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Investigating the relationship between digital instructional material development self-efficacy, digital literacy and critical thinking disposition

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Highlights

- Digital literacy and critical thinking disposition are significant predictors for self-efficacy in developing digital teaching materials
- Technical knowledge and the cognitive maturity are significant predictors of developing digital teaching materials.
- Pre-service teachers need to have digital literacy skills to develop and integrate digital materials in instruction.

Article Info: Research Article

Keywords: *Digital Instructional Material Development, Digital Literacy And Critical Thinking Disposition, Preservice teachers*

Abstract

The purpose of this study is to examine the relationship between pre-service teachers' digital instructional material development self-efficacy, digital literacy skills and critical thinking dispositions. The data were collected using the Digital Instructional Material Development Self-Efficacy Scale, Digital Literacy Scale and Critical Thinking Disposition Scale. Descriptive statistics, correlation analysis and regression analysis were used to analyze the data obtained from the study. According to the results of the study, digital literacy and critical thinking disposition are significant predictors of pre-service teachers' self-efficacy in developing digital teaching materials. In addition, the technical sub-dimension of digital literacy and the cognitive maturity sub-dimension of critical thinking disposition were found to be significant predictors of pre-service teachers' self-efficacy in developing digital teaching materials.

1. Introduction

The importance and necessity for today's teachers to possess a wide range of non-traditional skills has been addressed in many studies. Skills, also referred to as 21st century skills, include digital competencies such as the selection and use of technologies and soft skills such as communication skills, creativity, critical thinking, collaboration and problem solving (van Laar, van Deursen, van Dijk & Haan, 2017) and are seen as the skills that will enable individuals to survive and produce in the digital world we live in (Lasry, & Kobayashi, 2019; OECD, 2018). Those who are proficient in 21st century skills can work in fields that are more difficult to automate because they engage with uniquely human skills such as thinking skills, emotional and social skills, and attitudinal skills (Lamb & Doecke, 2017), and there is less risk that 21st century skills, which are high-level cognitive and social skills, will be replaced by automation (Ra, 2018). It is also very important to support the development of the skills of prospective teachers who will raise the next generation. Teacher training institutions, as factors affecting the future of both teachers and young people, need to support pre-service teachers both to develop 21st century skills and to develop these skills in their students while practicing their profession (Subramaniam, 2013; Teo, Unwin, Scherer, & Gardiner,

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2021). Various studies are being carried out for this purpose. For example, Agyei and Voogt (2016) found in their study that they enabled pre-service mathematics teachers to design mathematics lessons using spreadsheets and thus improved their digital competencies. It is an inevitable fact that enabling preservice teachers to design technology-rich lessons in which they integrate digital materials directly affects their design of instruction in which they can better integrate technology (Tondeur, Aesaert, Prestridge, & Consuegra, 2018).

The fact that children are introduced to technology at a very early age and that it is an integral part of their daily lives requires teachers to constantly update themselves about technology and especially instructional technologies (Cirocki & Farrell, 2019). In order to enable students to go beyond consuming technology and produce with technology, it is necessary to develop the high-level skills mentioned above. Teachers need to look at the instruction from different perspectives and carefully design a multidimensional process, including the design of the classroom environment, in-class and extracurricular activities, and assessment and evaluation activities, in a way that meets the needs and expectations of their students. For this reason, the role and importance of the teacher as a designer is now heavily emphasized in the literature (Chai, Hwee & Teo, 2019). It is important to utilize digital technologies while designing almost every part of instruction, which we also call instructional design, in order to create more effective and up-to-date instructional design. One of the important stages of the instructional design process is to create or use appropriate digital instructional materials for in- and out-of-class activities, assessment and evaluation. Research shows that designing digital instructional materials is also effective in developing digital competence (Tondeur, Howard & Yang, 2021).

In the age of artificial intelligence (Wang et.al., 2023), advanced technologies such as chatbots, as well as scientific evidence suggesting that new technologies such as AR, VR, and metaverse have the potential to make great contributions to education, show us the inevitability of using digital materials. While using advanced technologies, it is now one of the inevitable roles of teachers to know and recognize the features of these technologies and to focus on how they can be integrated into education.

