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The Mediating Role of Digital Literacy between Lifelong Learning Tendency and 21st Century Skills

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The rapid growth of technology accompanied new requirements in all aspects of life. The constant flow of information and the irresistible rise of technology gave rise to 21st-century skills, digital literacy, and lifelong learning concepts which are all in the spotlight of several organizations, policymakers, and researchers. Due to the increasing accessibility of technology, people, each day, feel the need to adapt to this new pace of life. Thus, teachers not only should be aware of their students' needs but also be equipped with the qualifications the current age entails. With this in mind, in this paper, the researchers studied the mediating role of digital literacy between teachers' lifelong learning tendency and their 21st-century skills. The sample consists of 273 randomly selected teachers. The researchers used three different multifactor data collection tools. In addition to the acceptable validity and reliability results, the findings indicate varying degrees of positive correlations among the factors of the data collection tools. The outputs also indicate that participants' lifelong learning tendencies were at a low, but digital literacy and 21st-century skills were at a medium level. Moreover, while lifelong learning tendency directly affects 21st-century skills, ethics and responsibility act as a mediator between lifelong learning tendency and 21st-century skills.

Introduction

Recently, society got acquainted with Information and Communication Technologies (ICT) making the way for various changes in social, economic, and educational areas. The advent of ICT has brought many changes in educational plans, which need to be adjusted to the educational practices dominated by digital practices (Arzola Franco, Loya Ortega & González Ortiz, 2016). Preparing individuals to get accustomed to professional and daily life, and new developments in accordance with the needs of age is a significant challenge for humanity (Trilling & Fadel, 2009). Focusing on learning to adapt to advances in technology

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and developing the necessary skills, catching the opportunities for change, and being eager to alter the steady course of life and work are more crucial than ever (Poquet & de Laat, 2021). Therefore, it is getting more and more important for individuals to acquire contemporary skills required by the century, such as lifelong learning, digital literacy, and 21st-century skills. For that reason, The Organization for Economic Co-operation and Development (OECD), in its international survey on teaching and learning, states that teachers should be lifelong learners (OECD, 2014, p. 5).

Thinking that 21st-century skills, lifelong learning, and digital literacy are interrelated, and that today's teachers are teaching 21st-century students (Yalçın İncik, 2020) the need for teachers with these skills and competencies is greater than ever.

Lifelong Learning

The need for up-to-date knowledge and everyday learning is a cross-the-board (Komşu, 2017). Therefore, individuals should always renew themselves to improve their living standards, which leads to the idea of "lifelong learning" (Şenel & Gençoğlu, 2003).

The idea of lifelong learning has been available in OECD and UNESCO reports since the 1970s and has begun to stand out in several studies (Akbaş & Özdemir, 2002; Wain, 2000). For instance, European Union (EU) member countries have been discussing lifelong learning since the 1980s (Turkish Statistical Institute, 2012). On the other hand, in Turkey, lifelong learning has been on the agenda conceptually since the 2000s, and accordingly, the Directorate General for Lifelong Learning was founded by the Ministry of National Education in 2018 (MoNE Directorate General for Lifelong Learning, 2018).

Lifelong learning, an approach referring to individuals' involvement in learning activities at every stage of their lives, and their continuous self-improvement (UNESCO, n.d.), basically focuses on three purposes, which are ensuring the personal development of the individual by creating opportunities for learning, realizing social integration, and ensuring economic growth (Güleç, Çelik & Demirhan, 2012). Therefore, by cooperating in all areas where learning takes place, it will be possible to create awareness in individuals that learning continues throughout life and to create active and participatory citizens who renew and develop themselves accordingly (Güler, 2004). In this context, individuals are expected to acquire personal and professional skills and competencies (Hammer, Chardon, Collins & Hart, 2012; Heinrich, Bhattacharya & Rayudu, 2007).

Digital Literacy

The growth of technology has highlighted the professional position of teachers (Li & Yu, 2022) since the world of technology, with its ever-developing structure, requires acquiring some new communication skills, and using the media and technological tools effectively with a sense of responsibility to catch up with its pace. As a consequence, the developments in technology have led to the emergence of digital literacy (Kurt et al., 2013). For Covello and Lei (2010), digital literacy is a general term for some integrated sub-disciplines or "literacies" like "Information Literacy", "Computer Literacy", "Media Literacy", "Communication Literacy" and "Visual Literacy". According to Tornero (2004) digital literacy is "the acquisition of the technical competence for using information and communication technologies, understood in a broad sense, in addition to the acquisition of the basic practical and intellectual capacities for individuals to completely develop themselves in the information society" (p. 29). Digital literacy is about skills such as understanding, using,

evaluating, and solving problems encountered with data accessed from different sources in computer or online environments (Gilster, 1997). In Turkey, digital competence can be described as "...the safe and critical use of information society technologies for work, daily life and communication..." (MYK. (Mesleki Yeterlilik Kurumu [Vocational Qualifications Authority of Türkiye]), 2015). Combining all, people with digital literacy should (Ng, 2012; Reddy, Sharma & Chaudhary, 2020):

