Journal of Curriculum Studies Research

https://curriculumstudies.org

E-ISSN: 2690-2788

Volume: 6 Issue: 1 2024

pp. 1-21

The Relationships between Pedagogical and Technological Competence and Digital Literacy Level of Teachers

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Article Info
Received: December 21, 2023
Accepted: January 27, 2024
Published: March 1, 2024

10.46303/jcsr.2024.2

How to cite
Orakova, A., Nametkulova, F., Issayeva, G., Mukhambetzhanova, S., Galimzhanova, M. & Rezuanova, G. (2024). The relationships between pedagogical and technological competence and digital literacy level of teachers. *Journal of Curriculum Studies Research*, *6*(1), 1-21. https://doi.org/10.46303/jcsr.2024.2

ABSTRACT
With the use of technology in education, the integration of digital literacy and technological skills with pedagogy has become one of the important competencies that teachers need to master. Thus, the study investigated the digital literacy, technological and pedagogical competencies of primary school teachers in Kazakhstan on a relational basis. The study was conducted with 223 primary school teachers working in various schools in Almaty. 'Digital Literacy Scale', 'Pedagogical Competence Scale' and 'Technological Competence Scale' were used to collect the data. T and F tests were used to compare school teachers' digital literacy, pedagogical and technological competencies based on gender and professional seniority. 'Multiple Regression Technique' was used to analyze the relationships between the variables of school teachers' digital literacy, pedagogical and technological competencies. The findings revealed that the pedagogical competencies of primary school teachers were high, while their digital literacy and technological competencies were at a moderate level. Pedagogical and technological efficacy and digital literacy of primary school teachers differed significantly based on gender and professional seniority. Male primary school teachers had high levels of technological competence and digital literacy, whereas female primary school teachers had high levels of pedagogical competence. Multiple regression analysis indicated that teachers' digital literacy significantly predicted their pedagogical and technological competencies.

KEYWORDS
Pedagogical competence; technological competence; digital literacy; primary school; teachers.

INTRODUCTION

The use of technology in education has led to a diversification of the skills that teachers are required to possess. According to Ball & Cohen (1999), educators' perspectives on knowledge and learning have evolved significantly over the last few decades, and as a result, they now hold quite divergent opinions on what should be taught in the classroom and how teachers should instruct students. What knowledge is necessary for the best teaching practices for educators, researchers, and teachers? Therefore, in addition to possessing fundamental knowledge and abilities linked to the teaching profession, instructors are required to be proficient in the appropriate use of technology in the classroom (Herro et al., 2021; Sa'ari et al., 2005; Tondeur et al., 2017). Identifying competencies in the integration of technology into education offers indicators for the effective implementation of professional development procedures for teachers. Mishra and Koehler (2008) argued that the core elements of effective technology-based instruction are content, pedagogy, and technological expertise, and that the interplay among these three elements is of equal significance. The three fundamental elements came together to form Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). Furthermore, these notions came together and interacted to form the notion of TPACK. According to Borko et al. (2009), TPACK is the conception of the knowledge that educators need to incorporate technology into their classes to enhance student learning. According to Wang (2016), TPACK is the capacity of educators to use technology to effectively integrate it into their pedagogical and content knowledge, as well as their intuitive grasp of the subject matter through the use of relevant technologies and pedagogical approaches. Teachers' technological and instructional skills are highlighted in this setting.

According to Záhorcová et al. (2012), competency is often defined as a set of knowledge, abilities, and experience that may be used to meet future demands. Extending the notion of teacher effectiveness, it describes some particular attributes that educators have in order to meet their high professional demands. The majority of research on the instructional components of teachers' efficacy has been on teachers' knowledge (e.g. pedagogical competence, pedagogical content knowledge and technological pedagogical competences) (Mansour, 2009; Zee & Koomen, 2016). Studies have also shown that in order to assist students in learning and applying the knowledge they have acquired, teachers must successfully oversee the teaching process; as a result, teachers must enhance their competencies in accordance with educational activities in the classroom. Such reasoning suggests that enhancing students' success may be greatly influenced by teachers' general and pedagogical competence (García-Martínez et al., 2019; Prasertcharoensuk et al., 2015). Academic accomplishment of students and the pedagogical competence of teachers are significantly correlated (Keller, Neumann & Fischer, 2017; Sadler et al., 2013).

