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PAPER

Pedagogical Conditions for the Training of Future Teachers Based on Digital Educational Technologies

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ABSTRACT

This study aimed to assess the pedagogical frameworks for developing future teachers using digital education technology. The mixed-methods design, which combines quantitative and qualitative approaches, was employed to develop this study. Three hundred seventeen teacher candidates who are enrolled at several universities in Kazakhstan make up the research team. The researchers created a semi-structured interview form and an attitude scale toward digital technology in order to gather research data. The data was determined to be regularly distributed. Therefore, descriptive statistics, the T-test, and one-factor analysis of variance (ANOVA) tests were employed to assess them. The descriptive analysis method was applied to study the research's qualitative data. The study's findings showed that most pre-service teachers who took part in it thought that teacher training programs based on digital technology had adequate pedagogical conditions. Based on its results, the study offers recommendations.

KEYWORDS

digital education, pedagogical conditions, teacher candidates, technology

1 INTRODUCTION

The 21st century, which is defined as the age of technology, has brought many requirements for education [1] [2] and required different structuring and reforms in education systems for meaningful and permanent learning [3–5]. The skills of the century we live in differ from the others in that they present a much more complex structure than the skills of the past centuries [6]. The reason for this complexity is the rapid changes and habits that occur with digitalization [7]. In this respect, it can be said that today's students are fundamentally different from the students of the past and have different learning needs and styles [8]. Pre-service teachers and teachers in general have a great role in raising future generations with competencies related to digital technologies [9] [10].

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1.1 Theoretical and conceptual framework

Teacher education refers to professional education aimed at reaching the desired attitudes, skills, and knowledge to ensure that teachers are efficient and effective in their work to meet the needs of a particular society at any given time [11] [12]. The quality of education and training is related to the competencies teachers have. How to give teachers these competencies is one of the main issues in education [13].

Shulman [14] states that in his work on teachers' knowledge and skills, pedagogical knowledge is neglected, content knowledge is emphasized, and content knowledge is focused on. With the new developments in technology becoming usable in education, the understanding of teacher competence has been replaced. He created the idea of "pedagogical content knowledge" by combining content knowledge and pedagogical knowledge. On the other side, Koehler and Mishra [15] expanded Shulman's [14] definition of "pedagogical content knowledge" to include the "technology" dimension. They introduced the idea of technological pedagogical content knowledge to the literature.

Currently, instead of programs where technical knowledge is limited to technology courses, approaches that will support technology knowledge together with field knowledge and field-specific pedagogical method knowledge are suggested [16–18]. It is very important for teachers to keep up with these changes in technology and to use technology appropriately in educational processes [19] [20]. This situation gains importance in terms of teachers gaining experience with educational technologies while they are still teacher candidates and incorporating technology appropriate for the learning outcome and content into the education process [21].

The inclusion of technology in the teaching process makes pre-service teachers more confident in using technology. This is also effective in making students aware of new technologies, developing their ability to use them by including them in the education process, and gaining experience with students' teaching needs. Considering that teaching is a professional field that requires special expertise, academic study, professional formation, and technology skills, new teachers need to be more self-sacrificing in this regard. It is thought that teachers' use of technological tools will contribute positively to the education system [22].

For 21st-century teachers to raise qualified individuals in the future, they should also have digital competencies in parallel with their technological pedagogical content knowledge [23]. Teachers are expected to have digital competencies to integrate technology into education. Digital technologies are applications that display, store, and transmit information electronically on screens. Digital technologies play a very important role in education [24] [25]. Almost every country in the world has started to develop education policies to increase and support the use of digital technologies [26].

Digital competence is the combination of knowledge, abilities, and attitudes that a person uses to access, comprehend, and use information in a variety of digital environments [27]. Although digital competence is a new concept today, the tradition that we will entrust our future to is described as a basic competence for generations [28]. In this context, there are some basic skills that teachers should have discussed within the framework of technological pedagogical content knowledge since they need to choose and use technology to support students' learning

and follow technological developments closely [29–31]. In this direction, teachers should be able to use technological hardware and software while performing basic operations such as document creation, editing, and sharing, as well as closely following technological developments and integrating technology into the learning environment to contribute to the learning of their students [32]. Teacher education programs play an important role in the formation of the knowledge necessary for pre-service teachers to integrate technology into their teaching skills and have digital competencies [33].