2. Literature

2.1. Digital Instructional Material Development Self-Efficacy

Whether face-to-face, online or hybrid learning environments, digital teaching materials should be used to ensure effective instruction (Erol Şahin & Kara Erol, 2022; Karaferye, 2022; Karsenti, Kozarenko, Skakunova, 2020; Friesen, Fisher & Roberts, 2001). Today, digital content and materials are an important components of learning environments (Sönmez, Göçmez, Uygun & Ataizi, 2018; Kumar & Kushwaha, 2010). At this point, digital tools such as Web 2.0 tools provide great convenience for teachers (Anderson, 2007; D'Souza, 2006; O'Reilley, 2007). Digital instructional technologies used in lessons provide a more effective learning process (Bakaç & Özen, 2015) and increase the retention of learning (Seferoğlu & Yağcı, 2001; Yalın, 2007). To determine the extent to which teachers have the necessary skills to use digital materials, self-efficacy levels can be examined to determine how much they have these skills (Korkmaz, Arıkaya, & Altıntaş, 2019).

Self-efficacy is defined as an individual's self-judgment about his/her capacity to accomplish the activities required for a certain performance (Bandura, 1997). In addition, teachers with high self-efficacy beliefs make more effort to increase student learning and achievement (Bergman, McLaughlin, Bass, Pauly, & Zellman, 1977; Ruble, Usher, & McGrew, 2011). Self-efficacy for developing digital teaching materials can be defined as be teachers' beliefs about having the skills needed to develop materials using digital technologies (Sun, Tsai, Finger, Chen & Yeh, 2008). When the literature is examined, it is seen that there is a positive relationship between self-efficacy perception and individuals' effort to be successful in a job (Pajares, 1996; Roberts, Henson, Tharp ve Moreno, 2001). In addition, teachers' positive self-efficacy perceptions lead to a more effective teaching experience (Özkan, Tekkaya ve Çakıroğlu, 2002; Andersen,

Dragsted, Evans ve Sorensen, 2004). Teachers' self-efficacy in developing digital teaching materials will also contribute to the more effective execution of teaching and learning practices (Birişçi, Kul, Aksu, Akaslan & Çelik, 2018).

2.2. Digital Literacy Skills

The term and definition of "digital literacy" was first used by Gilster (1997), who defined it as the ability to understand and use information in different formats from a variety of sources presented by computers. (Nelson, Courier & Joseph, 2011) defined it as the ability to understand and compose multimodal digital texts to communicate with others, while Marsh (2016) defined it as the ability to create a much wider range of interactions related to learning, to use different tools appropriately, and to open up the possibility of communicating meaningful messages across social parties. Digital literacy is not only a technological skill, but also the actions people take using digital technologies to achieve personal, social and educational goals. In addition, it is the ability to browse, select, analyze, analyze, organize, understand, evaluate, and create information using digital technology (Kim & Yang, 2016).

Digitally literate individuals are able to find the digital information they want, navigate the digital world without getting lost, determine whether the information is accurate or not, and modify it as they wish in order to communicate ethically with others (Kewalramani, Kidman & Palaiologou, 2021; Marsh, 2016). In the digital age, digital literacy is one of the key competencies citizens need to communicate with others using digital technologies (Öztürk, 2021; Breakstone, McGrew, Smith, Ortega & Wineburg, 2018).

Understanding how to acquire digital literacy skills is a critical issue for the field of education. Teachers' beliefs and attitudes are important and are shaped by their own digital literacy skills (Langub & Lokey-Vega, 2017). In addition, teachers with high digital literacy skills are more open-minded about using educational technology with their students and are much more prepared to integrate educational digital technology into their classrooms to support their students' learning (Breakstone et al., 2018).

Digital literacy is not only the ability to use a computer, but also the ability to think critically, to understand the various forms of information available through computers, and to combine new information and use it correctly for their purposes, which all users need in order to correctly assess the value of the information available on the Internet (Glister & Glister, 1997). In other words, digital literacy includes the ability to use digital technology to search, find, and understand the information necessary for oneself, as well as the ability to critically evaluate the reliability and validity of information and use it appropriately (Breakstone et al., 2018). At this point, critical thinking skill is an important supporting skill.

2.3. Critical Thinking Disposition

Critical thinking is seen as an important skill for students (Van Peppen et.al., 2018) in today's digital world. Critical thinking is a style of thinking that includes cognitive processes such as reasoning, analyzing and evaluating (Akın, Hamedoğlu, Arslan, Akın, Çelik, Kaya & Arslan, 2015). It can be thought of as the process of evaluating and explaining the available information in order to clearly understand the problem before making a decision about the problem and taking action. Researchers in the field of education have stated that the basic process of critical thinking consists of cognitive components. These cognitive components can be classified as comparison and contrast, evaluation, synthesis, inference, identification of prejudices, generalization of results, perception, analysis, decision-making process, problem solving, induction and deduction (Arslan, 2012).

