110	3.81	.80			

micro and macro factors such as the quality of the education received and the quality of technology integration that may vary from country to country.

According to the analysis results on the impact of year in college, we found that students' technological pedagogical content knowledge competencies did not significantly differ by year in college. Similar results were obtained for TPACK sub-components and therefore, it can be argued that social studies teacher candidates' competencies of TPACK and its sub-dimensions did not vary by year in college. Although there have been many studies on TPACK, only a limited number of studies have examined the impact of year in college. Nevertheless, the obtained results in previous studies by Koh and Chai (2011), Öztürk (2013), Tokmak et al. (2013) and Aytaş (2020) were consistent with our findings regarding the impact of the variable 'year in college'. Aytaş (2020) highlighted that teacher candidates' year in college was not effective on their information and communication technology skills and explained this finding with the fact that the pre-service teachers have similar technology experiences since they are at rather similar ages. In the literature, it is pointed out that there is a weak relationship between TPACK and age (Lee & Tsai, 2010; Cheng, 2017). The fact that the 3rd and 4th grade teacher candidates are close to each other in age could also explain why their TPACK self-efficacy beliefs did not differ by teaching level. Also, as pointed out in some sources in the literature (Lin et al., 2013; (Hsu et al., 2017), the relationship between age and TPACK levels may be more evident for in-service teachers; while years of teaching experience may be a variable that should also be considered.

The analysis results showed that social studies teacher candidates' overall TPACK levels did not significantly vary by personal computer ownership. A literature survey revealed that some studies have examined the relationship between personal computer ownership and self-efficacy levels regarding TPACK. Our results were consistent with the obtained findings in those studies (Şad & Nalçacı, 2015; Aydoğmuş & Karadağ, 2020). Aydoğmuş and Karadağ (2020) emphasized that teacher candidates mostly own a personal computer today and naturally, they had high levels of information and communication technology skills. So, experience level may not have significantly affected their information and communication technology skills. On the other hand, the current study showed that a statistically significant relationship exists between teacher candidates' levels of "Technological Knowledge (TK)" and personal computer ownership. The mean self-efficacy score of teacher candidates' who had a personal computer regarding technological knowledge was (3.55) higher than those who did not have a personal computer (3.25). This finding was partly consistent with the results found by Çifçi and Dikmenli (2018). It was noteworthy that statistically significant differences were found for TPACK and other sub-components except pedagogical knowledge in favor of participants who had a personal computer. In fact, this result of the research can also be explained by the fact that all teacher candidates can do most of the tasks that require computers with their smart phones. Because, "smartphones today have features that are comparable to an average computer, and this handheld mobile device can engage students in far more dynamic ways than a laptop or tablet computer" (Hingorani et al., 2012). Therefore, it can be said that teacher candidates who do not have a personal computer have filled this gap with their personal smartphones.

Perceived technology competency was also examined as a variable in the present paper. Accordingly, the obtained results showed that social studies teacher candidates' self-efficacy beliefs for overall TPACK significantly differ by perceived technology competency. Mean self-efficacy belief score of teacher candidates who perceived themselves as technology incompetent regarding overall TPACK (3.78) was higher than those who perceived themselves as technology competent (3.44). This finding indicated that perceived technology competency is an important predictor of social studies teacher candidates' self-efficacy beliefs for TPACK. Furthermore, all TPACK sub-components were examined and accordingly, it was found that teacher candidates' self-efficacy beliefs for all TPACK sub-components except pedagogical knowledge significantly differ by perceived technology competency. Similarly, the studies conducted by Öztürk (2013) and Karalar and Aslan-Altan (2016) with primary teacher candidates indicated that self-efficacy levels of the participants regarding TPACK and its sub-components significantly differ by perceived technology competency in favor of teacher candidates who feel themselves competent in technology. These results also point to the importance of teachers' having digital literacy. In our age, which is described as the age of technology, one of the important responsibilities of social studies teachers is to contribute to the growth of digitally literate individuals. However, the prerequisite for teachers to raise digital literate individuals is that they can combine their digital literacy with pedagogical content knowledge and use them effectively and efficiently in their classroom practices (Angeli & Valanides, 2009; Koehler & Mishra, 2008; Mishra & Koehler, 2006; Niess, 2008).