1.2 Related research

Profit [34] evaluated the use of digital technology in higher education classrooms in his doctoral thesis. He emphasized that with the support of the management, teachers and students can use digital technology in the classroom through mobile devices, which is an endless educational tool. In his research, Ally [35] aimed to create the competence profile of digital and online teachers in future education. As a result of the findings, it was argued that the role of the teacher changed as a result of the development of technology, and in this sense, the qualifications should also change.

König et al. [36], with the participation of 89 pre-service teachers in Cologne, Germany, during the COVID-19 epidemic in May and June 2020, learned about information and communication technologies (ICT) tools, especially digital teacher competence and digital competence. It was concluded that teacher training opportunities were effective in adapting to online teaching during school closures as part of COVID-19 measures. Walan [37], in his study, conducted research using the Technological Pedagogical Content Knowledge Model with science teachers. As a result of the research, it has been revealed that science teachers are confident in using digital technology, benefiting from digital materials, and using them when necessary.

Coles et al. [38] investigated the current digital technology use of higher education teachers according to their perceptions of importance, ability, and motivation. According to the research, their competence in digital technology in terms of learning and their importance to digital technology were found to be high. In Garzon Artacho et al. [39], 142 teachers from different schools participated in the study conducted in Spain to evaluate the development of the digital competence of teachers during the lifelong learning phase. According to the research findings, it was stated that there is a lack of teachers in the creation of digital content, and as a result, the development of teachers' digital competence is an important element of the education system.

Spiteri and Rundgren [40], in their study, in line with their interviews with teachers, found that although all teachers use digital technologies, not all of them use them to produce content and information. Instefjord and Munthe [41] focused on the integration of professional digital competence into teacher education programs. They conducted a survey among teacher educators, guidance counselors, and teacher candidates in Norway. In the study, it was concluded that there were weak positive correlations between positive management, management development support, and the digital competence of teacher educators, but strong positive correlations between the digital competencies of teacher educators.

1.3 Purpose of the research

The purpose of this research was to evaluate the pedagogical conditions for training future teachers based on digital education technologies. For this purpose, answers to the following research questions were sought:

1. What are the attitudes of teacher candidates towards digital technologies?
2. Do pre-service teachers' attitudes towards digital technologies differ according to gender?
3. Do pre-service teachers' attitudes towards their digital competencies differ according to the class variable they are studying?
4. Do pre-service teachers' attitudes towards their digital competencies differ according to the variables of their education?
5. How do teacher candidates evaluate the pedagogical conditions of teacher training programs based on digital technologies?
6. How do pre-service teachers evaluate the obstacles to the development of pedagogical conditions for teacher training programs based on digital technologies?
7. What are the suggestions of pre-service teachers to improve the pedagogical conditions of teacher training programs based on digital technologies?

2 METHODOLOGY

Details on the research methodology are provided in this section of the study. These included information regarding the research's sample population, the data gathering methods, the development of the data collection methods, the data collection process, the research's ethical principles, and the data evaluation.

2.1 Research method

This research was created using a mixed-methods design. In the design, it is envisaged that methods and techniques based on qualitative and quantitative approaches will be used together with a holistic approach. It can be said that the mixed-method design is holistic due to the comprehensiveness of its inclusion of both methodologies and the elaboration of the process by the design. Accordingly, a scale measuring attitudes toward digital technology was designed for this study's quantitative data collection, and a semi-structured interview form was developed for its qualitative data collection. After combining the results, significant findings were acquired and given to the reader.

2.2 Participants

A total of 317 teacher candidates enrolled in various universities across Kazakhstan make up the sample group for the quantitative portion of the study. Teacher candidates are enrolled in classes during the spring semester of the school year 2022–2023. Twenty randomly chosen teacher candidates from the 317 teacher candidates who participated in the research made up the sample group for the qualitative portion of the study. Table 1 lists the demographic details of the teacher candidates who participated in the study.

