The relationship between digital literacy levels and lifelong learning tendencies of future teachers

Ebru Elçi iD
Kocaeli University, Kocaeli, Türkiye
ebruelcipdr@hotmail.com

With this research we aimed to determine the correlation between teacher candidates' digital literacy levels and lifelong learning tendencies. This research was created as a mixed methods research. The quantitative group of the research consisted of 650 teacher candidates studying at the education faculties of different universities in Istanbul in the 2023–2024 academic year. The study group of the qualitative part of the research consisted of 25 faculty members working at different universities in Istanbul. Research data were obtained with the digital literacy scale, lifelong learning tendencies scale, and semi-structured knowledge collection form developed by the researchers. SPSS 25.0 statistical program was used to analyse the quantitative data and the content analysis method was used to analyse the qualitative data. Research results show that there was a moderately positive linear relationship between the digital literacy levels of teacher candidates and their lifelong learning tendencies. While the digital competencies and lifelong learning tendencies of teacher candidates differed according to gender and study-year variables, there was no remarkable difference accordingly the year variable.

Keywords: digital competence; faculty members; mixed methods; teacher candidates

Introduction

In the age we live in, information has a dynamic and self-renewing structure. For this reason, it is not possible for one to be satisfied with the knowledge we have acquired in a certain period (Seals, Clanton, Agarwal, Doswell & Thomas, 2008). Keeping up with the dynamic structure of information is only possible by tending to learn continuously. This learning dynamic of individuals is defined by lifelong learning activities (Lock, Lakhal, Cleveland-Innes, Arancibia, Dell & De Silva, 2021). Since these activities will be possible through the activities of accessing information, understanding information, using information, and evaluating information, the notion of literacy is needed. While information literacy alone played a remarkable role in learning in the past, digital platforms currently play a significant role in accessing information. This has led to the emergence of the concept "digital literacy" (Ojobor, Babarinde & Ezeh, 2021). Especially in the last decade, digital applications have gained importance in the field of education worldwide (Liu & Liu, 2021). In this age of technology, lifelong learners need to have digital literacy skills to access knowledge with the right methods and use it in the most accurate way (Anthonysamy, Koo & Hew, 2020).

Conceptual Framework

The inclusion of computers and the internet and developing technologies in our lives has become part of the ability to access information independently of time and space in our daily lives, thus allowing the emergence of new types of literacy (Park, Kim & Park, 2021). Information, one of the remarkable items of learning in the lifelong learning process, has brought new types of literacy to the fore in new ways that are aimed to be reached quickly, easily, accurately, and reliably (Knobel & Lankshear, 2006). It is critical to acquire skills to use technology in accessing these new types of information, distinguishing differences in information, following innovations, and benefiting from information (Bergdahl, Nouri & Fors, 2020). Literacy is no longer defined in the literature solely in terms of alphabetic practices (Kajee, 2018). With the integration of technology into education, multiple literacies, especially information literacy, have become part of new types of literacy (Leu, Kinzer, Coiro & Cammack, 2004).

Lifelong learning, which has a major place in terms of education and training activities today, has emerged as a well-known principle in the studies and reports of Labadi (2014) as well as international organisations such as the Organisation for Economic Co-operation and Development ([OECD] 1973). The newly emerging notion aims to transform society into a dynamic structure open to continuous learning by assigning new roles to individuals in the learning process (Field & Leicester, 2003). In the 2000s, the scope of the notion expanded and the perception of learning changed. The mission with lifelong learning is enabling an individual to reach the education he needs through his efforts by choosing the most suitable educational opportunity among the available educational opportunities (Kaya, 2014).

The distinction between the notion of lifelong learning and other concepts is that it primarily focuses on the individual. In parallel, a major difference is that it makes additional learning outside of formal education significant, carries education beyond the school, independent of place and time, and expands the boundaries of learning (Güleç, Çelik & Demirhan, 2012). With the increasing significance of lifelong learning in recent years, the integration of technological developments in education and its role in the lifelong learning process has paved the way for the concept of digital literacy to become major (Kilag, Malbas, Miñoza, Ledesma, Vestal & Sasan, 2024).

Paul Gilster was the first to use the concept of digital literacy in his book *Digital Literacy* in 1997 and points out this new concept where technology and education are integrated (Özerbaş & Kuralbayeva, 2018). In the years following the first emergence of the concept, different definitions were made and introduced into the literature. Eshet-Alkalai (2004) defines digital literacy as the ingenuity to survive in the digital age. At the same time, digital users and learning activities must have skills and strategies. Martin (2005) defines digital literacy more broadly and defines individuals' digital tools and opportunities; it is identified as the attitude and ability to identify digital resources properly.

The concept of digital literacy requires individuals to have a set of skills to perform certain tasks, solve problems, or provide healthy access to information (Falloon, 2020). These skills are grouped under four main headings: technical, cognitive, psychological, and social. Since it is not possible to think of digital literacy independently of technology, these skills, which combine technological skills and literacy skills, appear as major components of digital literacy. Digital literacy skills are also recognised as comprehensive and applicable components in all curriculum areas (Ng, 2011).

The increasing need for technology use in our day-to-day lives makes digital competencies critical (Mercader & Gairín, 2020). Having digital literacy skills is critical for individuals who strive to meet the needs of their age and who tend to learn throughout life (Garzón Artacho, Martinez, Ortega Martin, Marín Marín & Gómez García, 2020). For teacher candidates who will educate future generations, having digital literacy skills to perform technology-supported learning and being inclined towards lifelong learning to keep their personal and professional development dynamic is regarded as a necessity rather than a choice. The qualifications that teachers need can only be provided through properly created teacher training policies. From this perspective, the qualifications of teacher candidates can only be established by determining their qualifications during the education process provided to them. In addition, considering that digital literacy is a concept that has entered our lives with technology and is connected to the use of digital tools, it is thought that development in this area is linked to teacher candidates being open to lifelong learning. Therefore, in this research, it was found to be important to address the correlation between teacher candidates' digital literacy levels and lifelong learning tendencies.

Related Research

When the research in the field is reviewed, it is seen that studies have been conducted to define the digital literacy levels of teachers, students and teacher candidates in particular (Gui & Argentin, 2011; Hatlevik, 2010; Özerbaş & Kuralbayeva, 2018; Techataweewan & Prasertsin, 2018; Vélez, Olivencia & Zuazua, 2017). Some studies examine the lifelong learning levels of the participants with regard to different variables and investigate the impact of lifelong learning on individuals (Demiralp & Kazu, 2017; Finsterwald, Wagner, Schober, Lüftenegger & Spiel, 2013).