- Carry out basic computer-based operations and effectively search, identify, and evaluate resources needed in daily life.
- have broad knowledge about the efficient and effective use of ICT technologies.
- pay attention to personal privacy while using technology, protect themselves from possible harm, and communicate suitably with other people on digital platforms.
- be self-motivated to search and exchange information, discover new abilities, and improve oneself.
- be able to select the most appropriate technological tools or use their features to complete tasks, solve problems, or develop new products.

21st Century Skills

In the 21st century, people need various skills more than knowledge in specific subjects or previous knowledge (Cevik & Senturk, 2019). Knowledge has become so vital in the 21st century that people should have skills known as 21st-century skills to get a proper job. Therefore, in the 2000s, the idea gained importance in the educational community. Projects promoted by the OECD, large ICT businesses, and the EU have identified these skills and competencies so that school curricula can better meet the needs of society (Voogt & Roblin, 2012).

The Partnership for 21st Century Skills (Partnership for 21st Century Learning, 2015), formed by various institutions in the US and widely recognized, provides a list of 11 skills under 3 groups, which are learning and innovation skills, information, media and technology skills, and life and career skills. Taking the literature into account, one can conclude that 21st-century skills cover cooperation, adaptation, communication, digital literacy, citizenship, dealing with a problem, critical reasoning, originality, curiosity, social responsibility, reasoning and risk-taking, effective use of information tools and producing high-quality products (Önür & Kozikoğlu, 2019; Voogt & Roblin, 2012).

Method

Research Design

This is a correlational survey dealing with the correlations among teachers' digital literacy skills, their perceptions of 21st-century skills, and lifelong learning. The correlational survey gives information about the direction and amount of the correlation between variables (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2010). In other words, it investigates whether the hypothesized relations exist (Lau, 2016) and studies the extent to which the research variables are related (Seeram, 2019).

The paper also intends to reveal the mediating role of digital literacy between teachers' lifelong learning tendency and their 21st-century skills. Mediation analysis is a significant research model revealing whether the effect of independent variable on the dependent variable

can be explained by third or even fourth variables (Fiedler, Schott & Mesier, 2011). The idea behind mediation analysis is to reveal the structure through which the variables relate (Fairchild & McDaniel, 2017).

Participants

The participants are teachers teaching at state schools in the central Anatolia region. The research data were gathered through convenience sampling method before the fall semester of 2023-2024 school year began, while teachers were on summer holiday. In other words, the research data were collected in August 2023, by reaching the participants through telephone, e-mail and social media.

There may be various reasons to adopt convenience sampling such as being a cheaper and quick way to collect data, not well-defined populations, easy participant accession, lack of time and so on (Etikan, Musa & Alkassim 2015; Golzar, Noor & Tajik, 2022). However, this method of sampling has some drawbacks like biases or systematic errors (Golzar et al., 2022). Therefore, researchers choosing this sampling method are advised to be cautious.

Collecting data from teachers is a hard task. Most of the time participants are reluctant to fill out the data collection tools. They may choose the same option for all of the research questions, and they consider participating in the research as a waste of time. In addition, since the data for this paper was collected through Google Forms while teachers were on summer holiday there was no way except for the convenience sampling method. That's why, the researchers, in this paper, adopted this method due to easy access and data collection costs and time restrictions. Table 1 below has the demographic data.

Table 1. Demographic data of the participants

		n	%
Gender	Male	141	51.6
	Female	132	48.4
Job Seniority (Years)	1-5	11	4
	6-10	21	7.7
	11-15	42	15.4
	16-20	58	21.2
	21-25	75	27.5
	26+	66	24.2

Data Collection Tools and Data Collection Process

The data have been gathered utilizing the "Digital Literacy Scale, Lifelong Learning Tendency Scale, 21st Century Skills Scale, and the demographic information form", which included gender and professional seniority, developed by the researchers.