Table 1. Demographic characteristics of teacher candidates

	F	%
Gender		
Female	161	50.8
Male	156	49.2
Total	317	100
Class		
1. Class	88	27.8
2. Class	75	23.6
3. Class	72	22.7
4. Class	82	25.9
Total	317	100
Section		
Primary school teaching	65	20.5
Math teaching	61	19.3
Biology Teaching	72	22.7
Geography Teaching	59	18.6
Pre-school teaching	60	18.9
Total	317	100

In Table 1, the gender, class, and division distribution of the pre-service teachers participating in the research are given. 50.8% of the teacher candidates are girls, and 49.2% are boys. 27.8% of the teacher candidates are studying in the 1st grade, 23.6% in the 2nd grade, 22.7% in the 3rd grade, and 25.9% in the 4th grade. In addition, 20.5% of the pre-service teachers are primary school teachers, 19.3% are mathematics teachers, 22.7% are biology teachers, 18.6% are geography teachers, and 18.9% are preschool teachers.

2.3 Data collection tools

To collect research data, the researchers developed an attitude scale toward digital technologies and a semi-structured interview form.

Attitude scale towards digital technologies. The steps followed in the development of the Attitude Scale towards Digital Technologies and the process of creating the scale are given below.

1. Creating an item pool: An item pool consisting of 32 items was created by performing a literature review on the use of digital technologies in education and in line with the opinions of two academicians who have worked in this field.
2. Obtaining expert opinion for scope and face validity: Seven experts were asked to weigh in on the items in the item pool to determine whether they were appropriate for the research's scope. An expert evaluation form was created for each item, consisting of appropriate, corrected, unsuitable, and recommendation

options. Experts marked the options opposite the items according to their opinions and presented their suggestions. Corrections, subtractions, and additions were made according to the feedback from the experts. In addition, the items were presented for the opinions of two language experts in terms of grammar and spelling, and necessary corrections were made. Finally, a draft scale of 16 items was created.

3. Preliminary trial practice: The trial practice was carried out with 266 teacher candidates studying at the education faculties of various universities in Kazakhstan in the spring semester of the 2022–2023 academic year. Of the pre-service teachers who participated in the trial application of the research, 159 were girls and 107 were boys.
4. Exploratory factor analysis: First of all, the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett Test of Sphericity findings were examined to examine the suitability of the data for factor analysis. An analysis of the KMO coefficient and the Bartlett Test of Sphericity was examined. The KMO value on the scale was 0.906, and the Bartlett Test of Sphericity value was found to be significant. In this direction, exploratory factor analysis was performed on the data obtained from the draft scale, which consisted of 16 items. Using the statistical application SPSS 25.0, exploratory factor analysis was carried out. At this stage, item analysis was carried out. The item-total correlation method was chosen for item analysis. When the application results are examined, it is seen that the item correlations of the 16-item scale vary between 0.48 and 0.69. Experts state that items with an item-total correlation of 0.30 and higher have a good discrimination feature. It is possible to say that the one-dimensional structure of the scale developed in this direction is capable of measuring the intended feature and is capable of serving this purpose.
5. Confirmatory factor analysis: The suitability of the model for the factor structure revealed through exploratory factor analysis was tested using confirmatory factor analysis. The suitability of the resulting model, Chi-square/Degree of Freedom (x^2/df), Root Mean Square Error Approximation (RMSEA), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), and Tested with Adjusted Goodness of Fit Index (AGFI) fit criteria. As a result of the analysis, regarding the suitability of the model; χ^2/sd 1.965, RMSEA = 0.051, NFI = 0.95, NNFI = 0.94, IFI 0.903, CFI = 0.971, and AGFI = 0.988. These findings show that the model has a good fit. As a result, it was determined that the fit indices obtained as a result of confirmatory factor analysis and the structure in exploratory factor analysis were confirmed as models.
6. Findings regarding reliability: The reliability of the developed measurement tool was determined by the Cronbach's Alpha internal consistency coefficient. As a result of the analysis, the Cronbach's Alpha internal consistency coefficient of the attitude scale toward digital technologies was found to be 0.82. It can be said that the attitude scale towards digital technologies developed in this direction has sufficient reliability.