Critical thinking is thought to be a natural process, but this skill must be developed by teachers. Moreover, the presentation of teaching materials plays an important role in the development of critical thinking (Gashan, 2015). Teachers may not be fully aware of the methods and strategies necessary to integrate critical thinking skills into their teaching (Lauer, 2005). Likewise, teachers' lack of adequate theoretical and practical awareness of critical thinking skills likely hinders their competence in facilitating the development of critical thinking skills among their students (Kowalczyk, Hackworth & Case-smith, 2012). Therefore,

pre-service teachers' critical thinking skills emerge as an important factor in creating and integrating digital teaching materials.

2.4. Aim and Significance of The Study

In the literature, there is a dearth of research examining the relationship between pre-service teachers' digital teaching material development self-efficacy and digital literacy and critical thinking disposition. Digital instructional material development self-efficacy will always be a disposition that teachers need in the artificial intelligence age we live in, especially with the recent use of tools such as chatbots in education. For this reason, examining which variables affect the self-efficacy of developing digital teaching materials will help researchers in developing this skill and contribute to the literature. The aim of the study is to examine the relationship between pre-service teachers' self-efficacy to develop digital teaching materials and their digital literacy and critical thinking dispositions.

3. Methodology

In this study, the relational survey model was used to examine the relationship between two or more variables from the general survey model types (Karasar, 1995). The aim was to examine the relationships between pre-service teachers' digital material development self-efficacy, digital literacy and critical thinking disposition. The dependent variable of the study is digital material development self-efficacy and the independent variables are digital literacy and critical thinking disposition.

3.1. Participants

The participants of the study consisted of 152 pre-service teachers studying in the spring semester of 2021-2022 at the faculty of education in a state university located in the Marmara Region of Turkey. 127 of the participants were female and 24 were male. The distribution of the undergraduate programs in which the participants were enrolled is shown in Table 1. Although most participants represent pre-school and mathematics education, the sample includes all departments in the faculty of education. Table 2 illustrates the grade level of participants.

Table 1.
Participants' Major

Undergraduate Program	**f**	**%**
Preschool Education	24	15.8
Math Education	24	15.8
Primary Education	22	14.5
Guidance And Psychological Counseling	21	13.8
Social Studies Education	18	11.9
Turkish Language Education	17	11.2
Foreign Language Education	11	7.2
Special Education	10	6.6
Science Education	5	3.3
Total	152	100

Table 2.
Participants' Grade

Grade	f	%
Freshmen	1	0.7
Sophomore	46	30.3
Junior	65	42.8
Senior	40	26.3
Total	100	100

3.2. Data Collecting Tools

Digital Instructional Material Development Self-Efficacy Scale:

This scale was developed by Korkmaz, Arıkaya, and Altıntaş (2019) to determine teachers' self-efficacy in creating digital teaching materials. The scale consists of 38 items measured using a five-point Likert type across three factors. The Cronbach Alpha value of the total of the factors is 0.961. The internal consistency coefficients of the factors were found to be high and the scale was determined to be a valid and reliable scale.

Digital Literacy Scale:

The scale developed by Ng (2012) and adapted into Turkish by (Hamutoğlu, Güngören, Uyanık, & Erdoğan, 2016) consists of 17 items and 4 factors (attitude, technical, cognitive and social). It is a 5-point Likert-type scale with a rating Strongly Agree (5) to Strongly Disagree (1). The internal consistency coefficient obtained for the whole scale is .93. Sufficient reliability coefficients were obtained for all and sub-dimensions of the scale aiming to measure digital literacy skills.

Critical Thinking Disposition Scale:

This scale was developed by Florida University researchers and adapted into Turkish by Kılıç & Şen (2014) in order to measure the critical thinking disposition of individuals. The scale consists of 26 items and is a 5-point Likert scale (1=strongly disagree, 5=strongly agree). The internal consistency reliability coefficient is 0,91 for the whole scale, 0,88 for engagement subscale, 0,70 for cognitive maturity and 0,73 for innovativeness..

3.3. Data Analysis

Descriptive statistics, correlation analysis and hierarchical regression analysis were used to analyze the data collected from the scales. Data obtained in the study were analyzed using SPSS 26 program to statistically test the assumptions of regression analysis. Outliers in the data set were examined with the standardized errors method and the data that were not in the accepted range were removed and the analyses were performed on the data of 152 participants.

