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Research Article

Examination of Secondary School Mathematics Teachers' Digital Literacy Self-Efficacy, E-learning Readiness, Technology Acceptance Levels, and Attitudes Towards Distance Education*

Filiz Tuba DIKKARTIN ÖVEZ[1] **Sedat DEMİR[2]**

[1]Balıkesir University, Necatibey Faculty of Education, Balıkesir , Türkiye
tdikkartin@balikesir.edu.tr, https://orcid.org/0000-0003-2646-5327

Ministry of National Education Uşak, Banaz Hatiplar Secondary School, Uşak. Email:
sedat9696demir@gmail.com, https://orcid.org/0000-0002-7026-6301

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Abstract – In this study, digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes toward distance education of secondary school mathematics teachers were examined during the pandemic process. 108 secondary school mathematics teachers working in Uşak province and its districts, selected by convenience sampling method, participated in the study. Personal information forms, "Digital Literacy Self-Efficacy Scale", "E-learning Readiness Scale", "Technology Acceptance Scale for Teachers" and "Attitude Towards Distance Education Scale" were used as data collection tools. Descriptive statistics, t-tests for relational samples, one-factor analysis of variance, and multiple correlation analysis were used for data analysis. The study concluded that secondary school mathematics teachers' digital literacy self-efficacy levels, e-learning readiness levels and technology acceptance levels were at high level and their attitudes towards distance education were at medium level. It was determined that there was positive and high-level relationship between secondary school mathematics teachers' digital literacy self-efficacy and their readiness for e-learning, positive and medium-level relationship between their technology acceptance levels, and negative and low-level relationship between their attitudes towards distance education. In addition, it was determined that there was a moderate positive relationship between their e-learning readiness and technology acceptance, while there was a low positive relationship between their attitudes towards distance education.

Key words: Digital Literacy Self-Efficacy, Attitudes Towards Distance Education, Mathematics Teachers, E-learning Readiness, Technology Acceptance.

Corresponding author: Filiz Tuba DİKKARTIN ÖVEZ, tdikkartin@balikesir.edu.tr , Balıkesir University.

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Introduction

Technology has started to be used in every field with the development and spread of technology. International competition as a consequence of technological developments has also changed the qualifications expected by countries from individuals (Eruysal Sertbarut, 2021). The development of fingerprint and face recognition technologies, the use of unmanned aerial vehicles and drones in several fields, the use of tools developed with chip technologies, and the use of artificial intelligence and robots have changed our understanding of daily life. Now, qualified individuals who can produce and use technology rather than manpower are needed. The individuals are now expected to have some qualifications called 21st-century skills along with school diplomas and basic skills to find a job in the 21st century (Uluyol & Eryılmaz, 2015). To instill these skills, the Partnership for 21st Century Learning (P21) framework, also known as the 21st Century Skills Framework Partnership was developed (Gelen, 2017; P21, 2018). This framework was created for the first time in 2006 with businesses such as Microsoft, Apple, America Online (AOL), etc., and educational societies such as National Education Association (NEA) under the leadership of the United States of America (USA) Ministry of Education, and then continued with changes. This framework was created to ensure the integration of 21st-century skills into education (Kurudayıoğlu & Soysal, 2018). The P21 framework enables individuals to have a good working and daily life via a variety of learning resources and aids them to be ready for the qualifications required by the 21st century (P21, 2018). Individuals with 21st-century skills are individuals who can shape their lives, keep up with the changes in their lives, and develop themselves in pursuing a career and advancement. In addition, individuals who can look at the events around them critically, produce solutions to the encountered problems, have good communication with their environment and work in cooperation, make a difference with their creativity, and use information and communication technologies correctly and reliably can stand out in the 21st century (P21, 2018). In this period of digitalization of life, the importance of the technology dimension of the 21st century skills is also increasing. In Turkey, as in the world, there is a need for teachers who are open to development and follow innovations and developments for the integration of technology and scientific developments with education, the ability to catch these developments well by students, and rendering education more efficient (Aksoy et al., 2021). Teachers are required to be able to access reliable and correct e-content that is suitable for the outcomes, to shape this content in accordance with the technological equipment available in the school and the classrooms, and

to apply the content complying with a certain plan in the classroom considering the level of the students. In addition, they are expected to use the internet correctly and reliably and to be able to transfer the content to their students. The access and use of technology, digital tools, and equipment as well as their integration into the course can only be possible with a certain technological knowledge of teachers. The concept of digital literacy emerges in this process. Digital literacy is a concept encompassing some 21st-century skills that include correct and target-oriented use of digital resources. The concept of digital literacy, which was first introduced by Gilster (1997), was defined as accessing, using, and expressing information in different ways with the help of digital resources. In other words, digital literacy means correct and target-oriented use of digital equipment, reaching the desired information through digital resources, converting this information into different forms, and using the same in the desired way (Terzi & İşli, 2020). Briefly, digital literacy can be explained as reaching the goal by correct and target-oriented use of digital resources. Under today's conditions, individuals are expected to have digital competences to keep up with life and do their jobs. Teachers and students should keep up with these technological changes for the acquisition of the desired information and the appropriate use of the same (Doğan & Birişçi, 2022). It is hence important for students to have a certain level of digital literacy in order to keep up with this change. Therefore, teachers are expected to develop their digital literacy and guide students as well.