The results of the analysis examining the impact of teacher candidates' GPA on the mean scores obtained from the overall TPACK-S scale and its sub- components showed that no statistically significant difference exists among participants' scores by their GPA. Considering the fact that a majority of the courses determining students' academic success (GPA) are content knowledge and pedagogical knowledge related courses, such a result can be expected. In fact, self-efficacy is significantly associated with student achievement. Erdogan and Sahin (2010) indicated that the TPACK is a significant predictor of student achievement. As the TPACK requires confidence in combining different knowledge components successfully, it is related to self-efficacy beliefs (Sahin et al., 2009). Mutlu (2016) highlighted a similar finding and argued that teacher candidates' self-efficacy beliefs for TPACK are expected to be affected by their GPA therefore, selective courses increasing technological knowledge of students should be offered more in the curriculum.

Moreover, social studies teacher candidates' self-efficacy beliefs for overall TPACK were also examined according to the variable 'using content sharing platforms for professional purposes'. Teacher candidates' mean scores varied between (M=3.40) and (M=3.86) according to the variable using content sharing platforms for professional purposes (i.e. Facebook and content sharing sites) in favor of those who have more intention to use content sharing platforms. According to the analysis results, these differences were found to be statistically significant for overall TPACK and its sub-dimensions except content knowledge (CK) sub-dimension. These findings indicated that there is a significant relationship between teacher candidates' self-efficacy beliefs for overall TPACK and its sub-components and their tendency to use content sharing platforms for professional purposes. This can be considered a mutually reinforcing relation. It can be argued that as teacher candidates use content sharing platforms for professional purposes, their TPACK competencies increase and accordingly, the increase in these competencies increases their intention to use such content sharing platforms. To the best of our knowledge, there have been no studies that directly examine the relationship between teachers' or teacher candidates' self-efficacy beliefs for TPACK and their use of content sharing platforms for professional purposes. On the other hand, Tatlı et al. (2016) found that teacher candidates' competencies regarding Web 2.0 tools have significant impact on their self-confidence in TPACK. Furthermore, Kabakçı-Yurdakul (2011) determined a significant relationship between teacher candidates' use of information and communication technologies and their TPACK levels.

Another finding obtained in the current study is that no significant difference exists between social studies teacher

candidates' scores in the instructional technology and material development (ITMD) course which they took during college education and their TPACK mean scores. It was determined that teacher candidates' overall TPACK mean scores varied between (M=3.55) and (M=3.70), and higher ITMD course scores were related to the higher TPACK scores. Similar results were obtained for other TPACK sub-components however, these differences were found to be statistically insignificant. These findings pointed out that the ITMD course has a very limited impact on teacher candidates' self-efficacy beliefs for TPACK. The literature survey showed that only a limited number of studies have examined such relationships (Bakaç & Özen, 2017; Aktepe et al., 2018; Akgün, 2020). Bakaç and Özen (2017) determined a significant positive relationship at the medium level between teacher candidates' self-efficacy beliefs regarding material design and their TPACK levels. Furthermore, the same study indicated that teacher candidates' self-efficacy beliefs for TPACK had a positive impact on their self-efficacy beliefs for material design. Kılıç et al. (2019) highlighted that TPACK-based combined learning environments are important in developing teacher candidates' TPACK. In fact, the ITMD course which is included in the teacher education college programs is expect to make an important contribution to teacher candidates' self-efficacy beliefs about TPACK. Consequently, the findings presented in the current study can provide valuable insight to researchers and practitioners since the obtained results revealed the need to examine the content and feature of that course in further studies and to improve teacher candidates' self-efficacy beliefs for TPACK.

RECOMMENDATIONS FOR FUTURE RESEARCH

To better understand how TPACK development in teacher education, we are needed to more longitudinal studies. Triangulated study designs that include performance measures that spanning several years in this field will help us to not only better understand how TPACK, but also know what contextual factors are driving and hindering this growth. Considering the rapid technological developments and the variety and functionality of Web 2.0 tools, the number of courses that promote teacher candidates' TPACK skills and develop their competencies regarding the effective use of technology in teaching and research practices should be increased in the curriculums of teacher education programs. Courses related to technological and pedagogical content and their implementation, especially instructional technologies and material design and Social Studies I-II courses might be enriched with TPACK combined teaching environments. Digital literacy can be included in teacher education programs in the context of many positive effects it provides to students in the classroom and in the following years. To observe different dynamics in technology-oriented learning environments, teacher candidates' experiences regarding the use of technology in the classrooms, school support for this or their concerns about technology use should be included, especially during internship periods. Thus, digital literacy skills of teacher candidates can improve. Considering the Covid-19 pandemic situation, online training and seminars can be provided to teachers and teacher candidates on the effective use of content and media sharing platforms. More comprehensive research may be conducted to determine effective integration methods of technology into educational practices for both social studies teachers and teachers from other disciplines.

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