3.4. Findings

Correlations between the variables examined in the analysis, digital teaching material development self-efficacy, digital literacy and critical thinking disposition, are shown in Table 3.

Table 3.
Correlations between Variables

Variables	DIMDS	DLS	CTD
DIMDS	1	.498	.340
DL		1	.391
CTD			1

DIMDS= Digital instructional material development self-efficacy DLS= Digital literacy CTD= critical thinking disposition
$p< 0.001$

According to Table 3 there is a positive moderate significant relationship ($r=.498$; $p< 0.001$) between the variable of digital teaching material development self-efficacy and the variable of digital literacy skills, and a positive low significant relationship ($r=.340$; $p< 0.001$) between the variable of digital teaching material development self-efficacy and the variable of critical thinking disposition. In addition, there is a positive and low level significant relationship ($r=.391$; $p< 0.001$) between the variable of digital literacy skills and the variable of critical thinking disposition.

3.4.1. Findings related to the prediction of digital instructional material development self-efficacy

Predictive factors of pre-service teachers' self-efficacy for developing digital teaching materials in online environments were examined by stepwise regression analysis. Thus, the variables that contributed significantly to the prediction of digital teaching material development self-efficacy and the contribution of these variables to the total variance explained in the prediction of digital teaching material development self-efficacy were determined. In the application of this method, the total variance explained for digital instructional material development self-efficacy was reached at the end of two stages. The hierarchical regression analysis results regarding the relationship between digital literacy skills and critical thinking disposition are shown in Table 4.

Table 4.
Hierarchical Regression Analysis Summary for Digital Literacy Variables

Model		**β**	**t**	**Sig.**	**R**	**R^2**	**F**
1[a]	Digital Literacy	.498	7.037	.000	.498a	.248	49.526
2[b]	Digital Literacy	.431	5.682	.000	.523	.273	5.098
	Critical thinking disposition	.171	2.258	.025			

Dependent variable: Digital Instructional Material Development Self-Efficacy
a. Predictors: (Constant), Digital Literacy
b. Predictors: (Constant), Digital Literacy, Critical thinking disposition

In the first model, digital literacy variable was included. According to results from the regression analysis, it is seen that digital literacy (β=.498; p< .001) is a significant predictor of digital instructional material development efficacy. According to this finding, it shows that as digital literacy skill increases, self-efficacy in developing digital teaching materials increases. Digital literacy variable explains 24% of the variance related to digital instructional material development efficacy. Results reveal that digital literacy was the strongest variable predicting digital instructional material development self-efficacy.In the second model, critical thinking disposition was added for analysis. The variance related to digital instructional material development efficacy increased from 24% to 27%. As can be seen from Table 4, digital literacy and critical thinking disposition are significant predictors of digital instructional material development efficacy. The predictive effect of digital literacy (β=.431) is higher than the predictive effect of critical thinking disposition (β=.171).

3.4.2. Findings on the prediction of the sub-dimensions of Digital Literacy on digital instructional material development self-efficacy

The predictive effect of the sub-dimensions of digital literacy on digital instructional material development self-efficacy was examined by stepwise regression analysis. The sub-dimensions are Attitude, Technical, Cognitive and Social, and it is seen that the Attitude sub-dimension is a significant predictor of digital instructional material development self-efficacy (β=.284; p< .001). According to Table 5, the Attitude sub-dimension of the digital literacy variable explains 8% of the variance related to digital teaching material development efficacy. In the 2nd model, the Technique sub-dimension was added to the model. Results indicate that the variance related to the competence of developing digital teaching materials increased from 8% to 27%. In Model 3, the variance increased to 28% by adding the cognition subdimension and to 30% by adding the social subdimension. However, it is seen that the strongest variable predicting digital instructional material development self-efficacy is the technical subdimension of digital literacy.