Being an important part of education, teachers are under the influence of technological changes and try to benefit from these changes in the education-teaching process (Yılmaz & Toker, 2022). Appropriate trainings should be taken for the application of these technologies in the classrooms. In order to achieve this, the use and application of technology by enhancing technological opportunities in e-learning and the acceptance of technology have become important (Binay-Eyuboğlu & Karaoğlan-Yılmaz, 2018). This is where technology acceptance becomes significant. There have been studies on technology acceptance from the past to the present. Initially, the Technology Acceptance Model was developed by Davis et al. (1989). In another study, the Technology Acceptance and Use Model was developed by Venkatesh et al. (2003) by combining 8 different technology models. This model was developed by Venkatesh et al. (2012) and the Unified Theory of Acceptance and Use of Technology Model 2 was proposed. In this way, models were developed, and technology acceptance was attempted to be explained. Considering teachers' acceptance of technology, teachers' age, experience, technology knowledge, and self-confidence towards technology are

thought to affect the acceptance of technology and its adaptation to courses (Aktürk & Delen, 2020).

While the importance of technology acceptance was examined by various studies, the necessity of technology came to the fore once again with the COVID-19 pandemic, which emerged in China in 2019 and spread to the world in a short time. There have been changes in our lives in fields such as education, sociality, economy, etc. in the world and in our country. In our country, curfews, transportation restrictions, quarantines, and educational changes have been the main measures taken to protect from the effects of the pandemic (Kavuk & Demirtaş, 2021). In our country, face-to-face education was suspended in all schools affiliated with the Ministry of National Education on March 12, 2020, and for the entire semester at universities on March 16, 2020. With the suspension of face-to-face education, there has been an urgent transition to distance education. With this sudden development, teachers have been in search for the continuation of education. Despite this unusual situation, teachers have made an effort to continue education and training by teaching their courses with remote meeting applications such as social media tools, Zoom, Google Meets, etc., or by shooting course videos and sharing them with their students. Meanwhile, the Ministry of National Education made an urgent move to continue education and training by creating TRT EBA channels on television. In addition, live courses and distance education courses were tried in the determined pilot provinces, and 8th and 12th grades preparing for exams were taught by distance education (MoNE, 2020).

Teachers' e-learning readiness was felt most during this period. In addition, teachers' e-learning readiness is closely related to the effectiveness of education (Geniş, 2022; Hukle, 2009). E-learning readiness is the ability of individuals to effectively use e-learning technologies in order to increase the quality of education (Kaur & Abbas, 2004). Another definition includes an individual's ability to use e-learning technologies, motivation, attitude, belief, and self-efficacy towards e-learning (Baygeldi et al., 2021; Zor, 2021). A general readiness study should be conducted to reduce failures in e-learning and ensure a successful education (Demir Öztürk & Eren, 2021; Mercado, 2008). It is important to particularly examine the readiness of teachers for e-learning and to identify and correct the deficiencies (Geniş, 2022).

There are many factors in the success of distance education during the pandemic period (Koca & Tutal, 2021). The restrictions experienced by the teachers who play a crucial role in the conduct of the lessons during the pandemic, the internet infrastructure in the region, the

devices they own, and their attitudes towards distance education can create a disadvantage for distance education (Dönmez et al., 2022). One of the most important factors is teachers' attitudes towards distance education (Ağır et al., 2007). Examining the attitudes of teachers based on their experiences on distance education is important for future distance education activities.

With the transition to distance education during the Covid-19, students had difficulty adapting to this system. The mathematics course was especially one of the most difficult courses for students (İnci, 2021). The unique nature, concepts, symbols, and abstractness of mathematics, the interconnectedness of subjects, and the inability of students to attend the lessons caused this difficulty. Furthermore, teachers experienced problems due to the lack of use of technological equipment, inexperience in distance education, inability to reach appropriate materials, and absenteeism of students (Özdemir Baki & Çelik, 2021). As can be understood from the process, it is considered important for mathematics teachers to adopt and use digital literacy and technology for education.

Considering the developments experienced today, the changes brought by the pandemic have increased the use of technology. Especially the introduction of distance education into education life has increased the importance of e-learning. In our country, e-learning has previously been used as well. Some departments of universities continued their education with e-learning (Akdemir, 2011). In addition, various in-service trainings of teachers were also carried out through e-learning (Gebel & Tekin Bozkurt, 2022). During e-learning, teachers and students may experience problems in terms of hardware and learning. Given this context, some problems were experienced during the complete transition to distance education with the pandemic. Some problems such as the lack of adequate equipment, the inability to ensure attendance in distance education, and the ineffectiveness of distance education compared to face-to-face education have shown the improvement-requiring aspects of distance education (Baloğlu & Fırat, 2022). It is considered that making education effective is related to teachers' e-learning competences. The level of preparedness of teachers for e-learning, their e-learning readiness, and their self-development in this direction are considered important for distance education. With the continuation of the pandemic, people have started to make their lives easier by using technological opportunities. While seeking scenarios of retransition to face-to-face education, distance education also continued. In this process, educational technologies have also developed and provided opportunities for education to be enriched in terms of digital content. The frequency of teachers' use of technology here can