Pedagogy can be defined as a branch of science that binds educational processes to rules and enables teachers to perform their profession by adhering to these rules and provides

teachers with the necessary competencies to ensure this performance (Jay, 2023). According to Ewing (2005), pedagogy is the work of reconciling and integrating the activities of the teacher with the interaction of the learner, curricula and teaching sets, future and tradition, and the discourses of school administrators and education policy makers. Pedagogical competence is the teacher's knowledge of teaching approaches and the most appropriate teaching strategies to teach the subject matter to be taught. Pedagogical competence includes the competencies in making the methods, techniques and teaching process used in teaching the subject effectively (Barnett & Hodson, 2001; Wang, 2016). Pedagogical competence is teachers' competencies about teaching and learning methods, practices, and processes. This form of competence requires understanding and practicing how students learn, general classroom management skills, lesson planning and student assessment. It covers methods and techniques used in the classroom, strategies for assessing the nature of the target audience and student understanding. A teacher with strong pedagogical competence is aware of how pupils construct knowledge, acquire skills, form mental habits, and develop a positive attitude toward learning. Additionally, it makes the required adjustments. Thus, knowledge of cognitive, social, and developmental theories of learning and how to apply them to students in the classroom is necessary for pedagogical competence. (Koehler & Mishra, 2009; Twiselton, 2004). Putnam and Borko (2000) assert that educators are become increasingly removed from their research and instructional activities. Financial challenges and the social environment are regarded as some of the factors. One of the approaches that will help teachers to improve their learning practices is to establish a relationship between the methods they use in the classroom and the social environment in which the school is located. As teachers carry out their educational activities, they consider a wide range of issues, including classroom dynamics, the physical layout of the classroom, and classroom management techniques. Thus, it is thought that teachers with strong pedagogical competence will be effective in learning-teaching processes (Masrur, 2021).

Teachers' technological competencies in the teaching-learning process refer to their competencies in various technologies ranging from low technology such as pen and paper to digital technology such as the Internet, digital video, interactive whiteboards, and software programs (Schmidt et al., 2009; Ventayen, 2019). Teachers need to be able to realize not only the subject they teach but also the goal-behaviors of their teaching by using technology effectively. Teachers' acceptance and adaption of technology into their courses is assumed to be influenced by a variety of characteristics, including their professional self-efficacy, age, education, and perception of the technology. In this regard, several studies have investigated how useful instructors' technical skills are for their own learning, planning lessons, and engaging in classroom activities (Foulger et al., 2017; Judson, 2006, Norris et al., 2003; Sugar et al., Fine, 2004; Zhu et al., 2013). According to McManis and Gunnewig (2012), in general, teachers try to show students when they use technology or try to ensure that they use technology in turn. However, teachers should also tend to interact with students in order to support their positive approach to learning and increase their knowledge. To do this, they need to be competent in

educational technology. According to this viewpoint, teachers' technical abilities include skills like putting technology to use, active engagement, group participation, interaction, feedback, and connecting technology to the real world—in other words, guiding learners how to utilize technology (Guzman & Nussbaum, 2009; Parrish & Sadera, 2019).

With the use of technology in education, digital competence has become one of the important competencies that teachers need to master (Mathews, 2016; Moyo et al., 2022, Zhao et al., 2021). Teachers' digital competence refers to a set of skills that enable them to effectively use a variety of appropriate technologies to optimize the teaching process (Chadegani et al., 2013). However, in the realization of technology and digital competence, teachers are primarily expected to have digital literacy (Hutchison & Woodward, 2018; Zang, 2023). Digital literacy can lead to teachers' professional development and empowerment, improve the quality of their education, and thus lead to confidence and mastery in using these technologies (Hamakali & Josua, 2023; Pérez-Escoda et al., 2019).