In other studies the concepts of lifelong learning and digital literacy were considered together and the correlation between them was evaluated. In their research, Jimoyiannis and Gravani (2010) discussed digital literacy in a lifelong learning programme for adults and educators' experiences and understanding regarding teaching practices were evaluated. In her research, Smyrnova-Trybulska (2013) examined the correlate between online learning using digital technologies and lifelong learning. In this context, the research revealed the challenges and future expectations. In a study with teachers by Demir, Aktı Aslan and Demir (2022), the results show that teachers have high lifelong learning tendencies and find themselves sufficient in digital literacy, and their digital literacy levels predict their lifelong learning skills. Keskin (2023) evaluated the correlation between prospective teachers' lifelong learning propensities and digital competencies. In the study, it was emphasised that these two concepts should be reflected in teacher training programmes in a way that supports each other. Özoğlu and Kaya (2021) tried to define the connection between lifelong learning and digital literacy of young teacher candidates. The research results show that the lifelong learning trends and digital literacy of teacher candidates were at a high level. Alpsülün and Balıkçı (2024) examined the lifelong learning trends and digital literacy levels of school administrators. At the end of the research; a positive linear connection was defined between the digital literacy levels of school administrators and their long-term learning tendencies.

When the research in the field is analysed, it is seen that the digital literacy levels of teachers, students and especially teacher candidates are investigated. In some studies, the lifelong learning tendencies of these groups have been discussed. It was found that few studies examined the connection between digital literacy levels and lifelong learning tendencies. In our study, unlike other studies in the field, lifelong learning and digital literacy scales were developed in line with the purpose of the research and applied to teacher candidates. The opinions of faculty members were evaluated in terms of creating multifaceted research findings. In addition, no research was found to investigate the relationship between the digital literacy level of prospective teachers and their lifelong learning tendencies with students studying in very dissimilar

fields and in all years of study at the faculty of education. It is thought that the findings obtained from this mixed-methods research will provide a different perspective from the research carried out in the field, which makes this research important.

Purpose of the Research

The purpose of this research was to define the relationship between the digital literacy levels of teacher candidates and their lifelong learning tendencies. For this purpose, research hypotheses were tested and answers to the following research questions were sought.

1) How do faculty members evaluate the digital literacy levels of prospective teachers?
2) How do faculty members evaluate the lifelong learning tendencies of prospective teachers?
3) Do faculty members think that there is a relationship between prospective teachers' digital literacy levels and their lifelong learning tendencies?

Methodology

This research was created as a mixed methods research. Mixed methods is a research method in which qualitative and quantitative data are compiled and both designs are used together. In this type of research, the aim is to provide extra detailed and extended understanding of a phenomenon by using the benefits of qualitative and quantitative methods (Sandelowski, 2000). In this study, a mixed-method combination was implemented to define the connection between teacher candidates' digital literacy levels and lifelong learning tendencies.

Participants

The quantitative study group consisted of 650 teacher candidates studying at the education faculties of different universities in Istanbul in the 2023–2024 academic year. Convenience sampling, one of the non-random sampling methods, was used in the research. The convenient sampling method aims to take sample elements that the researcher can easily access and is used in cases where it is arduous for the researcher to create and reach the sample (Monette, Sullivan & De Jong, 1990). Many assessments of sample size exist in the literature. Ding, Velicer and Harlow (1995) recommend that the sample size in a study to be estimated using the maximum likelihood estimator should be at least 100 to 150. Accordingly, it was concluded that the sample group created for this research was sufficient.

The study group of the qualitative part of the research consisted of 25 faculty members working at different universities in Istanbul. In qualitative research, instead of large groups, it is necessary to define samples that match the purpose of the research and can provide detailed data (Coyne, 1997). Based on this, the sample size was limited to 25 faculty members. The qualitative group was formed using a purposeful random sampling method. In this sampling, the researcher first selects a sample group from the universe by random method and then selects a small subgroup from this group that s/he thinks will contribute significantly to the research (Marshall & Rossman, 2016). With this method 25 faculty members were selected to form part of the qualitative study group.

The prospective teachers participating in the study were studying at five different state universities in Istanbul. The faculty members were working at the same universities as the students in the 2023–2024 academic year. In this study, 11 of the faculty members participating in the study were female and 14 were male. The demographic distribution of the prospective teachers participating in the study is given in Table 1.

Data Collection Tools

Research data were created with the digital literacy scale, lifelong learning tendencies scale, and semi-structured knowledge collection form developed by the researchers.

Digital literacy scale
Creating an item pool

Firstly, a literature review on digital literacy was carried out. In the light of the data acquired, an item pool consisting of 48 items was created. During the creation of the item pool, we consulted two experts. The items were prepared on a 5-point Likert-type scale and the students' degrees of agreement were categorised as 1) Strongly disagree, 2) Disagree, 3) Partly agree, 4) Agree and 5) Strongly agree.

Ensuring content and face validity

Forty eights items in the item pool created for content and face validity were presented to eight experts. The expert staff for this research included three academics who worked in the department of computer and educational technologies teaching at different universities. Five of the academics taught educational technology courses at the faculties of education of universities. At this stage, the Lawshe (1975) technique was used. This technique is a six-stage technique (Yurdugül, 2005): 1) determining a group of field experts, 2) preparation of the candidate form, 3) acquiring expert opinions, 4) acquiring content validity rates for the questions, 5) acquiring content validity indexes for the form, and 6) shaping the final form according to content validity rates/index criteria. Expert opinions for each question were graded as "The item measures the targeted structure", "The item is related to the structure but should be improved" and "The item does not measure the targeted structure." The Lawshe content validity rate calculation was used to obtain the content validity rates of the questions. The minimum content validity criterion (KVR) for eight experts was 0.78 (Yeşilyurt & Çapraz, 2018).

$$KGO = \frac{Nu}{N/2} - 1 \text{ or } KGO = \frac{Nu - N/2}{N/2}$$

In this formula *Nu* refers to the number of experts who said "The question measures the targeted structure", and *N* refers to the total number of experts who expressed their opinions on the question. The content validity index calculated in line with the opinions received from experts was found to be 0.88. Twenty-seven items that met content and face validity were removed from the item pool to be used in the pilot scale.

Ensuring construct validity
At this stage, the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett data acquired from the sphericity test (KMO .81 and Bartlett Sphericity test $\chi^2 = 4394.65$, $p = .00$; $p < .05$) revealed that factor analysis could be performed on the scale. In order to define the construct validity, exploratory and confirmatory analyses were performed sequentially. A sample group of 366 teacher candidates was created for the pilot application. This sample group was excluded from the application group of the study. Following the implementation, rotated principal components analysis and the Varimax orthogonal rotation technique were used to determine the factor structure.

While creating the factors, special attention was paid to some criteria. These were the eigenvalue of all factors, which was at least 1, the factor load value was 0.40 or higher than 0.40, the difference between the two load values of items that had high load values in more than one factor was at least .10, and were included in all factors. The items were internally included in terms of meaning and content. After Varimax rotation, three items that did not meet the specified criteria were removed from the scale. The remaining 24 items were analysed again. The analysis results show that the scale had a two-factor structure. The first factor, "Competence", consisted of 13 items and the second factor, "Motivation", consisted of 11 items. The 13 items in the competence sub-dimension were statements in which teacher candidates evaluated themselves in the field of digital literacy on a 5-point Likert-type scale from "Very sufficient" to "Very inadequate." The aim with these statements was to measure the competence of teacher candidates in the use of digital literacy in education, which was created for their self-assessment. The 11 items in the motivation sub-dimension consist of statements in which teacher candidates evaluate whether they have a motivation to become digitally literate on a 5-point Likert-type scale from "Very low motivation" to "Very high motivation." These 11 items include self-assessment statements that enable teacher candidates to express their willingness to develop towards becoming digitally literate. The items in both sub-dimensions evaluate teacher candidates' general levels regarding digital literacy. The factor loadings of the items in the first factor varied between 0.88 and 0.69. The factor loadings of the items in the second factor varied between 0.68 and 0.54. The total variance related to the two factors was 71.09%, and it was seen that the scree graph confirmed the factor number of the scale. All items in the scale contain positive statements.