change the course of their lessons. Many factors such as the teacher's age, distance education experiences, self-efficacy in teaching, and perception of technology affect their willingness to use technology and adapt it to their courses (Aktürk & Delen, 2020). The attitudes of the teachers involved in this process towards distance education are also considered important. It is thought that it is necessary to determine the attitudes of teachers towards distance education in terms of the efficiency of distance education and its use in the future. In the distance education process, the mathematics course has been the most challenging course for secondary school students (Karataş, 2020). From the perspectives of teachers, the abstract language of mathematics, the difficulty of using mathematical concepts and symbols in distance education, and the absenteeism of students despite the interconnectedness of mathematics subjects made mathematics education more difficult for students as well as teachers (Özdemir Baki & Çelik, 2021). On the other hand, the lack of adequate hardware knowledge of teachers about distance education, the inability to access adequate materials, the concern about not completing subjects, and the lack of experience caused difficulties and disruptions in the distance education process (Özdemir Baki & Çelik, 2021). It is thought that there is a need for teachers who have the vision of educating well-equipped students in terms of 21st-century skills, use technology effectively, and have the ability to integrate it into the teaching process. The effective face-to-face, hybrid, and distance teaching of mathematics, which is known to be difficult to learn, is related to the competences of teachers (Coşkun Şimşek et al., 2022). In this direction, it is considered important to shed light on the mathematics teaching process during the pandemic, to be prepared for new emergency distance education situations, and to examine the teachers in terms of the factors that will affect distance education in the process of urgently planning the necessary precautions and measures. In this direction, the aim of the study is to examine the digital literacy self-efficacy, e-learning readiness, technology acceptance level, and attitudes towards distance education of secondary school mathematics teachers in terms of various variables and to examine the correlation between their technology acceptance levels, digital literacy self-efficacy, e-learning readiness, and attitudes towards distance education during the pandemic.

The problems determined in line with the purpose of the study are as follows:

1. How are secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education during the pandemic?

2. Do the secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education differentiate according to various variables (gender, professional seniority, and distance education status) during the pandemic?

3. Is there a significant correlation between secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education during the pandemic?

Method

Research Design

This study was based on the correlational screening model. The correlational screening model is a screening approach that aims to determine the existence of covariance between two or more variables. In the correlational screening model, it is tried to determine whether the variables change together and if there is a change, how it happened (Karasar, 2011). The independent variables are gender, seniority, and educational status related to distance education while the dependent variables are digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education. In the study, the correlational screening model was used since it was aimed to examine the digital literacy self-efficacy, e-learning readiness, technology acceptance level, and attitudes towards distance education of secondary school mathematics teachers with respect to various variables during the pandemic.

Participants

The study was carried out with 108 secondary school mathematics teachers selected by convenience sampling method, working in secondary schools affiliated with the Ministry of National Education in the province and districts of Uşak in 2021. It is a method that aims to prevent the loss of time, money, and labor in an appropriate sampling method (Büyüköztürk et al., 2015). The gender, educational status, and seniority distribution of the teachers in the study group are presented in Table 1.

Table 1 Secondary School Mathematics Teachers' Gender, Educational Status, and Professional Seniority Variables

	Gender	f	%
Gender	Female	74	68.52
	Male	34	31.48
Educational Status	Undergraduate	88	81.48
	Graduate	20	18.52
	PhD	-	-
Professional Title	0-5 Years	49	45.37
	6-10 Years	30	27.78
	11-15 Years	12	11.11
	16-20 Years	10	9.26
	21-25 Years	7	6.48
Total		108	100

On examination of Table 1, 74 (68.52%) of the teachers participating in the study were female, 34 (31.48%) were male; 88 (81.48) were at the undergraduate level and 20 (18.52%) at the graduate level. In addition, 49 (45.37%) were determined to have professional seniority between 0-5 years, 30 (27.78%) between 6-10 years, 12 (11.11%) between 11-15 years, 10 (9.26%) between 16-20 years, and 7 (6.48%) between 21-25 years.

Data Collection Tools

A personal information form was created in order to determine some demographic characteristics of secondary school mathematics teachers participating in the study. In this scope, questions were asked in order to obtain the data relating to teachers' demographic information (gender, education level, professional seniority year, status of having a personal computer, internet access status, main purpose of using the internet, the means of participation in distance education, status of receiving training related to distance education, the equipment they use in the distance education process). The "Digital Literacy Self-Efficacy Scale" (DLSS) developed by Karakuş and Ocak (2018) was used to measure teachers' digital literacy self-efficacy. The scale consists of 4 dimensions: "production, ability to use resources, ability to use applications, and support". The first dimension of the scale (production) consists of 11 items, the second dimension of the scale (ability to use resources) consists of 10 items, the third dimension of the scale (ability to use applications) consists of 9 items, and the fourth dimension of the scale (support) consists of 5 items. As a result of the reliability analyses regarding the sub-dimensions and the whole scale calculated during the development process of the scale used in the study, Cronbach's Alpha values were calculated as 0.90 for the first factor, 0.88 for the second factor, 0.86 for the third factor, 0.81 for the fourth factor, and 0.96 for the whole scale. In order to determine the teachers' e-learning readiness, the "E-Learning