Gilster (1997), who first used the concept of digital literacy, defined it as the ability to make sense of the information obtained, to evaluate it in the many dimensions offered by the computer, and to combine new information with previous knowledge. Martin (2006) explains the concept of digital literacy as the ability of individuals to recognize, access, use, combine, evaluate, analyze and synthesize digital materials and to access new information by using technological tools. Technology use competencies in education contribute to the healthy integration of technology into education and the sustainability of this process (Burnett, 2011; Li & Yu, 2022; Pianfetti, 2001).

The idea of digital literacy and the concept of digital competence are employed interchangeably in research, as demonstrated by the literature (Mujtahid et al., 2021). Although they have the same meaning, the use of these concepts interchangeably is due to the semantic differences between languages. As a matter of fact, according to Godhe (2019), although the digital literacy is used quite frequently in English-speaking societies, it cannot be easily translated into Spanish, Italian and Scandinavian languages. Instead, concepts such as digital competence or digital competency are preferred in these languages. Although languages are differentiated through cultures, digital literacy or digital competence can equip individuals with certain skills (Aslan, 2016; Falloon, 2020). In the current educational environment, the mission of teachers is to support students to master the knowledge and skills required in the twenty-first century. Moreover, digital literacy is recognized as an important factor in learning as well as one of the core competencies (Farihin, 2022; Japar, et al. 2023; Knutsson et al., 2012)

Digitalized education has had a significant impact on the way the materials used in the teaching of courses in classrooms and teaching methods. This effect in the classrooms has also had significant effects on teachers with the developing technology (Sahoo & Rana, 2023; Timotheou et al., 2023; Waters & Russell, 2016). Educators have had to change their traditional teaching methods in order to use digital technology techniques as course materials (Greenhow

et al., 2016). In addition, educators have started to use social media platforms to communicate with each other and share ideas (Mujtahid et al., 2021).

Research shows that both online applications used in the learning process and students' active use of digital devices and the internet have a positive impact on the quality of learning (Araniri, Nahriyah, Jamaludin, & Jatisunda, 2021; Kailani, Susilana, & Rusman, 2021). Digital literacy specifically supports educators and students' ability to teach and learn effectively in digital environments (Atmazaki & Indriyani, 2019; Kilinc et al., 2023). Thus, teachers need to have digital literacy skills in order to provide students with rich and diverse learning experiences by using digital resources and tools effectively. By developing digital literacy skills, teachers can support their career advancement and professional development. These skills can make them more competitive and versatile educators. In conclusion, understanding teachers' digital literacy levels and pedagogical-technological abilities are critical for them to grow professionally, succeed in the modern classroom, and provide learners a better education.

One of the reasons why teachers have some reservations about technology may be the barriers to the integration of information technologies into the classroom environment (Blackwell et al., 2013). In the literature, some of the obstacles in the process of integrating information technologies into the classroom environment are teachers' negative beliefs and attitudes towards information technologies, teachers' insufficient knowledge and skills in information technologies, and teachers' lack of adequate training in information technologies (Fenty et al., 2014; Lindahl & Folkesson, 2012; Parette et al., 2013; Wood et al., 2008). 21st century teachers are expected to use the possibilities of information technologies effectively, appropriately, creatively and ethically without encountering any obstacles (Kuhlthau et al., 2015; Willermark, 2021). Therefore, today's teachers need to have a certain level of digital literacy and digital literacy skills (Admiraal et al., 2016; Borthwick & Hansen, 2017).