Table 5.
Hierarchical Regression Analysis Summary for Subdimensions of Digital Literacy Variables Predicting Digital Instructional Material Development Self-Efficacy

Model		β	t	Sig.	R	R^2	F
1[a]	Digital Literacy-Attitude	.284	3.628	.000	$.284^a$	.081	13.165
2[b]	Digital Literacy - Attitude	.004	.051	.959	$.526^b$	.276	40.291
	Digital Literacy -Technical	.523	6.348	.000			
3[c]	Digital Literacy - Attitude	.007	.086	.932	$.536^c$	.287	2.177
	Digital Literacy - Technical	.451	4.702	.000			
	Digital Literacy - Cognitive	.125	1.476	.142			
4[d]	Digital Literacy - Attitude	-.049	-.568	.571	$.552^d$	.305	3.832
	Digital Literacy - Technical	.451	4.751	.000			
	Digital Literacy - Cognitive	.072	.824	.411			
	Digital Literacy - Social	.160	1.957	.052			

Dependent variable: Digital Instructional Material Development Self-Efficacy

a. Predictors: (Constant), Attitude
b. Predictors: (Constant), Attitude, Technical
c. Predictors: (Constant), Attitude, Technical, Cognitive
d. Predictors: (Constant), Attitude, Technical, Cognitive, Social

3.4.3. Findings related to the prediction of digital instructional material development self-efficacy by sub-dimensions of critical thinking disposition

The predictive effect of the sub-dimensions of critical thinking disposition on digital instructional material development self-efficacy was examined by stepwise regression analysis. The sub-dimensions are Cognitive Maturity, Engagement and Innovativeness, and it is seen that Cognitive Maturity sub-dimension is a significant predictor of digital instructional material development self-efficacy (β=.358; p< .001). As seen in Table 6, Participation and Innovativeness subscales are not significant predictors.

Table 6.
Hierarchical Regression Analysis Summary for Subdimensions of Critical Thinking Disposition Variables Predicting Digital Instructional Material Development Self-Efficacy

Model		β	t	Sig.	R	R^2	F
1[a]	CTD - Cognitive Maturity	.358	4.690	.000	$.358^a$	.128	21.994
2[b]	CTD - Cognitive Maturity	.355	3.205	.002	$.358^b$	.128	.001
	CTD - Engagement	. 003	.029	.977			
3c	CTD - Cognitive Maturity	.282	2.380	.019	$.380^c$	.144	2.839
	CTD - Engagement	.100	-.791	.430			
	CTD - Innovativeness	.208	1.685	.094			

Dependent variable: Digital Instructional Material Development Self-Efficacy
CTD= critical thinking disposition

a. Predictors: (Constant), Cognitive Maturity
b. Predictors: (Constant), Cognitive Maturity, Engagement
c. Predictors: (Constant), Cognitive Maturity, Engagement, Innovativeness

3.4.4. Findings on the prediction of the variables of technical and cognitive maturity on digital instructional material development self-efficacy

The predictive effect of the technical subdimension of digital literacy and the cognitive maturity subdimensions of critical thinking disposition on digital instructional material development self-efficacy was examined by hierarchical regression analysis. The findings are shown in Table 7. In the first model, the technical variable, which is the dimension of digital literacy, was analyzed. Results revealed that the technical (β=.526; p< .001) variable is a significant predictor of digital instructional material development competence. The technical subdimension explains 27% of the variance related to digital teaching material

development competence. In the second model, critical thinking disposition cognitive maturity sub-dimension was added and thus, it was seen that the variance related to digital instructional material development efficacy increased from 27% to 30%. As can be seen from Table z, digital literacy technical subdimension and critical thinking disposition cognitive maturity subdimension are significant predictors of digital instructional material development competence. The predictive effect of the technical variable (β=.456) is higher than the predictive effect of the cognitive maturity subdimension of critical thinking disposition (β=.193).

Table 7.
Hierarchical Regression Analysis Summary for Technical and Cognitive MaturityVariables Predicting Digital Instructional Material Development Self-Efficacy

Model		**β**	**t**	**Sig.**	**R**	**R^2**	**F**
1[a]	DL-Technical	.526	7.569	.000	$.526^a$	.276	57.282
2[b]	DL- Technical	.456	6.247	.000	$.556^b$	.309	7.014
	CTD- Cognitive Maturity	.193	2.648	.009			

Dependent variable: Digital Instructional Material Development Self-Efficacy
CTD: Critical Thinking Disposition DL: Digital Literacy

a. Predictors: (Constant), Technical
b. Predictors: (Constant), Technical, Cognitive Maturity

4. Conclusion and Suggestions

In this study, the relationship between preservice teachers' digital literacy and critical thinking dispositions on digital instructional material development self-efficacy were examined. According to the results, digital literacy and critical thinking disposition significantly predicted digital instructional material development self-efficacy. In addition, the self-efficacy of pre-service teachers who have technical knowledge about digital literacy and cognitive maturity related to critical thinking disposition increases.