Following the exploratory factor analysis, a confirmatory factor analysis was carried out to confirm the two-factor structure. In the confirmatory factor analysis, the goodness of fit indices of the scale were examined. For the data set, CMIN/*df* = 2.544 (minimum value of Chi-square/degree of freedom) RMSEA = 0.043 (root-mean-square error of approximation) was defined. SRMR = 0.03 (standardised root-mean-square residual), NFI = 0.97 (normed fit index), RFI = 0.92 (relative fit index), CFI = 0.96 (comparative fit index), GFI = 0.99 (goodness-of-fit index), AGFI = 0.91 (adjusted goodness of fit index). By Schermelleh-Engel, Moosbrugger and Müller (2003), for CMIN/*df* < 5, 0.00 < RMSEA < 0.05, 0.00 < SRMR < 0.05, 0.95 < NFI < 1.00, 0.90 < RFI < 1.00, 0.95 < CFI < 1.00, 0.95 < GFI < 1.00 and good fit values were defined as 0.90 < AGFI < 1.00. The acquired values reveal that the two-factor structure of the scale has high goodness of fit values. In this regard, the structure obtained from the exploratory factor analysis was confirmed.

Reliability study of the scale
Cronbach's alpha internal consistency coefficient was calculated for the two-factor structure of the digital literacy scale which includes 24 items. The Cronbach alpha coefficient for the competence subscale was found to be 0.79, 0.87 for the motivation subscale, and 0.82 for the overall digital literacy scale. These values reveal that the scale is reliable and applicable. Score ranges on the scale, namely, 1.00 to 1.80 Strongly disagree; 1.81 to 2.60 Disagree; 2.61 to 3.40 Partially agree; 3.41 to 4.20 Agree and 4.21 to 5.00 Strongly agree, are considered equal.

Lifelong learning tendencies scale
For the lifelong learning tendencies scale, the same steps were followed as for the digital literacy scale, and scale development studies were carried out simultaneously with the same sample group.

Creating an item pool
As a result of the literature review on lifelong learning, the item pool including 42 items was created with the help of two experts. The students' degree of agreement with the items in the scale was categorised as 1) Never, 2) Rarely, 3) Sometimes, 4) Frequently and 5) Strongly Agree.

Ensuring content and face validity
The 42-item pilot scale was sent to nine experts to calculate the content validity index in six stages using the Lawshe (1975) technique (Yurdugül,

2005). The Lawshe content validity criterion for nine experts is 0.75 (Yeşilyurt & Çapraz, 2018). The experts who contributed to the establishment of the scope and face validity of the lifelong learning tendencies scale development phase of the research were academics working at universities. The reason for including nine academics was that they had taught lifelong learning courses in the last 3 years or were teaching lifelong learning courses during the period when the research was carried out. The experts evaluated the items on the scale. The content validity index was calculated from the data acquired and found to be 0.80. Items that all experts rated as "The item measures the targeted structure" were taken from the item pool to be added to the scale. The pilot scale included 25 items.

Ensuring construct validity
At this stage, the KMO coefficient and Bartlett data acquired from the sphericity test (KMO .86 and Bartlett Sphericity test $\chi^2 = 4539.21$, $p = .00$; $p < .05$) reveal the suitability of the scale for factor analysis. The pilot scale was administered to 366 teacher candidates, and the teacher candidates who participated in this phase only contributed to the scale development process of the research. Following the application, exploratory factor analysis was implemented to the data set. Rotated principal components analysis and the Varimax orthogonal rotation technique were used to determine the factor structure. In this process, the eigenvalue of the factors was taken as at least 1 as a criterion. Factor load values of 0.40 or higher than 0.40 were taken into consideration. Items with high loading values on more than one factor were removed from the scale and cancelled. Finally, care was taken to ensure that the items in each factor were consistent in terms of meaning and content. The analysis was repeated by removing five items from the scale that did not meet the criteria. As a result of the second analysis, a two-factor structure was formed. The first factor of the scale, "Support for personal development", included nine items. The second factor, "Support for education", included 11 items. The nine items in the support for personal development sub-dimension included statements in which the prospective teachers evaluated their tendencies regarding the support of lifelong learning for their own development on a 5-point Likert-type scale from Very high to Very low. These statements were created to evaluate the personal contribution aspect of the prospective teachers' tendencies towards lifelong learning. The 11 items in the support for education sub-dimension included statements in which the prospective teachers evaluated their tendencies regarding the support of lifelong learning for the educational process on a 5-point Likert-type scale from Very high to Very low. These statements enabled the prospective teachers to evaluate their tendencies towards

lifelong learning in terms of the support that lifelong learning provides for education. While the item factor loadings on the first factor varied between 0.80 and 0.66, the item factor loadings on the second factor varied between 0.65 and 0.49. The total variance explained by the factors was 69.21%. The scree graph confirmed the two-factor structure of the scale. All scale items were positive.

The two-factor structure of the pilot scale was re-evaluated with confirmatory factor analysis. In this process, the goodness of fit indices of the data set were examined. Schermelleh-Engel et al.'s (2003) goodness of fit values were taken as criteria. Calculations made in the data set, CMIN/df = 3.239, RMSEA = 0.040 were defined. SRMR = 0.01, NFI = 0.95, RFI = 0.92, CFI = 0.99, GFI = 0.95, AGFI = 0.91 values were revealed. The obtained values revealed that the scale had a good degree of fit. At the same time, the goodness of fit index confirmed the two-factor structure of the scale.

Reliability of the scale
In the reliability analysis of the lifelong learning tendencies scale, the Cronbach alpha internal consistency coefficient was calculated. Cronbach's alpha was calculated as 0.77 for the first factor, 0.93 for the second factor, and 0.84 for the overall lifelong learning tendencies scale. The acquired values show that the scale is reliable. Final adjustments were made before the application phase of the scale. Score ranges on the scale, namely, 1.00 to 1.80 Strongly disagree; 1.81 to 2.60 Disagree; 2.61 to 3.40 Partially agree; 3.41 to 4.20 Agree and 4.21 to 5.00 Strongly agree, are considered equal.

Semi-structured information collection form
A literature review was conducted in the preparation step of the faculty information collection form. The questions created for the subsequent interviews were presented to three experts and their suitability was evaluated in terms of content validity. Then, a semi-structured information collection form was administered to four prospective teachers and the comprehensibility of the questions was evaluated. Teacher candidates found the questions in the semi-structured information collection form understandable. Teacher candidates who participated in this phase of the research were not included in the sample group. In the final stage, the questions were arranged in information collection format and made ready for application. The questions in the information collection form are given below.
1) How do you evaluate the digital literacy levels of teacher candidates? Justify it by choosing one of the categories: Very high, High, Medium, Low, Very low.
2) How do you evaluate the lifelong learning tendencies of teacher candidates? Justify it by choosing one of the categories: Very high, High, Medium, Low, Very low.