"The Digital Literacy Scale" developed by Bayrakcı (2020) for his doctoral dissertation has 29 items and 6 factors called "Ethics and Responsibility, Social Dimension, Daily Usage, Privacy-Security, Advanced Production and General Knowledge and Functional Skills" in 5-point Likert type. The responses are "Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree". High participant scores from the scale show a high digital literacy. Alpha value for the original scale is 0.91. In this research, unlike the original form "Advanced Production" and "General Knowledge and Functional Skills" factors, which were not considered to be directly related to teachers, were omitted. Therefore, the structure of the scale was re-tested. The outputs of the CFA to test whether the structure was confirmed with

4 factors and 19 items, showed that the scale had good fit values [χ^2 = 364.77 (sd = 143, p = .000), χ^2/sd = 2.55; CFI = .91; RMSEA = .076; GFI = .88].

The second data-gathering tool employed in the paper is the "Lifelong Learning Tendency Scale" developed by Diker Coşkun (2009). The 5-point Likert scale has 4 factors called "Motivation, Perseverance, Lack of Regulating Learning, Lack of Curiosity" and 27 items. Cronbach's alpha for the 27-item scale is .89. In this research the "Perseverance" factor was omitted, and the data collection tool was used as 20 items. However, in the analyses, item 12, in lack of curiosity factor, got high factor loading in more than one factor. Thus, the researchers decided to omit the item. As a result, the structure of the scale was tested and it came out that it had acceptable goodness of fit values [χ^2 = 402.430 (sd = 164, p = .000), χ^2/sd = 2.45; GFI = .87; CFI = .93; RMSEA = .073].

The third scale is the "21st Century Skills and Competences Scale" developed by Anagün, Atalay, Kılıç and Yaşar (2016). The five-point Likert scale, consisting of 3 factors called "Learning and Innovation Skills, Life and Career Skills, and Information, Media and Technology Skills" and 42 items, has "never, rarely, sometimes, often, always" response options. "Learning and innovation skills" factor has 16, "life and career skills" factor has 17, and "information, media and technology skills" factor has 8 items. However, in this research "Information, media, and technology skills" factor was omitted because of the fact that the digital literacy scale had resembling items for the same skill. The EFA and CFA indicated a different factorial structure from the original one. Omitting items with high factor loadings in more than one factor, the researchers got a new structure consisting of 3 factors and 23 items, and they named the factors as in the original scale. Consequently, "Life and career skills" factor has 9, "Learning skills" factor has 6, "Innovation skills" factor has 8 items. The fit values of the new structure is [χ^2 = 545.822 (sd = 224, p = .000), χ^2/sd = 2.43; GFI = .86; CFI = .92; RMSEA = .073].

To find reliability, researchers have used the alpha technique. Although there are no definite limits on how to interpret Cronbach's alpha value, the ranges specified by George and Mallery, (2019) were used (α < .5 Unacceptable, α > .5 Poor, α > .9 Excellent, α > .7 Acceptable). Cronbach's alpha values and interpretations for each scale and its factors are given below.

Table 2. Reliability of data collection tools

Scale & Factor	***α***	**Interpretation**
Innovation Skills	.90	Good
Learning Skills	.85	Good
Life and Career Skills	.93	Excellent
Total 21st Century Skills	.94	Excellent
Daily Usage	.79	Acceptable
Privacy and Security	.81	Good
Social Dimension	.80	Acceptable
Ethics and Responsibility	.84	Good
Total Digital Literacy	.89	Good
Lack of Regulating Learning	.90	Good
Lack of Curiosity	.91	Excellent
Motivation	.90	Good
Total Lifelong Tendency	.88	Good

The researchers got the necessary permissions via email from the developers of the scales. The data were gathered using Google Forms in August 2023.

Data Analysis

Data analysis was done using SmartPLS4 (Ringle, Wende & Becker, 2022). This study hypothesizes that digital literacy and its factors ("Ethics and Responsibility, Social Dimension, Daily usage, Privacy and Security") are mediators in the relationship between lifelong learning tendency and 21st-century skills. Since "Lifelong Learning Tendency Scale" and "the 21st Century Skills and Competences Scale" have 3 factors each, it would be confusing for readers to deal with the correlations and there would be a long list of hypotheses. That's why, in this research, although reliability and validity studies have been done for each of the factors, these two scales have been regarded as a whole. Accordingly, the hypotheses are as follows