Table 2 contains the items of the attitude scale towards digital technologies developed to collect research data.

Table 2. Attitude scale towards digital technologies

N	Scale Items
1	I like to use digital technology in my daily life
2	I like to learn new information in the field of digital technology
3	I think creatively when using digital technologies
4	I am confident that I will use even the most difficult-to-understand digital technology
5	I have sufficient skills to use digital technologies
6	I can make fast and practical transactions while using digital technologies.
7	Using digital technologies in my lessons helps me to be successful
8	I believe that digital technologies have improved me.
9	Digital technologies should be used for beneficial purposes.
10	I find digital technologies training necessary
11	News about digital technology catches my attention.
12	I would like to develop materials with digital technologies
13	I care about the development of digital teaching materials by the content.
14	I can distinguish what information is useful to me in the Internet environment.
15	I would like to be able to use technology effectively in work beneficial to my environment.
16	To use digital technology, it is necessary to have sufficient skills as well as knowledge.

The attitude scale towards digital technologies presented in Table 2 consists of one dimension and 16 items. The 5-point Likert-type scale was graded as follows: I strongly agree 5 points, I agree 4 points, I partially agree 3 points, I disagree 2 points, and I strongly disagree 1 point. Assuming equal intervals, the score interval coefficient for the arithmetic means was calculated as 0.80 [Score Interval = (Highest Value-Least Value)/5 = (5–1)/5 = 4/5 = 0.80]. Following this approach, teacher candidates are categorized as follows: 1.00–1.80 as very low, 1.81–2.60 as low, 2.61–3.40 as medium, 3.41–4.20 as high, and 4.21–5.00 as very high attitudes in terms of their attitudes.

Semi-structured interview form. The researchers presented semi-structured interview questions, to four field experts to evaluate the content's validity. Based on their feedback the questions in the form were revised. Additionally, a linguist reviewed the questions to evaluate their language validity. A pre-test of the semi-structured interview form, designed for the study, was carried out with three teacher candidates. The questions were deemed comprehensible by the pre-service teachers. The semi-structured interview form developed for research is provided in Table 3.

Table 3. Semi-structured interview form

1. How do you evaluate the pedagogical conditions of teacher training programs based on digital technologies? I find it very sufficient () I find it sufficient () I find it partially sufficient () I find it insufficient () I find it very insufficient ()
2. How do you evaluate the obstacles to the development of the pedagogical conditions of teacher training programs based on digital technologies? Opinion of teacher candidates:
3. What are your suggestions for improving the pedagogical conditions of teacher training programs based on digital technologies? Opinion of teacher candidates:

In Table 3, a semi-structured interview form created for the prospective teachers participating in the research to evaluate the pedagogical conditions of teacher training programs based on digital technologies is given. There are 1 closed-ended and 2 open-ended question in the interview form. The semi-structured interview duration was determined to be approximately 20–25 minutes.

2.4 Data collection process

Research data were collected in three stages. In the first stage, 266 pre-service teachers were reached through Google Forms for the trial application made during the development of the attitude scale towards digital technologies. In the second stage, the scale, which was ready for application, was delivered to 317 pre-service teachers via Google Forms. In the third stage, semi-structured interviews with 20 randomly selected teacher candidates from the sample group of the research were conducted face-to-face at the universities where the prospective teachers studied and during the appropriate period. The process of collecting all the data took approximately three months.

2.5 Compliance with ethics

During the conduct of the research, ethical principles were followed. During the development and implementation of the data collection tools, an information form was sent to the pre-service teachers who participated in the research, stating that the content of the research, ethical principles, and data would be kept confidential. In addition, each participant was asked to confirm by sending a consent form, which was delivered with the data collection tools, and declaring that they participated in the research voluntarily.