3) Do you think that a relationship exists between teacher candidates' digital literacy levels and lifelong learning tendencies? Select one of the options: No relationship, High positive relationship, Moderate positive relationship, low-level positive relationship, High negative relationship, Moderate negative relationship, and Low-level negative relationship.

Data Collection Process

Quantitative data were collected with the digital literacy and lifelong learning tendencies scales. The scales were delivered to teacher candidates via Google Forms. Data from the semi-structured information collection form were collected through face-to-face interviews with faculty members. Interviews with faculty members were carried out in the form of one-on-one interviews within the universities where they worked. Permission was acquired from the faculty members to record audio during the interviews. The interviews lasted approximately 20 to 25 minutes. It took approximately 8 weeks for the quantitative data to reach the researcher and to assimilate all the semi-structured information collection forms.

Compliance with Ethics

At each stage of the research, participating prospective teachers and faculty members were asked to sign research participation consent forms. The consent forms included explanations about the purpose of the research, the data collection process, ethical principles, that personal data would be kept confidential, and that participants declared their voluntary participation in the study. Teacher candidates and faculty members who did not sign the consent form were not included in the research. In addition, the required permissions were sought and gained from the universities where the research was carried out. During the writing phase, publication ethics were followed.

Data Collection Analysis

In the scale development phase the Statistical Package for the Social Sciences (SPSS) 25.0 program was used for exploratory factor analysis and the SPSS Analysis of Moment Structures (Amos) 25.0 program was used for confirmatory factor analysis. The SPSS 25.0 statistical program was used to analyse the research data. To test normal distribution, Kolmogorow-Smirnov test results were examined ($p < 0.05$) and it was seen that the data set was normally distributed. Parametric tests were performed on the data set taken from the scale. The independent sample *t*-test was used to analyse the differences between two groups, and one-way analysis of variance (ANOVA) was used for the differences between three or more groups. The Spearman correlation analysis was carried out to examine the connection between teacher candidates' digital literacy levels and lifelong learning tendencies. Statistical analyses were performed in the IBM SPSS Statistics 25.0 program. The significance level was taken as 0.05.

The content analysis method was used to analyse the qualitative data. Content analysis is used to examine the collected data in more detail – it finds concepts, categories and themes that explain the data. With these steps, data that explain the same condition in the data set are combined. Codes are created from events and facts that are frequently repeated or emphasised by the participants. Categories are taken from the codes and themes are taken from the categories. In short, data (codes) that were found to be similar and related to each other were combined and interpreted within the framework of certain concepts (categories) and themes (Strauss & Corbin, 1990). In this regard, an expert and I coded the faculty members' answers to the semi-structured information collection forms separately by creating a coding key. In the reliability of the data, the reliability formula suggested by Miles and Huberman (1994) (Reliability = Consensus / (Consensus + Disagreement)) was preferred and the reliability coefficient was found to be 94%. This result was found to be reliable in terms of research.

Results

Table 1 shows the demographic characteristics of the participating prospective teachers.

Table 1 Demographic distribution of teacher candidates

Teacher candidates		*N*	*%*
Gender	Female	341	52.5
	Male	309	47.5
Section	Classroom teaching	123	18.9
	Pre-school teaching	121	18.7
	Mathematics teaching	112	17.2
	Chemistry teaching	103	15.8
	Geography teaching	97	14.9
	Music teaching	94	14.5
Year of study	1st year	175	26.9
	2nd year	167	25.7
	3rd year	158	24.3
	4th year	150	23.1

In this study 52.5% of the participating teacher candidates were female and 47.5% male, 18.9% studied classroom teaching, 18.7% preschool teaching, 17.2% mathematics teaching, 14.9% geography teaching and 14.5% music teaching. Of the participating teacher candidates, 26.9% were in the first year, 25.7% in the second years, 24.3% in the third year and 23.1% in their fourth year of study.

In Table 2, the Spearman correlation analysis shows the correlation between the participating teacher candidates' digital literacy levels and their lifelong learning tendencies.

Table 2 Spearman correlation analysis

		Lifelong learning tendencies scale
Digital literacy scale	R	.647[*]
	p	> 0.001

Note. *0.01, Spearman correlation analysis.

The Spearman correlation analysis (Table 2) shows a moderately positive linear correlation between teacher candidates' digital literacy levels and lifelong learning tendencies ($p > 0.001$, $R = 0.647$). As the digital literacy levels of teacher candidates increased, their lifelong learning tendencies increased. Similarly, as teacher candidates' digital literacy levels decreased, their lifelong learning tendencies decreased.

Table 3 shows the digital literacy levels of the participating teacher candidates in terms of various variables, namely, gender, section and year.

Table 3 Digital literacy scale

		N	Mdn	Minimum (Min)	Maximum (Max)	p	Difference
Gender*	Female	341	2.44	1.81	4.25	< 0.001	2 > 1
	Male	309	3.63	1.75	4.25		
Section**	Classroom teaching	123	3.55	1.81	4.13	0.588	
	Pre-school teaching	121	3.42	1.75	4.25		
	Math teaching	112	3.42	1.75	4.13		
	Chemistry teaching	103	3.31	1.88	4.00		
	Geography teaching	97	3.55	1.81	4.25		
	Music teaching	94	3.18	1.81	4.00		
Year of study**	1st year	175	2.38	2.75	4.00	< 0.001	3.4 > 1.2
	2nd year	167	2.44	1.81	4.25		
	3rd year	158	3.55	1.81	4.00		
	4th year	150	3.63	1.75	4.25		

Note. $p < 0.05$, *Mann Whitney U Test, **Kruskal Wallis H Test.

The findings show that the male teacher candidates' digital literacy levels were higher than those of female teacher candidates. There was no remarkable difference in the participating teacher candidates' digital literacy according to the departments they studied in. According to the variable of the year in which the teacher candidates studied, the digital literacy levels of teacher candidates studying in the third and fourth years were found to be higher than those of teacher candidates studying in the first and second years.

The lifelong learning tendencies of the participating prospective teachers in terms of various variables, namely gender, section and year are shown in Table 4.

Table 4 Lifelong learning trends

		N	Mdn	Min	Max	p	Difference
Gender*	Female	341	3.58	1.00	5.00	< 0.001	1 > 2
	Male	309	2.96	1.75	5.00		
Section**	Classroom teaching	123	3.49	1.75	5.00	0.613	
	Pre-school teaching	121	3.51	1.75	5.00		
	Math teaching	112	3.45	1.00	4.25		
	Chemistry teaching	103	3.34	1.81	5.00		
	Geography teaching	97	3.27	1.00	4.25		
	Music teaching	94	3.36	1.00	4.00		
Year of study**	1st year	175	2.19	1.00	5.00	< 0.001	1 > 2 > 3 > 4
	2nd year	167	2.88	1.75	5.00		
	3rd year	158	3.36	1.00	4.25		
	4th year	150	3.70	1.00	5.00		

Note. $p < 0.05$, *Mann Whitney U Test, **Kruskal Wallis H Test.