When a teacher wants to demonstrate his/her knowledge and beliefs, he/she does so through actions (van Aalderen-Smeets et al., 2012). A person's skills form an integrated structure and determine the tendency to behave in a certain way, in other words, attitudes. The development of teachers' self-efficacy can positively affect their attitudes towards technology (Yeşilyurt et al., 2016). In addition, these competencies should be sought especially in teachers who are responsible for raising new individuals. It is not enough for teachers to adapt to this change in their daily lives. They also need to successfully integrate this adaptation into education. Thanks to this competency, it is thought that teachers will be able to use technology more efficiently in education and training instead of having problems in the process of integration of technology into education. As can be understood from the competencies mentioned above, teachers are not only technologically literate but also responsible for the effective use of technology in education. Teachers should question the accuracy and appropriateness of the resources they use while utilizing this technology. Teachers need to make use of technology from the methods they apply during teaching and learning, the materials, to the assessment of students. According to Raja and Nagasubmarani (2018),

computers, projections, cameras, 3D modeling, educational software and power point presentations provided by technological developments are not only a good resource for teachers but also help students grasp a concept easily. Therefore, it has become one of the responsibilities of teachers to follow the developments in this field constantly, improve themselves in this field and transfer their competencies in this field to the educational environment. Teachers possess the necessary skills when looking at the studies on digital literacy, pedagogical competences, and technological pedagogical content knowledge independently (Alkış Küçükaydın, 2022; Azgın & Şenler, 2018; Rizal et al., 2018; Tomczyk, 2019). However, the literature shows that the number of studies on teachers' digital literacy, pedagogical and technological competencies with a holistic approach is quite limited. This study differs from other studies in this respect and aims to fill this gap in the literature. Thus, the study is expected to contribute to the related literature. Answers to the following questions were sought in the study:

- What is the level of primary school teachers' digital literacy, pedagogical and technological competencies?
- Do primary school teachers' digital literacy, pedagogical and technological competencies differ by gender and professional seniority?
- What is the relationship between primary school teachers' digital literacy, pedagogical and technological competencies?

METHOD

The research design is correlational survey method within the framework of quantitative research paradigm. In this context, in the first stage, digital literacy and pedagogical and technological competence levels of teachers were examined with the survey model. In the survey design, the phenomenon, factor or characteristics focused on are described in a natural and non-intervened framework. The correlational survey model is a survey technique that aims to determine the existence of a common change between two or more variables. In the correlational survey model, it is aimed to determine whether the variables change together and if they do, how they change. In general, survey models enable to determine the current situation of the group from the individuals within the selected group and to collect information about their opinions, competencies, and attitudes. "Simple cluster sampling" method, one of the selective sampling methods, was used as the sampling method.

Probability-based sampling method was used for quantitative research. The sample of the study was selected according to the cluster sampling method among the teachers working in public primary schools in Almaty city center of Kazakhstan. The criterion taken as a basis in determining the participants was that the teachers were working in public schools. Therefore, 10 schools were identified in the city center and teachers working at the primary school level in these schools were included in the study. The study's data collection instruments were applied to 223 instructors as part of its scope. Of these, 133 were female and 90 were male.

Data Collection Tools

The survey was conducted online due to transportation and time constraints. Three scales were used in addition to questions about demographic information. The following scales, which have demonstrated validity and reliability in Kazakhstan, were used to gather the data. In the demographic section, teachers were asked in multiple-choice form in terms of gender, age, professional seniority, digital media use, duration, and the frequency of internet use.

Pedagogical Competence Scale

The studies of Shulman (1986) and Mishra and Kohler (2006) were utilized to develop the pedagogical competence scale. These sources were used to construct an item pool of 20 items. To gain a clear understanding of each item's position in the item pool across all the previously mentioned sources, special tables were prepared, and horizontal and vertical readings were made. The developed item pool was shared with teachers from the field of educational sciences with different levels of experience and 5 expert opinions were obtained. The final scale was reexamined by two field experts after modifications were made in accordance with the advice of these five experts, and after duplicate and inclusive items were removed from the pool that an assessment and evaluation expert had reviewed. The expert opinions were evaluated by comparing them with each other. Another purpose of this comparison to ensure content validity was to ensure that the pedagogical competencies in question could be rephrased in a field-specific manner in line with the sources and to do so in scientific consistency. In order to eliminate the risk of bias in the research, dimensions were hidden and competencies that were not related to pedagogy were eliminated and reduced to 15 items in the scale, which was organized in accordance with the battery type with the opinion of the assessment and evaluation expert. Before piloting, the draft scale was read and applied to 2 Kazakh literature teachers/instructors to evaluate the comprehensibility and functionality of the items. Items that were not understood or misunderstood were reorganized. During the pre-testing process, it was determined that the participants answered the 15 items in 4-5 minutes on average. Thus, care was taken to organize the time component in a way that would not negatively affect the internal reliability. Since the developed scale is an efficacy scale, all of the items were prepared in positive sentence structure and no negative structure was included. Due to time constraints, the scale was made suitable for implementation via digital platforms and transferred to Google Form. Google Form was chosen as the digital intermediary component because it was likely to have been used by the participants before due to its widespread use and the form facilitated the analysis process by giving a 5-point Likert-type measurement.