2.6 Data analysis

The SPSS 25.0 statistical program was used in the analysis of the quantitative data of the research. Before the analyses, the Kolmogorov-Smirnov test was performed to test whether the data showed a normal distribution, and it was seen that the test result was $p > .05$ for the variables. Descriptive statistics, t-tests, and one-factor analysis of variance (ANOVA) tests were used to evaluate the data that were found to have a normal distribution. In the analysis of the qualitative data from the research, the descriptive analysis method was used. The purpose of descriptive analysis is to bring together the data collected as a result of interviews or observations with the reader in an organized and interpreted way. In this direction, the findings obtained from the semi-structured interviews developed to collect the qualitative data of the research were presented to the reader in tables by using the descriptive analysis method and frequency and percentage distributions.

3 RESULTS

In this section, information about the quantitative and qualitative data from the research is presented. Quantitative data were obtained with the attitude scale towards digital technologies, and qualitative data were obtained with a semi-structured interview form.

3.1 Findings regarding the attitude scale towards digital technologies

In Table 4, the weighted average and standard deviations of the pre-service teachers participating in the research on the attitude scale toward digital technologies are given.

Table 4. Attitude scale towards digital technologies

	X	SS
Attitude scale towards digital technologies	3.68	0.691

In Table 4, the weighted average and standard deviations (X = 3.68, SD = 0.691) of the attitudes towards digital technologies scale are given. The findings reveal that pre-service teachers have a high degree of attitude toward digital technologies.

In Table 5, independent variable T-test results according to the gender variable of the pre-service teachers participating in the research are given.

Table 5. Independent variables T-test results

Gender	N	X	SS	F	P
Female	161	3.32	0.853	16.547	.000
Male	156	4.05	0.612		

In Table 5, the attitudes of pre-service teachers participating in the research towards digital technologies according to the gender variable were evaluated with the independent variable T-test. As a result of the independent variables t-test, it was determined that the attitudes of teacher candidates towards digital technologies showed a significant difference according to the gender variable ($F = 16.547$, $P < 0.5$). It was determined that the significant difference in the attitudes of teacher candidates towards digital technologies according to the gender variable was in favor of male teacher candidates.

In Table 6, one-way analysis of variance ANOVA results according to the class variable of the teacher candidates participating in the research are given.

Table 6. One-way analysis of variance ANOVA results

	N	X	SS	F	P
1. Class	88	3.61	0.691	6.582	.209
2. Class	75	3.70	0.620		
3. Class	72	3.65	0.685		
4. Class	82	3.76	0.611		

In Table 6, the attitudes of the teacher candidates participating in the research toward digital technologies were evaluated according to the class variable they studied. As a result of the one-way analysis of variance ANOVA, it was determined that the attitudes of pre-service teachers towards digital technologies did not show a significant difference according to the class variable ($F = 6.582$, $P > 0.5$).

In Table 7, a one-way analysis of variance ANOVA results is given according to the department of education of the pre-service teachers participating in the research.

Table 7. One-way analysis of variance ANOVA results

	N	X	SS	F	P
Primary school teaching	65	3.40	0.683	14.591	.000
Math teaching	61	4.04	0.441		
Biology Teaching	72	4.08	0.436		
Geography Teaching	59	3.43	0.699		
Pre-school teaching	60	3.38	0.664		

In Table 7, virtual reality attitudes and competencies of teacher candidates participating in the research were evaluated according to the variables of the department they studied. As a result of a one-way analysis of variance ANOVA, it was determined that teacher candidates' attitudes toward digital technologies showed a significant difference according to the variable of the department they studied ($F = 14.591$, $P < 0.5$). It was determined that the significant difference was in favor of pre-service teachers studying in the mathematics and biology teaching departments.

3.2 Findings regarding the semi-structured interview form

In Table 8, the evaluations of the teacher candidates participating in the research regarding the pedagogical conditions of teacher training programs based on digital technologies are given.

Table 8. Pedagogical conditions of teacher training programs based on digital technologies

Category	F	%
I find it very sufficient	2	10
I find it sufficient	4	20
I find it quite sufficient	11	55
I find it insufficient	3	15
I find it very inadequate	–	–
Total	20	100

The evaluations of the teacher candidates who took part in the study on the pedagogical circumstances of programs for teacher preparation based on digital technologies are broken down into five categories in Table 8. It was deemed highly sufficient by 10% of the pre-service teachers, enough by 20%, only partially good by 55%, and insufficient by 15%. No pre-service teacher who participated in the research responded that the pedagogical conditions of teacher preparation programs based on digital technology must be revised.