The findings show that female teacher candidates had a higher tendency towards lifelong learning than male teacher candidates. The variable of the department in which the participating teacher candidates studied did not make a difference in their lifelong learning tendencies. The teacher candidates' lifelong learning tendencies increased as they advanced from the first to fourth year of study.

Table 5 Faculty members' answers to the question: How do you evaluate the digital literacy levels of prospective teachers?

Category	Theme	*f*	%
Very high	Very high digital source scanning	4	16
	Very high technology integration		
High	High interest and curiosity	6	24
	High digital perception		
	High technology-oriented reading skills		
Middle	Partial use in education and training activities	13	52
	Moderate openness to innovation		
Low	Lack of practice	2	8
	Not being affected by Internet information pollution		
Very low	-	-	-
Total		25	100

The assessments of the participating faculty members regarding the prospective teachers' digital literacy levels were divided into categories and themes, which are shown in Table 5. The faculty members' responses show that 16% found the digital literacy levels of the teacher candidates to be very high, 24% found them high, 52% found them medium and 8% found them low.

The participating faculty members' assessments regarding the prospective teachers' lifelong learning tendencies were divided into categories and themes, which are shown in Table 6.

Table 6 Faculty members' answers to the question: How do you evaluate the lifelong learning tendencies of teacher prospective teachers?

Category	Theme	*f*	%
Very high	Interest in professional development	1	4
High	Giving importance to personal development	7	28
	Awareness of information needs		
	High interest in independent learning		
Middle	Intermediate questioning skills	15	60
	Following technological developments at a certain level		
	Moderate learning interest		
Low	Poor sense of initiative and entrepreneurship	2	8
	Poor future goals		
Very low	-	-	-
Total		25	100

The faculty members' responses show that 4% found the teacher candidates' lifelong learning tendencies to be very high, 28% found them high, 60% found them medium and 2% found them low.

The opinions of the participating faculty members regarding the relationship between the prospective teachers' digital literacy levels and their lifelong learning tendencies were divided into categories, which are shown in Table 7.

Table 7 Faculty members' answers to the question: Do you think there is a relationship between prospective teachers' digital literacy levels their lifelong learning tendencies?

Category	*f*	%
No relationship	1	4
Highly positive relationship	5	20
Moderate positive relationship	12	48
Low positive relationship	7	28
High negative relationship	-	-
Moderate negative relationship	-	-
Low negative relationship	-	-
Total	25	100

The results show that 4% of the faculty members stated that no relationship existed between the teacher candidates' digital literacy levels and their tendency towards lifelong learning. On the type of relationship between the teacher candidates' digital literacy levels and lifelong learning tendencies, 20% of the faculty members indicated a high-level positive relationship, 48% a medium-level positive relationship, and 28% a low-level positive relationship.

Discussion
The results obtained from the research reveal that a moderately positive linear correlation existed between the teacher candidates' digital literacy and their lifelong learning tendencies. As their digital literacy levels increased, so did their lifelong learning tendencies. Öteles (2020) concluded that a moderate, positive and remarkable correlation existed between teacher candidates' lifelong learning tendencies and their digital literacy levels, similar to the findings of this research. Gökbulut (2021) also revealed that a positive, moderate correlation existed between teachers' lifelong learning tendencies and their digital literacy levels. Özçiftçi and Çakır (2015) found a moderate, positive and remarkable correlation between teachers' lifelong learning tendencies and their educational technology digital self-efficacy. Bundy (2004) states that digital literacy is linked to lifelong learning and independent learning. Anthonysamy et al. (2020) make a general assessment and state that digitally literate individuals will have a better learning experience and thus become better learners throughout their lives. When the findings acquired from my research and other research in the field are evaluated, it shows that a generally remarkable and positive correlation existed between teacher candidates' digital literacy levels and their lifelong learning tendencies. This finding shows that these two competencies support each other and that a teacher candidate with digital literacy skills continues to learn throughout life using digital literacy. In other words, teacher candidates with a lifelong learning tendency tend to use digital literacy skills in line with developing technology. It can thus be concluded that the content of digital literacy and lifelong learning courses to be provided to future teachers in teacher training programmes, which is a major factor in the formation of their competencies, will positively trigger each other.

When the participating faculty members were asked about the digital literacy levels of the prospective teachers and their life-long learning tendencies, the majority of the faculty members stated that the digital literacy levels of the prospective teachers were at a medium level. Bay (2021) worked with pre-school teacher candidates in her research and revealed that teacher candidates' digital literacy levels were high. The majority of

faculty members stated that they found the lifelong learning tendencies of prospective teachers to be at a moderate level. Research findings by Ertaş (2022) support the findings of this research by showing that students' lifelong learning skills were at a moderate level. Most of the faculty members who participated in this research expressed similar opinions as those of the prospective teachers and stated that there was a moderate, positive relationship between the prospective teachers' digital literacy levels and their lifelong learning tendencies. Ocak, Çengelci and Yurtseven (2022) found similar results – a moderately positive correlation between prospective teachers' digital literacy levels and their lifelong learning tendencies.

In terms of gender, I found that male teacher candidates' digital literacy levels were higher than those of female teacher candidates – a finding confirmed by other studies in the field (Çetin, 2016; Özerbaş & Kuralbayeva, 2018). Öztürk and Budak (2019) also concluded that the digital literacy assessment averages of male teacher candidates were significantly higher than the averages of female teacher candidates. In his research, Horne (2007) revealed that male students' computer usage levels were higher than those of female students. Based on this result, it is possible to say that men's high computer usage skills also lead to their high digital literacy.

The digital literacy levels of teacher candidates did not show a remarkable difference based on the departments that they studied in. Yazıcıoğlu, Yaylak and Genç (2020) also state that there was no distinction in teacher candidates' digital literacy levels according to their branch variable. Öztürk and Budak (2019) conclude that the department in which teacher candidates study and their daily internet usage time do not create a significant difference in their digital literacy assessments. Contrary to this research, Frye and Dornisch (2008) say that science and mathematics are the fields most prone to the use of technology. They state that teachers working in these fields use technology more than teachers in other fields, and that they are more competent in this regard.

According to the variable of the year of study, the digital literacy levels of teacher candidates in the third and fourth years were found to be higher than those of teacher candidates studying in the first and second years. Similarly, Gülmez (2024), in his research examining the digital literacy skills of teacher candidates, found that fourth-year teacher candidates had higher digital literacy skills than teacher candidates studying in other years. Sarıkaya (2019) also states that fourth-year prospective teachers have higher digital competencies than first-year prospective teachers.

When the gender variable was considered with regard to lifelong learning tendencies, it was shown that female teacher candidates had a higher lifelong

learning tendency than male teacher candidates. Kurt, Cevher and Arslan (2019) also revealed that female teacher candidates had a greater tendency towards lifelong learning than male teacher candidates. Jenkins (2004) explains the reason for women's high tendency towards lifelong learning as a result of keeping up with change, as they frequently encounter situations such as changing jobs and taking breaks in business life.