Readiness Scale (E-LRS)" developed by Yurdagül and Demir (2015) was used. The scale consists of 4 dimensions. These dimensions are "ICT use self-efficacy", "self-confidence in e-learning", "attitude towards e-learning", and "training needs for e-learning". As a result of the reliability analyses of the entire scale, Cronbach Alpha values were calculated as 0.89 for ICT use self-efficacy, 0.92 for self-confidence in e-learning, 0.94 for attitude towards e-learning, 0.83 for training need for e-learning, and 0.92 for the entire scale. "Scale of Technology Acceptance of Teachers: T-TAS" developed by Ursavaş et al. (2014) was used to determine teachers' technology acceptance levels. As a result of the reliability analyses regarding the sub-dimensions and the whole scale calculated during the development process of the scale, Cronbach Alpha values were calculated as 0.901 for "perceived usefulness", 0.908 for "perceived ease of use", 0.894 for "attitude towards use", 0.896 for "behavioral intention", and "facilitating situations". 0.811 for "perceived joy", 0.798 for "self-efficacy", 0.856 for "technological complexity", 0.822 for "suitability", 0.869 for "concern", 0.835 for "subjective norm", and 0.864 for the entire scale. In order to determine the attitudes of teachers towards distance education, the "Distance Education Attitude Scale (DEAT)" developed by Ağır et al. (2007) was used. The Cronbach Alpha value of the scale was 0.835. Ethics committee approval was applied during the study, and it was approved with the ethics committee permission document dated 18.11.2021 and numbered E-19928322-302.08.01-87821 that there was no violation of research ethics.

Data Analysis

Statistical analysis package program (IBM SPSS Statistics 26) was used to analyze the data obtained in the study. Descriptive statistics were used in order to determine the distributions of the DLSS, E-LRS, T-TAS, and DEAT scores. The scores of the secondary school mathematics teachers participating in the study were calculated to determine the type of analysis to be used in the study and the skewness and kurtosis values were examined to determine the normality of the scores according to the independent variables. In addition, the Shapiro-Wilk test was used to determine the normality of the data. Table 2 presents the Shapiro-Wilk test results, skewness, and kurtosis values of the teachers' DLSS, E-LRS, T-TAS, and DEAT scores and Shapiro-Wilk test results, skewness, and kurtosis values according to the variables of gender, professional seniority, and distance education status.

Table 2 Normality Results of The DLSS, E-LRS, T-TAS, and DEAT Scores According to Gender, Seniority, and Distance Education Variables

Scales	Variables		Shapiro-Wilk Value	Skewness	Kurtosis
DLSS	Scale		.18	-.36	.36
	Gender	Female	.40	-.15	-.40
		Male	.23	-.47	.68
	Seniority	0-5	.59	-.12	.34
		6-10	.38	-.57	.49
		11-15	.91	.49	-.12
		16-20	.68	.11	-1.13
		21-25	.69	-.31	1.08
	Distance education status	Yes	.53	.19	-.64
		No	.37	-.37	.24
E-LRS	Scale		.24	-.32	.41
	Gender	Female	.11	-.35	-.34
		Male	.25	-.42	1.32
	Seniority	0-5	.07	-.69	.32
		6-10	.45	.72	1.12
		11-15	.67	-.52	.00
		16-20	.23	-.33	-.75
		21-25	.45	.12	-1.77
	Distance education status	Yes	.53	.19	-.64
		No	.37	-.37	.24
T-TAS	Scale		.40	-.33	.45
	Gender	Female	.73	-.10	-.17
		Male	.35	-.74	1.19
	Seniority	0-5	.07	-.49	-.41
		6-10	.31	-.40	.48
		11-15	.78	.36	-.38
		16-20	.67	-.19	.51
		21-25	.58	-.19	.12
	Distance education status	Yes	.75	.07	-.32
		No	.28	-.46	.54
DEAT	Scale		.12	-.35	.84
	Gender	Female	.03	-.55	1.44
		Male	.47	-.03	-.38
	Seniority	0-5	.00	-1.01	1.22
		6-10	.94	-.20	.61
		11-15	.59	.45	-.83
		16-20	.27	1.06	1.76
		21-25	.63	.56	.34
	Distance education status	Yes	.19	-.54	1.08
		No	.82	-.03	-.20

The data was assumed to have a normal distribution if kurtosis and skewness values were between -1.5 and +1.5 according to Tabachnick and Fidell (2013) and between -2.0 and +2.0 according to George and Mallery (2010). Accordingly, on examination of the data in Table 2, the data obtained from the scales showed a normal distribution in terms of seniority,

gender, and distance education variables. In addition, it was observed that the p-value obtained from the Shapiro-Wilk test did not (extremely) deviate from the normal distribution of the scores at the significance level of α=.05. Due to the normal distribution of the data, a t-test for unrelated samples was used to determine whether secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and distance education attitude scores differ according to gender and distance education status; and one-way analysis of variance for unrelated samples to determine whether they differ according to the variable of professional seniority. In addition, the score ranges of secondary school mathematics teachers from the scales of DLSS, E-LRS, T-TAS, and DEAT were evaluated. If the ranking measurement level can be ranked in terms of having a certain feature, this ranking can be defined as the measurement level. Accordingly, for five-point Likert-type scales and their sub-dimensions, the mean ranges of 1-2.33 was accepted low, 2.34-3.66 moderate, and 3.67-5 high; and for the seven-point Likert scale, 1-2.99 was accepted low, 3-5 moderate and 5.01-7 high. In addition, a multi-correlation analysis was conducted to determine the correlation between the scores obtained from secondary school mathematics teachers' technology acceptance levels, digital literacy self-efficacy, e-learning readiness, and attitudes towards distance education.

Findings and Discussions

From the responses to the first question of the study "Do the secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education differentiate according to various variables during the pandemic?", descriptive statistics of the teachers' DLSS, E-LRS, T-TAS, and DEAT scores were calculated. Descriptive statistics are given in Table 3.