In the literature on research methods, there is a common view that the size of the study group in quantitative studies should be 5-10 times the number of items (Desu, 2012). According to this view, it was decided that the size of the study group was sufficient for Exploratory Factor Analysis, considering the narrowness of the population compared to other disciplines, since data were collected from 218 participants, and the analysis phase started. Before the factor analysis of the scale, the KMO and Barlett Sphericity Test was performed to determine the suitability of

the data for factor analysis. According to Pallant (2011), KMO value should be greater than 0.6 for factor analysis. As a result of the analysis, the KMO value of the scale was found as 0.945. This value shows that the collected data is suitable for factor analysis. Barlett Sphericity Technique was used to test for normal distribution. This test yielded a significant chi-square test value, suggesting that the data are drawn from a multivariate normal distribution. As a result of the analysis of the scale applied to the sample, it was concluded that Barlett's Test for the scale was significant (p=.0.00). According to the findings of the scale, the data are suitable for factor analysis. After determining the suitability for factor analysis, the process of collecting and processing the data continued. After determining the suitability of the scale data for factor analysis, the variance explained by the items of the scale formed in a single dimension was 55.96%. The factor loadings of the items ranged between .39 and .81. The Cronbach Alpha reliability coefficient of the scale was .93.

Technological Competence Scale

In the study, the “Technology Proficiency Self-Assessment” developed by Ropp (1999) and adapted into Kazakh by the researchers was used to measure teachers' self-efficacy perceptions of technology. The scale has 20 items in the form of a six-point Likert-type scale. The rating options for the scale items are expressed as "strongly disagree = 1" and "strongly agree = 6". There are no reverse-scored items in the scale and a unidimensional structure was obtained as a result of the factor analysis performed on the Kazakh form of the scale. High scores obtained from each factor indicate high self-efficacy in that dimension. According to the validity and reliability studies conducted by Ropp (1999), Cronbach's Alpha coefficient for all items in the scale was .95. The Cronbach's Alpha coefficient of the items in the Kazakh form of the scale was .92.

Digital Literacy Scale

The adaptation of the 17-item "Digital Literacy Scale" developed by Ng (2012) into Kazakh was carried out by the researchers. The original version of the scale has a 4-factor structure and consists of attitudinal, technical, cognitive and social dimensions. In the scale, which uses a 5-point Likert-type rating as Strongly Agree (5), Strongly Disagree (1), there are no reverse-scored items. Higher scores on the 'Digital Literacy Scale' indicate higher digital literacy. The Cronbach Alpha internal consistency coefficient of the scale was 0.89. The lowest Cronbach Alpha coefficient in the four sub-dimensions of the scale was 0.76, indicating that the scale is highly reliable.

Data Analysis

The data obtained from the scale used in the study were analyzed using IBM SPSS 27.0 and AMOS 24.0 package programs. In the first stage of the questionnaire, frequency and percentage distributions of demographic and general information are presented. In addition, the percentage and frequency distributions of the scale responses and the mean response and standard deviation are also presented. In the second stage, exploratory factor analysis (EFA) was applied to the scales used in the study. Confirmatory factor analysis (CFA) was also applied for

the construct validity of the scale. The methods to be used in the analyses are determined according to whether the distribution is normal or not. Therefore, Kolmogorov-Simirnov and Shapiro-Wilk normality tests were applied to the scale dimensions. Since the data followed normal distribution, unpaired sample t-tests were conducted for each paired group and ANOVA-F tests were conducted for groups of three or more. Shceffe's test was used to determine the source of the differences between the groups. Multiple Regression analysis was used to test the relationship between the scales.