The variable of the department in which teacher candidates studied did not make a difference in their lifelong learning tendencies. Güzel (2017) found that there was no correlation between the department in which the teacher candidates studied and their lifelong learning tendencies. Oral and Yazar (2015) also present a similar result and emphasise that the variable of the teacher field in which the prospective teachers studied had no effect on their lifelong learning tendencies.

In addition, as the teacher candidates progressed from their first to their fourth year of study, their lifelong learning tendencies increased. Boyacı (2019) revealed that the scores of agent candidates regarding lifelong learning tendencies did not create a statistically remarkable difference according to the year level variable. Diker Coşkun and Demirel (2012) also examined the lifelong learning tendencies of university students in terms of various variables and stated that fourth-year students had higher lifelong learning tendencies.

Conclusion
In this research where the relationship between future teachers' digital literacy levels and their lifelong learning tendencies was evaluated based on data acquired from teacher candidates and faculty members, it was shown that there was a moderately positive linear relationship between teacher candidates' digital literacy levels and their lifelong learning tendencies. In terms of the gender variable, it was found that male teacher candidates had higher digital literacy levels than female candidates. The variable of the department in which teacher candidates studied did not affect their digital literacy levels. Accordingly the variable of the year of study, it was found that the digital literacy levels of teacher candidates in the third and fourth years were found to be higher than those of teacher candidates studying in their first and second years. The results further show that participating female teacher candidates' lifelong learning tendencies were higher than those of male candidates. Although the variable of the department in which the teacher candidates studied did not influence their lifelong learning tendencies, these tendencies increased as the students progressed in their years of study.

The majority of participating faculty members stated that prospective teachers' digital literacy levels were at a medium level, while they were of the opinion that the prospective teachers' lifelong learning tendencies were at a moderate level. Most of the faculty members expressed a similar opinion as the prospective teachers and stated that there was a moderate, positive correlation between the prospective teachers' digital literacy levels and their lifelong learning tendencies.

Recommendations
The results acquired from this research show a necessity of improving teacher candidates' digital literacy levels and lifelong learning tendencies. Considering the correlation between teacher candidates' digital literacy levels and lifelong learning tendencies, teacher training programmes in education faculties can be arranged accordingly. In addition, repeating the research with teacher candidates studying in other departments than those presented in this study will contribute to knowledge gain in this field.

References
Alpsülün M & Balıkçı HC 2024. Okul yöneticilerinin yaşam boyu öğrenme eğilimleri ile dijital okuryazarlık düzeylerinin incelenmesi [Investigation of the lifelong learning dispositions and digital literacy levels of school administrators]. *Eğitim ve İnsani Bilimler Dergisi: Teori ve Uygulama*, 15(29):131–154. https://doi.org/10.58689/eibd.1415279

Anthonysamy L, Koo AC & Hew SH 2020. Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning. *Education and Information Technologies*, 25:2393–2414. https://doi.org/10.1007/s10639-020-10201-8

Bay DN 2021. Okul öncesi öğretmen adaylarinin dijital okuryazarlik düzeyleri [Digital literacy levels of preschool teacher candidates]. *Mustafa Kemal Üniversitesi Eğitim Fakültesi Dergisi*, 5(7):172–187. Available at https://dergipark.org.tr/en/pub/mkuefder/issue/63331/937574. Accessed 1 October 2024.

Bergdahl N, Nouri J & Fors U 2020. Disengagement, engagement and digital skills in technology-enhanced learning. *Education and Information Technologies*, 25:957–983. https://doi.org/10.1007/s10639-019-09998-w

Boyacı Z 2019. Öğretmen adaylarının yaşam boyu öğrenme eğilimleri ile dijital okuryazarlık düzeyleri arasındaki ilişki (Düzce Üniversitesi örneği) [The relationship between teacher candidates' lifelong learning tendencies and digital literacy levels (Düzce University example)]. Master's thesis. Sakarya, Türkiye: Sakarya University. Available at https://www.proquest.com/openview/62ee7e1f9aba2448c685cca422cb4704/1?pq-origsite=gscholar&cbl=2026366&diss=y. Accessed 26 April 2024.

Bundy A (ed.) 2004. *Australian and New Zealand information literacy framework: Principles, standards and practice* (2nd ed). Adelaide, Australia: Australian and New Zealand Institute for Information Literacy. Available at https://adbu.fr/wp-content/uploads/2013/02/Infolit-2nd-edition.pdf. Accessed 1 October 2024.

Çetin O 2016. Examining the digital literacy levels of undergraduate science education and pedagogical formation programme preservice teachers. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, 18(2):658–685. https://doi.org/10.17556/jef.01175

Coyne IT 1997. Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries? *Journal of Advanced Nursing*, 26(3):623–630. https://doi.org/10.1046/j.1365-2648.1997.t01-25-00999.x

Demir O, Aktı Aslan S & Demir M 2022. Examining the relationship between teachers' lifelong learning tendencies and digital literacy levels. *Journal of Education Technology & Online Learning*, 5(2):379–392. https://doi.org/10.31681/jetol.1034697

Demiralp D & Kazu H 2017. Comparison of effective lifelong learning levels of pre-service teachers in terms of various variables. *Inonu University Journal of the Faculty of Education*, 18(3):71–85. https://doi.org/10.17679/inuefd.354234

Diker Coşkun Y & Demirel M 2012. Üniversite öğrencilerinin yaşam boyu öğrenme eğilimleri [Lifelong learning tendencies of university students]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 42(42):108–120. Available at https://dergipark.org.tr/en/pub/hunefd/issue/7794/102006. Accessed 10 October 2024.

Ding L, Velicer WF & Harlow LL 1995. Effects of estimation methods, number of indicators per factor, and improper solutions on structural equation modeling fit indices. *Structural Equation Modeling: A Multidisciplinary Journal*, 2(2):119–143. https://doi.org/10.1080/10705519509540000

Ertaş S 2022. Pandemi sürecinde yaşam boyu öğrenme yeterlikleri ve öz-yeterlik algıları bağlamında İngilizce öğretmenlerinin e-öğrenmeye hazırbulunuşluklarının incelenmesi [Examining the readiness of English teachers for e-learning in the context of lifelong learning competencies and self-efficacy perceptions during the pandemic]. Master's thesis. Bartın, Türkiye: Bartin University. Available at https://acikerisim.bartin.edu.tr/handle/11772/16062. Accessed 30 September 2024.

Eshet-Alkalai Y 2004. Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, 13(1):93–106. Available at https://www.learntechlib.org/primary/p/4793/. Accessed 26 April 2024.

Falloon G 2020. From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development*, 68:2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Field J & Leicester M (eds.) 2003. *Lifelong learning: Education across the life span*. New York, NY: Psychology Press.