Table 3 Descriptive Statistics of DLSS, E-LRS, T-TAS, and DEAT Scores

Scales	f	Minimum	Maximum	$\bar{X}$	S
DLSS	108	2.69	4.82	3.71	.65
E-LRS	108	2.85	6.36	5.07	.64
T-TAS	108	2.20	4.19	3.63	.47
DEAT	108	1.93	4.28	3.32	.24

On examination of Table 3, the mean score of the DLSS was seen as $\overline{X}$ =3.71. According to the scaling specified in the data analysis section of this score, the digital literacy self-efficacy of secondary school mathematics teachers can be interpreted at a "high" level. The mean score of the E-LRS was seen as $\overline{X}$ =5.07. According to the scaling specified in the

data analysis section of this score, the e-learning readiness of secondary school mathematics teachers can be interpreted at a "high" level. The mean score of the T-TAS was seen as $\overline{X}$ =3.63. According to the scaling specified in the data analysis section of this score, the technology acceptance levels of secondary school mathematics teachers can be interpreted at a "moderate" level. The mean score of the DEAT was seen as $\overline{X}$ =3.32. According to the scaling specified in the data analysis section of this score, the attitudes of secondary school mathematics teachers to distance education were determined to be at a "moderate" level.

On item-by-item examination of the answers given by the teachers to the DLSS, the item "I can establish a group where I can communicate with students or parents (for example, a Whatsapp group)" was marked by the highest number of people with an average of 4.82 points. Accordingly, the teachers' ability to establish a communication environment with students and parents can be interpreted to be at a high level. The item "I can create an educational blog" in DLSS was marked by the least number of people with an average of 2.69 points. Accordingly, the teachers' skills in preparing blogs for educational purposes were determined to be at a moderate level.

On item-by-item examination of the answers given by the teachers to the E-LRS, the item "I can use search engines (Google, Yandex search, etc.) confidently" was marked by the highest number of people with an average of 6.36 points. Accordingly, the teachers' ability to use search engines effectively can be interpreted to be at a high level. The item "I think I will be nervous while teaching through e-learning" was marked by the least number of people with an average of 2.85 points. Accordingly, the anxiety levels of the teachers while teaching through e-learning were determined to be at a moderate level.

On item-by-item examination of the answers given by the teachers to the T-TAS, the item "Using ICT makes the lesson more enjoyable and interesting" was marked by the highest number of people with an average of 4.19 points. Accordingly, the teachers' thought that ICT use makes the lessons fun and enjoyable can be interpreted to be at a high level. The item "Using new technologies has always been complicated for me" was marked by the least number of people with an average of 2.20 points. Accordingly, the teachers' thought of finding new technologies complicated was determined to be at a low level.

On item-by-item examination of the answers given by the teachers to the DEAT, the item "Face-to-face education is more useful than distance education" was marked by the highest number of people with an average of 4.28 points. Accordingly, the teachers' opinion

of finding face-to-face education more useful than distance education can be interpreted to be at a high level. The item "Face-to-face education is more effective than distance education" in DEAT was marked by the least number of people with an average of 1.93 points. Accordingly, the teachers' opinion of finding distance education more effective than face-to-face education was determined to be at a low level.

From the responses to the second question of the study "Do the secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education differentiate according to various variables (gender, professional seniority, and distance education status) during the pandemic?" DLSS, E-LRS, T-TAS, and DEAT scores by independent variables were examined. Due to the normal distribution of the data, a t-test for unrelated samples was used to determine whether they differed according to gender and distance education status variables. The t-test results for the unrelated samples are presented in Table 4.

Table 4 T-test Results of the DLSS, E-LRS, T-TAS, And DEAT Scores According to Various Variables

Scales	Variables		N	$\bar{X}$	S	sd	t	p
DLSS	Gender	Female	74	3.75	.59	106	.87	.15
		Male	34	3.63	.76			
	Distance Education Status	Yes	36	3.87	.54	106	1.85	.13
		No	72	3.63	.68			
E-LRS	Gender	Female	74	3.52	.91	106	-1.02	.68
		Male	34	5.03	.60			
	Distance Education Status	Yes	36	5.16	.65	106	1.01	.29
		No	72	5.03	.64			
T-TAS	Gender	Female	74	3.60	.43	106	-1.01	.23
		Male	34	3.70	.55			
	Distance Education Status	Yes	36	3.77	.44	106	2.21	.74
		No	72	3.56	.47			
DEAT	Gender	Female	74	3.29	.23	106	-1.34	.67
		Male	34	3.36	.24			
	Distance Education Status	Yes	36	3.30	.29	106	-.42	.12
		No	72	3.32	.21			

On examination of Table 4, the average of the male participants' E-LRS, T-TAS, and DEAT scores can be said to be higher than the average of the female participants' scores. On examination of the t-test results for unrelated samples performed to determine the significance of the observed difference, it can be seen that female and male participants' E-LRS mean scores [t(106)= -1.02, p>.05], T-TAS mean scores [t (106)= -1.01, p>.05], and DEAT mean

scores [t (106)= -1.34, p>.05] do not differ significantly. On the other hand, the mean scores of the female participants can be said to be higher than the mean scores of the male participants. On examination of the t-test results for unrelated samples performed to determine the significance of the observed difference, it can be seen that female and male participants' DLSS mean scores [t (106)=.87, p>.05] do not differ significantly. With these results, no statistically significant correlation was determined between the DLSS, E-LRS, T-TAS, and DEAT scores and gender.