FINDINGS

In this section, in accordance with the general purpose of the study, the findings obtained by comparing the scores obtained by teachers from pedagogical and technological competence and digital literacy scales based on the variables of gender and professional seniority are presented. Before the comparisons are made, descriptive information about the scores obtained from the scales is presented.

Table 1.

Descriptive Values of Teachers' Scores from the Pedagogical Competence, Digital Literacy and Technological Competence Scales

	N	Minimum	Maximum	Mean	Std. Deviation
Pedagogical Competence	223	1.00	5.00	3.79	0.92
Digital Literacy	223	1.00	5.00	3.36	1.00
Technological Competence	223	1.00	5.00	3.20	1.02

The table displays that the pedagogical competence scores ranged between 1.00 and 5.00 and the mean pedagogical competence score was 3.79±0.92. According to the mean values obtained, it is understood that the participant teachers in the research sample had a high level of pedagogical competence.

The table also shows that the digital literacy scores ranged between 1.00 and 5.00 and the mean digital literacy score was 3.36±1.00. According to the mean values obtained, the digital literacy of the participant teachers in the research sample was at a moderate level.

In addition, the technological competence scores ranged between 1.00 and 5.00 and the mean digital literacy score was 3.20±1.02. According to the mean values obtained, the technological competencies of the participant teachers were at a moderate level.

Table 2.

Comparison of the Scores Obtained from the Pedagogical Competence Scale by Gender

	Gender	N	Mean	Std. Deviation	t	p
Pedagogical Competence	Female	133	3.91	0.85	2.370	0.019
	Male	90	3.61	0.99		

According to the table, a significant difference was found in teachers' pedagogical competence scores based on gender variable ($p<0.05$). Female teachers included in the study had significantly higher pedagogical efficacy scores compared to their male colleagues.

Table 3.

Comparison of the Scores Obtained from the Digital Literacy Scale by Gender

	Gender	N	Mean	Std. Deviation	t	p
Digital Literacy	Female	133	3.21	0.92	-2.894	0.004
	Male	90	3.59	1.07		

According to the table, a significant difference was found in the digital literacy scores of teachers based on gender variable ($p<0.05$). Male teachers included in the study had significantly higher digital literacy scores compared to their female colleagues.

Table 4.

Comparison of the Scores Obtained from the Technological Competence Scale by Gender

	Gender	N	Mean	Std. Deviation	t	p
Technological Competence	Female	133	3.09	1.03	-1.943	0.048
	Male	90	3.35	1.00		

When the table is analyzed, a significant difference was found in the technological competence scores of teachers based on the variable of gender ($p<0.05$). Male teachers included in the study had significantly higher pedagogical competence scores compared to their female colleagues.

When the table (Table 5) is analyzed, there was a significant difference in the pedagogical competence scores of the teachers based on the variable of professional seniority ($p<0.05$). According to the Scheffe test results, the mean pedagogical efficacy scores of teachers with 20 years or more of service were significantly higher than the mean scores of their colleagues with 19 years or less.

Table 5.

Comparison of the Scores Obtained from the Pedagogical Competence Scale by Professional Seniority

	Years of Profession	N	Mean	Std. Deviation	F	p
Pedagogical Competence	0-9 years	53	3.18	0.93	29.421	<0.001
	10-19 years	84	3.68	0.69		
	20 years or more	86	4.26	0.86		
	Total	223	3.79	0.92		

Table 6.