Finsterwald M, Wagner P, Schober B, Lüftenegger M & Spiel C 2013. Fostering lifelong learning – Evaluation of a teacher education program for professional teachers. *Teaching and Teacher Education*, 29:144–155. https://doi.org/10.1016/j.tate.2012.08.009

Frye NE & Dornisch MM 2008. Teacher technology use and student evaluations: The moderating role of content area. *Journal of Educational Technology Systems*, 36(3):305–317. https://doi.org/10.2190/ET.36.3.g

Garzón Artacho E, Martinez TS, Ortega Martin JL, Marín Marín JA & Gómez García G 2020. Teacher training in lifelong learning—The importance of digital competence in the encouragement of teaching innovation. *Sustainability*, 12(7):2852. https://doi.org/10.3390/su12072852

Gökbulut B 2021. Öğretmenlerin dijital okuryazarlık düzeyleri ile hayat boyu öğrenme eğilimlerinin incelenmesi [Examination of teachers' digital literacy levels and life long learning tendencies]. *Yükseköğretim ve Bilim Dergisi*, 11(3):469–479. https://doi.org/10.5961/jhes.2021.466

Gui M & Argentin G 2011. Digital skills of internet natives: Different forms of digital literacy in a random sample of northern Italian high school students. *New Media & Society*, 13(6):963–980. https://doi.org/10.1177/1461444810389751

Güleç İ, Çelik S & Demirhan B 2012. Yaşam boyu öğrenme nedir? Kavram ve kapsamı üzerine bir değerlendirme [What is lifelong learning? An evaluation on definition and scope]. *Sakarya University Journal of Education*, 2(3):34–48. Available at https://dergipark.org.tr/en/pub/suje/issue/20631/219952. Accessed 26 April 2024.

Gülmez R 2024. Sosyal bilgiler öğretmen adaylarının dijital okuryazarlık becerilerinin incelenmesi [Examination of digital literacy skills of social studies teacher candidates]. *International Journal of Values in Education and Society*, 2(1):37–47. https://doi.org/10.5281/zenodo.10456469

Güzel H 2017. Öğretmen adaylarının yaşam boyu öğrenme eğilimlerinin incelenmesi [Lifelong learning tendency investigations of prospective teachers]. *Uluslararası Eğitim Bilimleri Dergisi*, 10:312–325. Available at https://dergipark.org.tr/en/pub/inesj/issue/40034/476094. Accessed 29 September 2024.

Hatlevik OE 2010. How to identify and understand digital literacy among 9th grade Norwegian students: Examining the influences from school and home on students' digital literacy. *Nordic Journal of Digital Literacy*, 4(3-4):159–174. https://doi.org/10.18261/ISSN1891-943X-2009-03-04-04

Horne J 2007. Gender differences in computerized and conventional educational tests. *Journal of Computer Assisted Learning*, 23(1):47–55. https://doi.org/10.1111/j.1365-2729.2007.00198.x

Jenkins A 2004. *Women, lifelong learning and employment*. London, England: Center for the Economics of Education, London School of Economics and Political Science. Available at https://eprints.lse.ac.uk/19467/1/Women,_Lifelong_Learning_and_Employment.pdf. Accessed 26 April 2024.

Jimoyiannis A & Gravani M 2010. Digital literacy in a lifelong learning programme for adults: Educators' experiences and perceptions on teaching practices. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, 1(1):40–60. Available at https://www.researchgate.net/profile/Athanassios-Jimoyiannis/publication/303421166_Digital_Literacy_in_a_Lifelong_Learning_Programme_for_Adults_Educators'_Experiences_and_Perceptions_on_Teaching_Practices/links/57f65da708ae91deaa5ec149/Digital-Literacy-in-a-Lifelong-Learning-Programme-for-Adults-Educators-Experiences-and-Perceptions-on-Teaching-Practices.pdf. Accessed 29 November 2024.

Kajee L 2018. Teacher education students engaging with digital identity narratives. *South African Journal of Education*, 38(2):Art. # 1501, 9 pages. https://doi.org/10.15700/saje.v38n2a1501

Kaya HE 2014. Yaşam boyu öğrenme ve Türkiye [Lifelong learning and Turkey]. *Ankara University Journal of Faculty of Education Sciences (JFES)*, 47(1):81–102. https://doi.org/10.1501/Egifak_0000001318

Keskin I 2023. The relationship between teacher candidates' lifelong learning tendencies and their digital competencies. *Asian Journal of Education and Training*, 9(3):66–74. https://doi.org/10.20448/edu.v9i3.4951

Kilag OKT, Malbas MH, Miñoza JR, Ledesma MMR, Vestal ABE & Sasan JMV 2024. The views of the faculty on the effectiveness of teacher education programs in development lifelong learning competence. *European Journal of Higher Education and Academic Advancement*, 1(2):92–102. Available at https://journal.silkroad-science.com/index.php/EJHEAA/article/view/106. Accessed 27 April 2024.

Knobel M & Lankshear C 2006. Discussing new literacies. *Language Arts*, 84(1):78–86.

Kurt E, Cevher TY & Arslan N 2019. Türkçe öğretmen adaylarının yaşam boyu öğrenme eğilimleri [Pre-service Turkish teachers' tendencies towards lifelong learning]. *Trakya Eğitim Dergisi*, 9(1):152–160. https://doi.org/10.24315/tred.473391

Labadi S 2014. UNESCO World Heritage Convention (1972). In C Smith (ed). *Encyclopedia of global archaeology*. New York, NY: Springer. https://doi.org/10.1007/978-1-4419-0465-2_1039

Lawshe CH 1975. A quantitative approach to content validity. *Personnel Psychology*, 28(4):563–575. https://doi.org/10.1111/j.1744-6570.1975.tb01393.x

Leu DJ, Jr, Kinzer CK, Coiro JL & Cammack DW 2004. Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In RB Ruddell & NJ Unrau (eds). *Theoretical models and processes of reading* (5th ed). Newark, DE: International Reading Association. Available at https://www.researchgate.net/profile/Julie-Coiro/publication/265628542_Toward_a_Theory_of_New_Literacies_Emerging_From_the_Internet_and_Other_Information_and_Communication_Technologies/links/55afafbc08ae11d310398169/Toward-a-Theory-of-New-Literacies-Emerging-From -the-Internet-and-Other-Information- and-

Communication-Technologies.pdf. Accessed 27 April 2024.

Liu Y & Liu Q 2021. Factors influencing teachers' level of digital citizenship in underdeveloped regions of China. *South African Journal of Education*, 41(4):Art. #1886, 17 pages. https://doi.org/10.15700/saje.v41n4a1886

Lock J, Lakhal S, Cleveland-Innes M, Arancibia P, Dell D & De Silva N 2021. Creating technology-enabled lifelong learning: A heutagogical approach. *British Journal of Educational Technology*, 52(4):1646–1662. https://doi.org/10.1111/bjet.13122

Marshall C & Rossman GB 2016. *Designing qualitative research* (6th ed). Thousand Oaks, CA: Sage.

Martin A 2005. DigEuLit –a European framework for digital literacy: A progress report. *Journal of eLiteracy*, 2(2):130–136. Available at https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=7e9ba99227c94e610b9ff2a6ee08c187c179dc25. Accessed 27 April 2024.

Mercader C & Gairín J 2020. University teachers' perception of barriers to the use of digital technologies: The importance of the academic discipline. *International Journal of Education Technology in Higher Education*, 17:4. https://doi.org/10.1186/s41239-020-0182-x

Miles MB & Huberman AM 1994. *Qualitative data analysis: An expanded sourcebook* (2nd ed). Thousand Oaks, CA: Sage.