In Table 9, the evaluations of the teacher candidates participating in the research regarding the obstacles to the development of the pedagogical conditions of teacher training programs based on digital technologies are given.

Table 9. Obstacles to the development of pedagogical conditions of teacher training programs

Category	F	%
Insufficient digital citizenship education	14	70
Inadequate courses on technological pedagogical content knowledge	11	55
Lack of sufficient digital equipment in universities	7	35
Low digital competence of lecturers	6	30
Not using different methods and techniques for implementation	4	20
Insufficient application opportunity	2	10

In Table 9, the evaluations of the teacher candidates participating in the research regarding the obstacles to the development of the pedagogical conditions of teacher training programs based on digital technologies are categorized. 70% of the pre-service teachers answered that digital citizenship education is insufficient, 55% answered that the courses related to technological pedagogical content knowledge were insufficient, 35% did not have sufficient digital equipment in universities, and 30% answered that the digital competence of the instructors was low. While 20% of the pre-service teachers answered that different methods and techniques are not used for practice, 10% emphasized the inadequacy of the opportunity to practice.

In Table 10, suggestions for teacher candidates participating in the research on improving the pedagogical conditions of teacher training programs based on digital technologies are given.

Table 10. Suggestions of pre-service teachers on improving teacher training programs

Category	F	%
Digital citizenship education should be given	13	65
The number of courses related to technological pedagogical content knowledge should be increased.	10	50
Universities should be better equipped in terms of digital opportunities	9	45
Teacher candidates should be allowed to practice.	8	40
Seminars on extracurricular digital technologies should be organized	6	30
The competencies of the instructors regarding digital technologies should be increased.	5	25
Different courses on digital technologies should be given in each class and term.	3	15

In Table 10, the suggestions of the teacher candidates participating in the research on improving the pedagogical conditions of teacher training programs based on digital technologies are categorized. 65% of teacher candidates answered that digital citizenship education should be given, 50% of them answered that the number of courses related to technological pedagogical content knowledge should be increased, 45% of them answered that universities should be better equipped in terms of digital opportunities, and 40% of them gave the answer that teacher candidates should be offered the opportunity to practice. 30% of the pre-service teachers suggested that extracurricular digital technologies seminars should be organized, 25% of the instructors should increase their proficiency in digital technologies, and 15% suggested that different courses on digital technologies should be given in each class and term.

4 DISCUSSIONS

It has been determined that the pre-service teachers participating in the research have a high degree of attitude toward digital technologies. Similar to the research findings, Heerwegh et al. [42] also revealed in their study that pre-service teachers' skills for digital technologies are at a high level. It was determined that the attitudes of the teacher candidates participating in the research towards digital technologies differed significantly according to the gender variable, and the significant difference was in favor of male teacher candidates. He and Freeman [43] also revealed in their research that men have higher attitudes toward digital technologies. In the study, it was stated that this difference emerged because men were more interested in technological tools and spent more time with them. In different studies conducted in the field, results supporting the findings of this research have been reached, and it has been revealed that male pre-service teachers and teachers have more technology knowledge [44] [45].

Although it was shown that teacher candidates' attitudes toward digital technologies did not differ significantly depending on the variable of their education, it was found that they did depending on the department they studied. It was determined that the attitudes of pre-service teachers towards digital technologies were in favor of pre-service teachers studying in mathematics and biology teaching departments, according to the variables of the department they studied. In their study, Akçay and Halmatov [46] revealed that there was no significant difference between the attitudes of teacher candidates regarding digital technology-supported education according to the grade level variable. However, according to Frye and Dornisch's research [47], science and mathematics are areas that are more closely tied to the use of technology. Additionally, science and mathematics teachers use technology more than teachers in other fields and are more skilled in this area.