Comparison of the Scores Obtained from the Digital Literacy Scale by Professional Seniority

	Years of Profession	N	Mean	Std. Deviation	F	p
Digital Literacy	0-9 years	53	3.55	0.96	1.187	0.307
	10-19 years	84	3.31	0.78		
	20 years or more	86	3.30	1.19		
	Total	223	3.36	1.00		

When the table is examined, there was a significant difference in the digital literacy scores of teachers based on the variable of professional seniority ($p<0.05$). According to the Scheffe test results, the mean digital literacy scores of teachers with 9 years or less working time were significantly higher than the mean scores of their colleagues with 10 years or more.

Table 7.

Comparison of the Scores Obtained from the Technological Competence Scale by Professional Seniority

	Years of Profession	N	Mean	Std. Deviation	F	p
Technological Competence	0-9 years	53	3.51	0.96	3.950	0.021
	10-19 years	84	3.19	0.71		
	20 years or more	86	3.02	1.25		
	Total	223	3.20	1.02		

When the table is analyzed, there was a significant difference in the technology efficacy scores of teachers based on the variable of professional seniority ($p<0.05$). According to the Scheffe test results, the mean technology efficacy scores of teachers with 9 years or less working time were significantly higher than the mean scores of their colleagues with 10 years or more working time.

When Table 8 is examined, it is understood that the regression model developed to determine the effect of digital literacy on technological competence was statistically significant

(R=0.81; F=332.16; p<0.01). Approximately 66% of the change in teachers' technological efficacy was explained by their digital literacy. Digital literacy had a positive and high effect on teachers' technological competence (β=0.83; p<0.01).

Table 8.

Regression Analysis Results to Determine the Effect of Digital Literacy on Technological Competence

	Unstandardized Coefficients		Standardized Coefficients		
Variable	β	Std. Error	β	t	Sig.
(Constant)	0.402	0.141		2.856	0.005
Digital Literacy	0.831	0.040	0.812	20.704	<0.001
Dependent Variable= Technological Competence; R=0.81; R^2=0.66; F= 332.16					

Table 9.

Regression Analysis Results to Determine the Effect of Digital Literacy and Technological Competence on Pedagogical Competence

	Unstandardized Coefficients		Standardized Coefficients		
Variables	β	Std. Error	B	t	P
(Constant)	3.181	0.216		14.713	<0.001
Technological Competence	0.105	0.101	0.116	1.033	0.303
Digital Literacy	0.280	0.104	0.305	2.702	0.007
Dependent Variable: Pedagogical Competence; R= 0.221; R^2= 0.049; F= 5.635; p<0.05					

When the table is examined, it is understood that the regression model developed to determine the effect of digital literacy and technological competence on pedagogical competence was statistically significant (R=0.22; F=5.64; p<0.05). Approximately 4.9% of the change in teachers' pedagogical efficacy was explained by their digital literacy and technological efficacy. According to the Beta analysis, only digital literacy had a significant and positive effect on teachers' pedagogical competencies (β=0.28; p<0.01).

DISCUSSION

Teachers need to have pedagogical and technological competencies to respond to the learning needs of learners in the digital age and to increase the level of learnability. Therefore, in this study, pedagogical and technological competencies and digital literacy of primary school teachers were examined based on some variables. The research findings showed that primary school teachers had a high level of pedagogical competencies. In addition, the pedagogical

competencies of the participant teachers showed differences based on gender and professional seniority. It was found that female teachers and participants with longer work experience had high pedagogical competencies. These findings are similar to the findings of Colodarci (1992), Hosseini and Kamal (2012), Lin, Tsai, Chai, and Lee (2013), and Mahmudoğlu (2019). In Mahmutoğlu's (2019) study, female teachers were found to have stronger pedagogical competencies and more effective interactions with their students. Coladarci (1992) stated that female teachers are more committed to their profession than male teachers and it affects their pedagogical competencies. On the other hand, teachers' length of experience in their profession is also an important factor in their pedagogical efficacy. As a matter of fact, Cheung (2008) and Daughetry (2005) argued that teachers' professional seniority is an important factor in their competence and confidence in the learning-teaching process. According to the findings of this study, it was found that teachers' pedagogical competencies increased as their professional seniority increased.