On examination of Table 4, the mean scores of the participants who received training on distance education can be said to be higher than the mean scores of the participants who did not receive training on distance education. On examination of the t-test results for unrelated samples performed to determine the significance of the observed difference, it can be seen that DLSS mean scores [t(106)=1.85, p>.05], E-LRS mean scores [t(106)=1.01, p>.05], and T-TAS mean scores [t(106)=2.21, p>.05] of participants who received and did not receive training on distance education do not differ significantly. The DEAT mean scores of the participants who did not receive training in distance education can be said to be higher than the mean scores of the participants who received training in distance education. On examination of the t-test results for unrelated samples performed to determine the significance of the observed difference, it can be seen that DEAT mean scores [t(106)=-.42, p>.05] of participants who received or did not receive training on distance education do not differ significantly. These results can be interpreted as the absence of a statistically significant correlation between the scores of DLSS, E-LRS, T-TAS, and DEAT and the status of receiving distance education (Büyüköztürk, 2020).

In order to seek an answer to the second question of the study, the teachers' scores of DLSS, E-LRS, T-TAS, and DEAT were also examined according to the variable of professional seniority. The distributions of the teachers' scores of DLSS, E-LRS, T-TAS, and DEAT according to these variables are given in Table 5.

Table 5 Distribution of Secondary School Mathematics Teachers' DLSS, E-LRS, T-TAS, and DEAT Scores According to Professional Seniority Variable

Scales	Professional Title	N	$\bar{X}$	S
DLSS	0-5	49	3.77	.62
	6-10	30	3.62	.74
	11-15	12	3.67	.41
	16-20	10	3.44	.73
	21-25	7	4.15	.45
	Total	108	3.71	.65

E-LRS	0-5	49	5.03	.64
	6-10	30	5.13	.62
	11-15	12	5.03	.56
	16-20	10	4.84	.85
	21-25	7	5.50	.51
	Total	108	5.07	.64
T-TAS	0-5	49	3.64	.39
	6-10	30	3.68	.59
	11-15	12	3.54	.46
	16-20	10	3.47	.56
	21-25	7	3.70	.26
	Total	108	3.63	.47
DEAT	0-5	49	3.27	.24
	6-10	30	3.41	.24
	11-15	12	3.32	.23
	16-20	10	3.25	.18
	21-25	7	3.33	.23
	Total	108	3.32	.24

On examination of Table 5, it can be seen that the DLSS, E-LRS, T-TAS, and DEAT scores of the participants differ according to the variables of professional seniority. ANOVA test was performed to test the statistical significance of the differences seen in the participants' DLSS, E-LRS, T-TAS, and DEAT scores. The results of the ANOVA test are given in Table 6.

Table 6 ANOVA Results of DLSS, E-LRS, T-TAS, and DEAT Scores by Professional Seniority

Scales		Sum of Squares	sd	Mean of Squares	F	p
DLSS	Intergroup	2.47	4	.62	1.51	.20
	Intragroup	42.08	103	.41		
	Total	44.55	107			
E-LRS	Intergroup	2.02	4	.50	1.22	.31
	Intragroup	42.38	103	.41		
	Total	44.39	107			
T-TAS	Intergroup	.49	4	.12	.55	.70
	Intragroup	22.91	103	.22		
	Total	23.40	107			
DEAT	Intergroup	.44	4	.11	2.04	.09
	Intragroup	5.59	103	.05		
	Total	6.03	107			

On examination of Table 6, it is seen that DLSS [F(4,103)=1.51, p>.05], E-LRS [F(4,103)=1.22, p>.05], T-TAS [F(4,103)=.55, p>.05], and DEAT [F(4,103)=2.04, p>.05] mean scores do not differ significantly according to the professional seniority.

From the responses to the third question of the study "Is there a significant correlation between secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education during the pandemic?", the Pearson correlation coefficient between the DLSS, E-LRS, T-TAS, and DEAT scores were examined. The results of the correlation analysis are given in Table 7.

Table 7 Correlation Analysis Results

Scales	DLSS	E-LRS	T-TAS	DEAT
DLSS	1	.71	.36	-.01
E-LRS		1	.45	.03
T-TAS			1	.19
DLSS				1

On examination of Table 7, while a positive and high correlation was determined between secondary school mathematics teachers' digital literacy self-efficacy and their e-learning readiness ($r = .71$), a moderate positive correlation was determined between their technology acceptance levels, and a low negative correlation between their attitudes towards distance education ($r =. -.01$). In other words, it can be said that as secondary school mathematics teachers' digital literacy self-efficacy increases, their e-learning readiness and technology acceptance levels increase, while their attitudes towards distance education decrease. While a moderate positive correlation was determined between e-learning readiness and technology acceptance ($r = .45$) of secondary school mathematics teachers, while a low positive correlation between their attitudes towards distance education ($r = .03$). In other words, it can be said that as secondary school mathematics teachers' e-learning readiness increases, their technology acceptance levels and attitudes towards distance education increase.

There is a low positive correlation between secondary school mathematics teachers' technology acceptance level and their attitudes towards distance education ($r = .19$). In other words, it can be said that as secondary school mathematics teachers' technology acceptance levels increase, their attitudes towards distance education increase.