H1: Lifelong learning tendency has a positive impact on 21st-century skills.
H2: Lifelong learning tendency has a positive impact on ethics and responsibility.
H3: Lifelong learning tendency has a positive impact on privacy and security.
H4: Lifelong learning tendency has a positive impact on daily usage.
H5: Lifelong learning tendency has a positive impact on the social dimension.
H6: Ethics and responsibility have a positive impact on 21st-century skills.
H7: Privacy and security have a positive impact on 21st-century skills.
H8: Daily usage has a positive impact on 21st-century skills.
H9: Social dimension has a positive impact on 21st-century skills.
H10: Privacy and security have a mediating effect on 21st-century skills.
H11: Social dimension has a mediating effect on 21st-century skills.
H12: Daily usage has a mediating effect on 21st-century skills.
H13: Ethics and responsibility have a mediating effect on 21st-century skills.

Multicollinearity, reliability, validity analysis

To find out the factorial structure of the scales the researchers did a final factor analysis using SmartPLS4, and during the analysis, one of the items (20) had to be omitted from the 21st century skills scale due to low factor loading (0.11). After omitting the item, the scale got its final form. Moreover, high factor loading indicates high correlations between the items in a factor. However, low factor loading indicates that the item can flip from one factor to another which obscures interpretability (Martinez, Marshall & Sechrest, 1998). Additionally, it is helpful to keep in mind that high reliability is also an indicator of high validity (Raykov & Grayson, 2003). Accordingly, in this paper, the factor loads of items in the research vary between 0.66 and 0.92. Table 3 has validity and reliability results.

Table 3. Reliability & Validity

21st Century Skills	ρc	AVE
Innovation Skills	0.911	0.681
Learning Skills	0.925	0.679
Life and Career Skills	0.936	0.655
Digital Literacy	ρc	AVE
Daily Usage	0.825	0.628
Privacy and Security	0.862	0.732
Social Dimension	0.822	0.555
Ethics and Responsibility	0.886	0.592
Lifelong Learning Tendency	ρc	AVE
Lack of Regulating Learning	0.947	0.751
Lack of Curiosity	0.942	0.629
Motivation	0.911	0.612

The composite reliability (ρc) is the ratio of true variance to observed variance (McDonald, 1999, as cited in Raykov, Gabler & Dimitrov, 2016). According to the literature, composite reliability values above 0.60 are satisfactory (Hair, Ringle & Sarstedt, 2011). "Average Variance Extracted" (AVE) which is an indicator of the explained variance of the construct (Zaiţ & Bertea, 2011) has been used for discriminant validity. Fornell and Larcker (1981) recommend that AVE for factors be greater than 0.50. It is clear from Table 4 above that the scales meet all the above-mentioned criteria.

On the other hand, multicollinearity is one of the major problems researchers commonly face. Multicollinearity, a type of interdependence, affects the right estimation of structural relationships in regression analyses (Farrar & Glauber, 1967). Although there are various suggestions to test multicollinearity, it is commonly offered that "Variance Inflation Factor" (VIF) results should be no greater than 5 (Daoud, 2017; Purwanto & Sudargini, 2021). VIF values of the items vary between 1.32 and 4.45. Accordingly, none of the scales are intercorrelated.

Moreover, discriminant validity, which shows how the construct differs from other constructs, is an important issue in any construct (Briones Peñalver, Bernal Conesa & de Nieves Nieto, 2018). There are different ways of determining discriminant validity in the literature. However, in this paper, Fornell-Larcker criterion, and the Heterotrait-Monotrait ratio (HTMT) have been utilized. Fornell-Larcker criterion suggests that the square root of AVE in latent variables is utilized for discriminant validity. According to the criterion, the square root of each AVE ought to be higher than other correlation values among the latent variables (Hair et al., 2011; Kwong & Wong, 2013). On the other hand, the HTMT approach puts forward that the ratio should be less than 0.85 (Yusoff, Peng, Razak & Mustafa, 2020). Taking both approaches into account, Table 4 and Table 5 below indicate that the data-gathering tools employed in the paper have discriminant validity.