Most of the research's pre-service teachers only viewed the pedagogical circumstances of teacher preparation programs based on digital technology as partially sufficient. Krumsvik [48], on the other hand, stated in his research that teacher education programs do not provide pre-service teachers with sufficient digital competencies and do not display a consistent approach. Prospective teachers are obstacles to the development of pedagogical conditions in teacher training programs based on digital technologies. They listed them as insufficient digital citizenship education, insufficient courses on technological pedagogical content knowledge, and insufficient digital equipment in universities. In addition, some of the pre-service teachers answered that the digital competencies of the instructors are low, different methods and techniques are not used for practice, and the opportunity to practice is insufficient.

Gudmundsdottir and Hatlevik [49] revealed in their research that teacher training programs should be adjusted to increase the digital competencies of pre-service teachers. Researchers emphasized the importance of providing pre-service teachers with practical opportunities to perform activities using digital technologies in training to improve their digital competencies. Martinovic and Zhang [50] also stated that the most important obstacle to the development of pre-service teachers' skills in using digital technologies is their inability to access the relevant technologies sufficiently, and they emphasized that the teaching staff and the university environment should be adapted to this.

Pre-service teachers' suggestions for improving the pedagogical conditions of teacher training programs based on digital technologies: digital citizenship education should be given, the number of courses related to technological pedagogical content knowledge should be increased, universities should be better equipped in terms of digital opportunities, and teacher candidates should be offered the opportunity to practice. In addition, some of the teacher candidates suggested that extracurricular

seminars on digital technologies should be organized, the proficiency of lecturers on digital technologies should be increased, and different courses on digital technologies should be given in each class and term. Tomte [51] stated in his research, similar to the findings of this study, that instructors should be role models for teacher candidates with their experience, exemplary practices, and the strategies they use in the development of digital competencies.

5 CONCLUSION

In the 21st century, which is called the "age of information and technology," information technologies shape the learning and teaching process. Changes and innovations affect the field of education as well as every other field, and the need to gain new knowledge and skills arises. In this direction, it has become an extremely important issue to establish the digital competencies of teacher candidates as well as their pedagogical knowledge. Based on this, this research is aimed at evaluating the pedagogical conditions for training future teachers based on digital education technologies.

As a result of the research, it has been determined that pre-service teachers have a high degree of attitude toward digital technologies. While the attitudes of pre-service teachers towards digital technologies did not differ significantly according to the variable of the class they studied, they differed in favor of the pre-service teachers studying in the departments of mathematics teaching and biology teaching according to the variable of the department they studied. The majority of the pre-service teachers who participated in the research stated that they found the pedagogical conditions of teacher training programs based on digital technologies partially sufficient.

Prospective teachers listed obstacles to the development of pedagogical conditions for teacher training programs based on digital technologies as insufficient digital citizenship education, insufficient courses on technological pedagogical content knowledge, and insufficient digital equipment in universities. In addition, some of the pre-service teachers answered that the digital competencies of the instructors are low, different methods and techniques are not used for practice, and the opportunity to practice is insufficient. Pre-service teachers' suggestions for improving the pedagogical conditions of teacher training programs based on digital technologies included the following: digital citizenship education should be given; the number of courses related to technological pedagogical content knowledge should be increased; universities should be better equipped in terms of digital opportunities; and teacher candidates should be offered the opportunity to practice. In addition, some of the teacher candidates suggested that extracurricular seminars on digital technologies should be organized, the proficiency of lecturers on digital technologies should be increased, and different courses on digital technologies should be given in each class and term.

6 RECOMMENDATIONS

In line with the results obtained from the research, the following suggestions were developed:

1. Taking into account the departments of teacher candidates, course curriculum distributions aiming to increase their proficiency in digital technologies should be created in different intensities.

2. Inadequacies in the pedagogical conditions of teacher training programs based on digital technologies at universities should be identified and eliminated.
3. Digital citizenship education should be given to teacher candidates in universities; the number of technological pedagogical content knowledge courses should be increased; sufficient digital equipment should be provided; the digital competencies of the instructors should be increased; and the opportunity to practice using different methods and techniques within the scope of the curriculum should be provided to the teacher candidates.

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