Conclusions and Suggestions

In this study, secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education during the pandemic were examined according to various variables. Furthermore, the correlation between secondary school mathematics teachers' digital literacy self-efficacy, e-

learning readiness, technology acceptance levels, and attitudes towards distance education was examined. As a result of the study, it was concluded that secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, and technology acceptance levels were at a high level and their attitudes towards distance education were moderate. These results are similar to the studies conducted by Dönmez et al. (2022), Gündüzalp (2022), and Ocak et al. (2022) examining the digital literacy levels of teachers in various branches. These results are also similar to the studies conducted by Kabataş (2019), Adıyaman (2020), and Parlak (2021) examining the e-learning readiness of teacher candidates, teachers, and lecturers. These results are also similar to the studies conducted by Binay-Eyuboğlu and Karacaoğlan-Yılmaz (2018), Aktürk and Delen (2020), and Kandemir (2020) examining the technology acceptance levels of teachers at primary, secondary, and high school levels. These results are also similar to the studies conducted by Gündüzalp (2021) and Yassıbaş (2022) investigating teachers' attitudes towards distance education. In studies examining teachers' attitudes towards distance education by Ülkü (2018), Akman (2021), and Timurkan (2021), teachers were observed to have negative attitudes towards distance education. Although the advancement of technology and the use of technology in every field including education show that teachers have adopted technology and have certain qualifications, unpreparedness for distance education during the pandemic, lack of experience, and habits from face-to-face education can be shown as the cause of these results.

In this study, no significant difference was found between secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education during the pandemic and their gender. The results of the studies conducted by Dönmez et al. (2022), Gündüzalp (2022), and Ocak et al. (2022) also show that digital literacy self-efficacy does not differ according to the gender of teachers. Similarly, the results of the study conducted by Adıyaman (2020) show that the e-learning readiness does not differ according to the gender of the teachers. Likewise, the results of the studies conducted by Eyuboğlu (2018) and Binay-Eyuboğlu and Karacaoğlan-Yılmaz (2020) show that the technology acceptance levels do not differ according to the gender of the teachers. Also, the results of the studies conducted by Gündüzalp (2021), Timurkan (2021), and Çelik (2022) show that the attitudes of teachers towards distance education do not differ according to their gender.

In this study, no significant difference was found between secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology

acceptance levels, and attitudes towards distance education during the pandemic and their professional seniority. The results of the studies conducted by Dönmez et al. (2022), Doğan and Birişçi (2022), and Gündüzalp (2022) and Mazlum (2022) indicate that there is no significant difference between digital literacy self-efficacy and professional seniority of teachers. Similarly, the results of the studies conducted by Yurdugül and Demir (2017), Adıyaman (2020), and Parlak (2021) show that the e-learning readiness does not differ according to the professional seniority of the teachers. Likewise, the results of the studies conducted by Eyüboğlu (2018) and Sırakaya (2019) show that the technology acceptance levels do not differ according to the professional seniority of the teachers. Also, the results of the studies conducted by Soydan (2021), Timurkan (2021), and Çelik (2022) show that the attitudes of teachers towards distance education do not differ according to their professional seniority. However, it was detected in the studies that digital literacy self-efficacy, e-learning readiness, technology acceptance level, and attitudes towards distance education of teachers with less professional seniority were high (Ağır et al. 2007; Aktürk & Delen, 2020; Kandemir, 2020; Koca & Tutal, 2021; Yumbul, 2021; Gündüzalp, 2021; Gülay Ogelman et al., 2022; Yurtseven, 2022). When the underlying reasons are considered, it can be concluded that the childhoods of teachers with low seniority are mostly spent with technology, they have received technology education at the university, their excitement about starting a new profession, and their desire to learn.

In this study, no significant difference was found between secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance levels, and attitudes towards distance education during the pandemic and their distance education training status. The results of the studies conducted by Korkmaz (2020), Yaman (2020), Buzkurt (2021), and Kara (2021), no significant difference was found between teachers' digital literacy self-efficacy and distance education status. Similarly, the results of the study conducted by Parlak (2021) and Zor (2021) show that the e-learning readiness does not differ according to the distance education status of the teachers. Likewise, the results of the studies conducted by Binay-Eyuboğlu and Karacaoğlan-Yılmaz (2020), and Kandemir (2020) show that the technology acceptance levels do not differ according to the distance education status of the teachers. Also, the results of the studies conducted by Gündüzalp (2021), Timurkan (2021), and Çelik (2022) show that the attitudes of teachers towards distance education do not differentiate according to their status of receiving distance education. However, the results of the studies conducted by Ağır et al. (2007), Deniz (2021),

and Demir (2021) indicate a differentiation in teachers' attitudes towards distance education in favor of those having received distance education.

A positive and high-level correlation was found in the study between the digital literacy self-efficacy and the e-learning readiness of secondary school mathematics teachers. Based on this, it can be said that secondary school mathematics teachers' e-learning readiness increases as their digital literacy self-efficacy increases. Similarly, a moderate positive correlation was determined between the digital literacy self-efficacy and the technology acceptance levels of secondary school mathematics teachers. Based on this, it was concluded that the technology acceptance level of secondary school mathematics teachers increases as their digital literacy self-efficacy increases. A low negative correlation was detected between the digital literacy self-efficacy and the attitudes towards distance education of the secondary school mathematics teachers. A moderate positive correlation was detected between the e-learning readiness and the technology acceptance levels of the secondary school mathematics teachers. This result can be interpreted as the increase of the secondary school mathematics teachers' technology acceptance levels with the increase in their e-learning readiness. A low positive correlation was detected between the e-learning readiness and the attitude towards distance education of the secondary school mathematics teachers. This result may increase to a certain extent in secondary school mathematics teachers' attitudes towards distance education with the increase of their e-learning readiness.