Table 4. Fornell-Larcker Criterion

	Lack of Regulating Learning	Ethics and Responsibility	Privacy and Security	Daily Usage	Life and Career Skills	Lack of Curiosity	Motivation	Learning Skills	Social Dimension	Innovation Skills
Lack of Regulating Learning	**0.866**									
Ethics and Responsibility	-0.162	**0.769**								
Privacy and Security	-0.081	0.482	**0.855**							
Daily Usage	-0.042	0.584	0.563	**0.793**						
Life and Career Skills	-0.202	0.502	0.408	0.343	**0.810**					
Lack of Curiosity	0.670	-0.202	-0.168	-0.188	-0.143	**0.793**				
Motivation	0.091	0.281	0.275	0.339	0.467	-0.114	**0.782**			
Learning Skills	-0.068	0.371	0.334	0.329	0.698	-0.156	0.589	**0.824**		
Social Dimension	0.121	0.304	0.516	0.510	0.118	-0.070	0.326	0.276	**0.745**	
Innovation Skills	-0.059	0.353	0.267	0.273	0.616	-0.119	0.509	0.775	0.282	**0.825**

Table 5. Heterotrait-Monotrait ratio (HTMT)

	Lack of Regulating Learning	Ethics and Responsibility	Privacy and Security	Daily Usage	Life and Career Skills	Lack of Curiosity	Motivation	Learning Skills	Social Dimension	Innovation Skills
Lack of Regulating Learning										
Ethics and Responsibility	0.179									
Privacy and Security	0.126	0.554								
Daily Usage	0.113	0.674	0.673							
Life and Career Skills	0.206	0.550	0.454	0.384						
Lack of Curiosity	0.742	0.215	0.170	0.203	0.143					
Motivation	0.151	0.302	0.297	0.381	0.497	0.134				
Learning Skills	0.104	0.408	0.371	0.365	0.748	0.159	0.632			
Social Dimension	0.211	0.320	0.615	0.616	0.162	0.181	0.378	0.298		
Innovation Skills	0.074	0.388	0.306	0.319	0.665	0.137	0.553	0.838	0.310	

Results

Before testing the hypotheses of the research, some descriptive statistics and correlations are available in the tables below. The findings indicate that teachers' perceptions of 21st-century skills are high ($\bar{x}$=4.21; Std=0.48), while their lifelong learning tendencies are relatively below the average ($\bar{x}$=2.91; Std=0.61). Furthermore, the total scores the participants got from the digital literacy tendency scale are also on average ($\bar{x}$=3.96; Std=0.60). Considering the factors of the scales, teachers have high perceptions in ethics and responsibility ($\bar{x}$=4.39; Std=0.65), while they have moderate perceptions in the social dimension ($\bar{x}$=3.23; Std=0.94).

Table 6. Descriptive statistics for the data collection tools

	n	Min	Max	Mean	Std
21st Century Skills	273	3.00	5.00	4.21	.487
Ethics and Responsibility	273	1.00	5.00	4.39	.652
Social Dimension	273	1.00	5.00	3.23	.945
Daily Usage	273	1.00	5.00	4.02	.828
Privacy and Security	273	1.33	5.00	4.08	.800
Digital Literacy	273	1.47	5.00	3.96	.600
Lifelong Learning Tendency	273	1.65	5.00	2.91	.614

This research studies whether there is a statistically significant correlation among teachers' perceptions of digital literacy, lifelong learning tendency and 21st-century skills. Table 7 below the correlations.

Table 7. Correlations among digital literacy, lifelong learning tendency, and 21st-century skills

		1	2	3	4	5	6	7
1	21st Century Skills	1						
2	Ethics and Responsibility	.407	1					
3	Social Dimension	.264	.263	1				
4	Daily Usage	2.99	.526	.522	1			
5	Privacy and Security	.360	.465	.497	.539	1		
6	Digital Literacy	.429	.724	.775	.820	.750	1	
7	Lifelong Learning Tendency	.356	.278	.151*	.231	.208	.268	1

* p<.05

Table 7 shows positive and significant correlations among all the variables. The weakest correlation is between lifelong learning and the social dimension factor (r=.151). On the other hand, the strongest correlation is between digital literacy and the daily usage factor

(r=.82). Taking these findings into account, it is obvious that all the variables of the research could be included in the analyses for hypothesis testing. Accordingly, the structural model created as well as some guidelines designed regarding the model, and the output are all given below.

The structure has been evaluated employing R^2, Q^2, and β. The coefficient of determination (R^2) is of great importance since it is an indicator of the goodness of the model (Latif et al., 2020). The structural analysis deals with the relationships between variables, and the researchers employed the explained variance of the endogenous variables (R^2), the path coefficients (β), and their significance levels (Castro & Roldán, 2013; Gallardo-Vázquez & Isabel Sánchez-Hernández, 2014).