Sub-problems of the study were “What is the level of digital literacy and technological competencies of primary school teachers?” and “Do digital literacy and technological competencies show differences based on gender and seniority in the profession?” Answers to these questions were sought. According to the research findings, primary school teachers' digital literacy and technological competencies were at a moderate level. Previous studies have shown that teachers generally do not have sufficient digital literacy (Sun et al., 2016). There are also research findings that educators' data literacy has improved significantly in recent years (Kippers et al., 2018). Participants' digital literacy and technological competencies differed based on gender and professional seniority. Male teachers had higher digital literacy and technological competencies than their female colleagues. Lin, Tsai, Chai, and Lee (2013) reported that male pre-service teachers had better technological competencies than female pre-service teachers. Studies showing that gender differences in technology use and related skills persist support the research results in this regard (Colley & Comber, 2003; Li & Kirkup, 2007; Drabowicz, 2014). According to Van Grootel (2018) and colleagues (2018), the difference in the use of digital technologies between genders corresponds to gender stereotypes that portray boys as autonomous. In this context, males are better at independent and technology-related fields, whereas females are better at nurturing, i.e. pedagogical fields. Similarly, specifically, it has been suggested that males may have an advantage over females in the online classroom only because of their higher perceived ability, comfort and interaction with computers (Ashong & Commander, 2012).

In the study, primary school teachers with 9 years or less in the profession had higher digital literacy and technological competencies compared to their colleagues with more professional seniority. Some studies show that age and seniority are significantly and inversely related to digital competencies (Li & Ranieri, 2010; Salajan, Schönwetter, & Cleghorn, 2010). It can be argued that the reason for lower digital competencies is that teachers with more professional seniority and age show resistance to new technologies in education. In contrast to

this situation, the high level of digital literacy and technological competencies of novice teachers may be due to the importance given to technology-related courses in line with the requirements of the age in the curriculum during the pre-service education process. At the same time, it may be based on the fact that teachers with lower professional seniority are characterized as digital natives (Prensky, 2001) who adapt to digital environments more easily and actively use new technologies. In addition, it is thought that teachers who are new to the profession have higher self-confidence in digital self-confidence.

One of the research questions addressed in this study is the relationship between primary school teachers' digital literacy, technological and pedagogical competencies. Regression analyses showed that teachers' digital literacy had a very high effect on their technological competencies. On the other hand, digital literacy and technological competence variables together were found to be a significant predictor of pedagogical competence. However, the highest effect on these relationships was shown by whether teachers had digital literacy skills or not. Indeed, Redmond & Lock (2019) argue that "*designing and facilitating robust learning in technology-enhanced environments is complex and challenging if one does not possess the relevant skills*". An important finding from the literature was that teachers who lack digital literacy skills face challenges and problems when using TPACK and SAMR models. Similarly, Drugova et al. (2021) in Russia found that inadequate digital skills lead to disadvantages in the use of technologies and associated pedagogical skills for teacher users. Similar findings were obtained in studies conducted in a similar context (Redmond & Lock, 2019, Voithofer & Nelson, 2021).

In conclusion, with the implementation of digital technology in the education system, the use of digital technology in the teaching process has created higher requirements for teachers' digital literacy, pedagogical and technological competencies. Accordingly, teachers' knowledge and skills should be developed and teachers should improve their ability to use technology effectively in their teaching. As with any research, the present study has limitations in addition to its results. The first one is that the sample of the study was selected by convenient sampling method in a single city in Kazakhstan and the generalizability of the findings is low due to its relatively small size. As a matter of fact, it should not be ignored that the participants' digital literacy, technological and pedagogical competencies may be affected by individual and environmental factors. Therefore, a similar study can be repeated on a larger sample group including different regions and schools in the future. In addition to teachers, including academics, pre-service teachers and other educators in the research sample may allow categorical inferences. Second, in the study, digital literacy, technological and pedagogical competencies were addressed based on certain variables at a limited level. In future studies, different variables such as digital literacy, technological and pedagogical competencies, age, type of education and in-service training can be investigated and modeling studies can be conducted.

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