In this study, which was carried out with secondary school mathematics teachers who had both hybrid, distance, and face-to-face teaching experience during the pandemic, teachers' digital literacy levels, e-learning readiness, technology acceptance levels, and attitudes towards distance education were examined according to various variables. As a result of this study, no significant difference was found in terms of teachers' digital literacy levels, e-learning readiness, technology acceptance levels, and attitudes towards distance education according to the variables of gender, seniority, and distance education status. A high level of positive correlation was found between the level of digital literacy and the e-learning readiness, the level of technology acceptance, and the attitude towards distance education, and a moderate positive correlation between the level of digital literacy and the technology acceptance as well as the e-learning readiness and the technology acceptance.

With the onset of the pandemic, there have been some disruptions in e-learning and distance education. The maintenance of education in emergency situations depends entirely

on the performance of teachers and their attitudes towards various variables, self-efficacy levels, and acceptances. In this direction, it is considered important to examine the knowledge, self-efficacy, and skill levels of teachers both in the implementation of up-to-date teaching models that can be used in the integration process of primary learning technologies such as learning blended from innovative approaches and hybrid learning, the integration of technology, and in the healthy execution of distance education applications. In this context, various studies should be carried out to increase the technology acceptance levels, the digital literacy levels, and the e-learning readiness of teachers, and improvements in teachers' attitudes can be achieved by providing professional trainings for distance education. In addition, it is recommended to deepen the study by examining the experiences and opinions of teachers working in disadvantaged schools and having internet problems in terms of the variables examined.

The pandemic in the 21st century has led to problems in the education process having undergone a rapid transformation and the realization of many opportunities such as digital education, hybrid learning, and distance learning. In this context, it is considered important to disseminate digital literacy and teachers with positive affective characteristics about digital technologies, so that the teaching process, which has become inseparable from technology, can create producing and not-consuming brains. Ensuring technology integration for the mathematics course, where abstract concepts are intense, many problems occur even in face-to-face teaching, conceptual understandings emerge, and the ability to ensure effective mathematics teaching in distance education courses are directly related to the knowledge, skills, attitudes, and competences of the teacher. In this direction, in the process of integrating technology into mathematics lessons, evaluations can be made in terms of digital literacy, e-learning readiness, technology acceptance, and attitudes towards distance education, and practices can be carried out.

Compliance with Ethical Standards

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Research involving Human Participants and/or Animals

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Pandemi Sürecinde Ortaokul Matematik Öğretmenlerinin Dijital Okuryazarlık Öz Yeterlikleri, E-öğrenmeye Hazırbulunuşlukları, Teknoloji Kabul Düzeyleri ve Uzaktan Eğitime Yönelik Tutumlarının İncelenmesi

Özet:

Bu araştırmada pandemi sürecinde ortaokul matematik öğretmenlerinin dijital okuryazarlık öz yeterlikleri, e-öğrenmeye hazırbulunuşlukları, teknoloji kabul düzeyleri ve uzaktan eğitime yönelik tutumları incelenmiştir. Araştırmaya Uşak ili ve ilçelerinde görev yapan uygun örnekleme yöntemiyle seçilmiş 108 ortaokul matematik öğretmeni katılmıştır. Veri toplama aracı olarak kişisel bilgi formu, "Dijital Okuryazarlık Öz Yeterliliği Ölçeği", e "E-öğrenmeye Hazırbulunuşluk Ölçeği", "Öğretmenler İçin Teknoloji Kabul Ölçeği" ve "Uzaktan Eğitime Yönelik Tutum Ölçeği" kullanılmıştır. Araştırmada veri analizi için betimsel istatistikler, ilişkisel örneklemler için t testi, tek faktörlü varyans analizi ve çoklu korelasyon analizinden faydalanılmıştır. Araştırmada ortaokul matematik öğretmenlerinin dijital okuryazarlık öz yeterlik düzeylerinin, e-öğrenmeye hazırbulunuşluk düzeylerinin, teknoloji kabul düzeylerinin yüksek düzeyde ve uzaktan eğitime yönelik tutumlarının orta düzeyde olduğu sonucuna ulaşılmıştır. Ortaokul matematik öğretmenlerinin dijital okuryazarlık öz yeterlikleri ile e-öğrenmeye hazırbulunuşlukları arasında pozitif yönde ve yüksek düzeyde, teknoloji kabul düzeyleri arasında pozitif yönde orta düzeyde, uzaktan eğitime yönelik tutumları arasında ise negatif yönde düşük ilişki olduğu tespit edilmiştir. Ayrıca e-öğrenmeye hazırbulunuşlukları ile teknoloji kabulleri arasında pozitif yönde orta düzeyde ilişki varken uzaktan eğitime yönelik tutumları arasında ise pozitif yönde düşük düzeyde ilişki olduğu belirlenmiştir.

Anahtar kelimeler: Pandemi, Uzaktan Eğitim ve Matematik Öğretmeni

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