Monette DR, Sullivan TJ & De Jong CR 1990. *Applied social research: Tool for the human services* (2nd ed). London, England: Harcout Brace Jovanovich College.

Ng W 2011. Why digital literacy is important for science teaching and learning. *Teaching Science*, 57(4):26–32.

Ocak G, Çengelci S & Yurtseven R 2022. Öğretmenlerin dijital okuryazarlık beceri düzeyleri ile yaşam boyu öğrenme eğilimleri arasındaki ilişkinin incelenmesi: Afyonkarahisar Örneklemi [Examining the relationship between teachers' digital literacy skill levels and lifelong learning tendencies (Afyonkarahisar Sample)]. *Uluslararası Sosyal Bilimler Eğitimi Dergisi*, 8(1):123–155. https://doi.org/10.47615/issej.1103143

Ojobor RC, Babarinde ET & Ezeh GS 2021. Assessing the impact of collaboration in improving students' information literacy skills in the digital environment. *Global Review of Library and Information Science (GRELIS)*, 17(2):1–15. Available at https://www.researchgate.net/profile/Rebecca-Ojobor/publication/356503711_Assessing_the_Impact_of_Collaboration_in_Improving_Students'_Information_Literacy_Skills_in_the_Digital_Environment/links/619e4fdb4fe4ea1cea9944aa/Assessing-the-Impact- of-Collaboration-in-Improving-Students-Information-Literacy-Skills-in- the-Digital-Environment.pdf. Accessed 27 April 2024.

Oral B & Yazar T 2015. Examining teacher candidates' perceptions of lifelong learning according to various variables. *Electronic Journal of Social Sciences*, 14(52):1–11. https://doi.org/10.17755/esosder.72011

Organisation for Economic Co-operation and Development 1973. *OECD Observer, Volume 1973*

Issue 3. Paris, France: OECD Publishing. https://doi.org/10.1787/observer-v1973-3-en

Öteles ÜU 2020. A study on the examination of the relationship between lifelong learning tendency and digital literacy level. *European Journal of Education Studies*, 7(8):57–73. https://doi.org/10.46827/ejes.v7i8.3185

Özçiftçi M & Çakır R 2015. Öğretmenlerin yaşam boyu öğrenme eğilimleri ve eğitim teknolojisi standartlari özyeterliklerinin incelenmesi [Teachers' lifelong learning trends and self-efficiencies about the educational technology standards]. *Eğitim Teknolojisi Kuram Ve Uygulama*, 5(1):1–19. https://doi.org/10.17943/etku.57410

Özerbaş MA & Kuralbayeva A 2018. Türkiye ve Kazakistan öğretmen adaylarının dijital okuryazarlık düzeylerinin değerlendirilmesi [A review of digital literacy levels of future primary-school and secondary-school teachers in Turkey and Kazakhstan]. *Muğla Sıtkı Koçman Üniversitesi Eğitim Fakültesi Dergisi*, 5(1):16–25. https://doi.org/10.21666/muefd.314761

Özoğlu C & Kaya E 2021. Z kuşağı öğretmen adaylarının yaşam boyu öğrenmeleri ve dijital okuryazarlıkları arasındaki ilişki [Analysis of the relationship between the lifelong learning and digital literacy of generation Z teacher candidates]. *Anadolu Journal of Educational Sciences International*, 11(1):415–437. https://doi.org/10.18039/ajesi.824040

Öztürk Y & Budak Y 2019. Öğretmen adaylarinin kendilerine yönelik dijital okuryazarlik değerlendirmelerinin incelenmesi [Research on preservice teachers' own perception of digital literacy]. *Kesit Akademi Dergisi*, 5(21):156–172. Available at https://dergipark.org.tr/en/pub/kesitakademi/issue/59817/863676. Accessed 27 April 2024.

Park H, Kim HS & Park HW 2021. A scientometric study of digital literacy, ICT literacy, information literacy, and media literacy. *Journal of Data and Information Science*, 6(2):116–138. https://doi.org/10.2478/jdis-2021-0001

Sandelowski M 2000. Combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed-method studies. *Research in Nursing & Health*, 23(3):246–255. https://doi.org/10.1002/1098-240X(200006)23:3<246::AID-NUR9>3.0.CO;2-H

Sarıkaya B 2019. Türkçe öğretmeni adaylarının dijital okuryazarlık durumlarının çeşitli değişkenler açısından değerlendirilmesi [Evaluation of digital literacy status of prospective Turkish teachers in terms of various variables]. *Uluslararası Sosyal*

Araştırmalar Dergisi, 12(62):1098–1107. https://doi.org/10.17719/jisr.2019.3122

Schermelleh-Engel K, Moosbrugger H & Müller H 2003. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychology Research Online*, 8(2):23–74. Available at https://www.stats.ox.ac.uk/~snijders/mpr_Schermelleh.pdf. Accessed 27 April 2024.

Seals CD, Clanton K, Agarwal R, Doswell F & Thomas CM 2008. Lifelong learning: Becoming computer savvy at a later age. *Educational Gerontology*, 34(12):1055–1069. https://doi.org/10.1080/03601270802290185

Smyrnova-Trybulska E 2013. E-learning & lifelong learning. In E Smyrnova-Trybulska (ed). *E-learning and lifelong learning: Monograph*. Katowice, Poland: Studio Noa. Available at https://core.ac.uk/download/pdf/197755702.pdf. Accessed 27 April 2024.

Strauss A & Corbin J 1990. *Basics of quality research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Techataweewan W & Prasertsin U 2018. Development of digital literacy indicators for Thai undergraduate students using mixed method research. *Kasetsart Journal of Social Sciences*, 39(2):215–221. https://doi.org/10.1016/j.kjss.2017.07.001

Vélez AP, Olivencia JJL & Zuazua II 2017. The role of adults in children digital literacy. *Procedia - Social and Behavioral Sciences*, 237:887–892. https://doi.org/10.1016/j.sbspro.2017.02.124

Yazıcıoğlu A, Yaylak E & Genç G 2020. Okulöncesi ve sınıf öğretmen adaylarının dijital okuryazarlık düzeyleri [Digital literacy levels of prospective preschool and primary school teachers]. *Sosyal Bilimler Araştırmaları Dergisi*, 10(2):274–286. Available at https://dergipark.org.tr/en/pub/odusobiad/issue/56076/686913. Accessed 26 September 2024.

Yeşilyurt S & Çapraz C 2018. Ölçek geliştirme çalışmalarında kullanılan kapsam geçerliği için bir yol haritası [A road map for the content validity used in scale development studies]. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, 20(1):251–264. https://doi.org/10.17556/erziefd.297741

Yurdugül H 2005. *Ölçek geliştirme çalışmalarında kapsam geçerlik için indekslerinin kullanılması* [Using content validity indices in scale development studies]. Paper presented at the XIV National Educational Sciences Congress, Denizli, Türkiye. Available at https://yunus.hacettepe.edu.tr/~yurdugul/3/indir/PamukkaleBildiri.pdf. Accessed 27 April 2024.