One important findings revealed that digital teaching material development self-efficacy was related to digital literacy. Considering that digital literacy includes the ability to use and produce technology more effectively in business and daily life within the framework of ethical rules, competency in this skill enables pre-service teachers to effectively integrate digital technologies into teaching. Moreover, it was observed that there was a higher level of relationship between the technical subdimension of digital literacy and self-efficacy in developing digital teaching materials. Teachers' technical knowledge of technology increases their ability to use and integrate these technologies into education. Therefore, their competence in this sense also increases.

Interestingly, Erdoğdu and Eskimen (2021) found in their study that pre-service teachers' experience and knowledge of digital story creation tools for the lesson positively affected their motivation and self-efficacy in developing materials using digital tools. Extant literature suggests that self-efficacy in using basic Information and Communication Technologies (ICT) seems to be important for teachers to develop self-efficacy in using these technologies for teaching purposes (Krumsvik, 2011; Hatlevik, 2017). Basic ICT self-efficacy and digital competence are positively related to each other (Fanni, rega & Cantoni, 2013); thus, there seems to some overlap between self-efficacy and digital competence (Hatlevik, 2017). It is important to acknowledge that digital competence is positively related to ICT use, as higher levels of digital competence can contribute to a more responsive and critical use of technology in school (Hatlevik, 2017).

It is critical to understand that preparing teachers to use ICT skills with new technologies is one of the most needed areas for professional development among teachers. Teachers benefit from more systematic training on this issue (Gudmundsdotti et al., 2014). Thus, teacher educators need to find ways to integrate digital competence as part of teacher education and teacher professional development (Krumsvik, 2014). In particular, it can be predicted that enabling pre-service teachers to have increased self-efficacy, advanced strategies for evaluating knowledge and advanced digital competencies can contribute to the digital competencies of future teachers. In addition, Technology Knowledge, Technological Content Knowledge

and Technological Pedagogical Content Knowledge, which are the sub-fields of the TPACK model, constitute technological formation. In their study, Ağıç and Korkmaz (2022) found a significant positive relationship between the technological formation levels of elementary mathematics teachers and their self-efficacy in developing digital teaching materials.

Second, a positive significant relationship was found between digital instructional material development self-efficacy and critical thinking disposition. It is reported in the literature that there is a positive relationship between teachers' general self-efficacy and critical thinking disposition (Kezer, Ogurlu, & Akfırat, 2016; Phan, 2009; Zangenehvandi, Farahian, & Gholami, 2014). Critical thinking disposition is defined as having an open mind, finding and conceptualizing problems, developing plans and strategies, understanding, performing and working with mental processes (Tishman, Jay ve Perkins, 1993). Importantly, Cansoy and Türkoğlu (2017) found a significant relationship between critical thinking disposition and problem solving skills and the adequacy of teaching strategies. Considering this there is a possibility of integrating digital materials will increase. Pre-service teachers' developing competencies and strategies for student engagement and classroom management are, therefore, related to their critical thinking disposition and problem solving skills.

In the studies on digital teaching material development self-efficacy in the literature, teachers' digital material design self-efficacy was generally found to be at a medium level (Karademir, 2018; Chuang & Ho, 2011), but it was also stated to be at a low level in some studies (Arı, 2019). This shows that teachers need to be supported in terms of their self-efficacy in developing digital teaching materials such as in adapting or developing and integrating digital technologies specific to their subject areas into their own lessons. In this regard, it is important for teacher training programs to provide teacher candidates with practical training on this issue. Today, although there are many studies on the effective integration of technology into classroom environments, there are still no definitive solutions to the problems experienced in this regard. While it is an inevitable fact that teachers should utilize technology to reach students and help them do their best, and even have the competence to develop appropriate digital teaching materials, an important step in this regard is to take steps to increase the competence and skills of pre-service teachers in this regard. It can be suggested that studies should be conducted to determine the needs of pre-service teachers when developing digital teaching materials and to study the practices that can be applied in this regard.

Regardless of the technology, teachers' self-efficacy in developing digital teaching materials is an important issue. New technologies that are constantly developing will always bring up the question of how we can use these technologies in education and then teacher competencies related to this will be on the agenda. This is still not a fully solved problem and there is a need for research on this issue. Further research is also needed on how to improve teachers' self-efficacy, knowledge assessment strategies and digital competencies according to the competence goals in the curriculum (Hatlevik, 2017).

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