Table 8. Hypothesis testing

	β	Std	t	p	The Hypothesis
Lifelong learning tendency -> 21st-century skills	0.453	0.127	3.554	0.000	Supported
Lifelong learning tendency -> Ethics and responsibility	0.335	0.112	2.993	0.003	Supported
Lifelong learning tendency -> Privacy and security	0.314	0.101	3.093	0.002	Supported
Lifelong learning tendency -> Daily usage	0.372	0.114	3.254	0.001	Supported
Lifelong learning tendency -> Social dimension	0.316	0.100	3.164	0.002	Supported
Ethics and responsibility -> 21st-century skills	0.281	0.074	3.810	0.000	Supported
Privacy and security -> 21st-century skills	0.166	0.090	1.837	0.066	Not Supported
Daily usage -> 21st century skills	-0.037	0.078	0.470	0.638	Not Supported
Social dimension -> 21st century skills	-0.057	0.066	0.864	0.388	Not Supported
	R^2	Q^2			
21st Century Skills	0.428	0.299			
Ethics and responsibility	0.112	0.090			
Privacy and security	0.099	0.081			
Daily usage	0.138	0.118			
Social dimension	0.100	0.079			

(R^2) values of 0,1 or more are acceptable (Falk & Miller, 1992). Moreover, the predictive sample reuse technique (Q^2) which indicates the predictive validity (Akter, D'ambra & Ray, 2011) has been adopted. For a model to have predictive relevance Q^2 should be greater than 0 (Castro & Roldán, 2013). Path coefficients, in other words, (β), indicate the strength of correlations. Chin (1998) states that β values above 0.2 are acceptable, however, β values greater than 0.3 are ideal. Accordingly, taking β, Q^2 and R^2 values and the significance levels in Table 9 into account, the researchers tested the hypotheses below.

The outputs show that the effect of lifelong learning tendency on 21st-century skills was significant (β=0.453, p<0.05), the effect of lifelong learning tendency on ethics and responsibility was significant (β=0.335, p<0.05), the effect of lifelong learning tendency on privacy and security was significant (β=0.314, p<0.05), the effect of lifelong learning tendency on daily usage was significant (β=0.372, p<0.05), the effect of lifelong learning tendency on social dimension was significant (β=0.316, p<0.05), the effect of ethics and responsibility on 21st-century skills was significant (β=0.281, p<0.05), the effect of privacy and security on 21st-century skills was not significant (β=0.166, p>0.05), the effect of daily usage on 21st-century skills was not significant (β=-0.037, p>0.05), and the effect of social dimension on 21st-century skills was not significant (β=-0.057, p>0.05).

The researchers also studied the mediating role of digital literacy between participants' lifelong learning tendencies and 21st-century skills. A mediator is like a transmitter. It transmits the effect of the independent variable on the dependent variable in research (MacKinnon, Fairchild & Fritz, 2007) and mediation analysis aims to find out whether the data set used in particular research acts as a mediator (Iacobucci, 2008). In mediation analysis, the independent variable affects the mediator variable, and it affects the dependent variable which, in turn, results in a chain of relations. This chain of relations among the variables is the indirect effect of the independent variable on the dependent variable. The independent variable shows an effect on the dependent variable which is called the direct effect (MacKinnon & Fairchild, 2009). In this paper, the mediation analysis was employed to evaluate the mediating function of digital literacy and its factors (privacy and security, daily usage, social dimension, and ethics and responsibility) between lifelong learning tendency and 21st-century skills. Table 10 below shows the mediation analysis results.

Table 9. Mediation analysis results

Indirect effect							**The Hypothesis**
	β	Std	t	p	BI(2.5%;97.5%)		
Lifelong learning tendency -> Privacy and security -> 21st-century skills	0.052	0.034	1.537	0.124	-0.018	0.112	Not Supported
Lifelong learning tendency -> Daily usage -> 21st-century skills	-0.014	0.031	0.443	0.658	-0.075	0.047	Not Supported
Lifelong learning tendency -> Social dimension -> 21st-century skills	-0.018	0.023	0.780	0.436	-0.065	0.027	Not Supported
Lifelong learning tendency -> Ethics and responsibility -> 21st-century skills	0.094	0.041	2.277	0.023	0.033	0.172	Supported

Total effect (Lifelong learning tendency-> 21st-century skills)		**Direct effect (Lifelong learning tendency-> 21st-century skills)**	
β	p	β	p
0.567	0.000	0.453	0.000

Based on the findings, the mediating effect of privacy and security was not significant (H10: β =0.052, p = 0.124). The mediating effect of "daily usage" was not significant (H11: β =-0.014, p = 0.658). The mediating effect of the "social dimension" was also not significant (H12: β =-0.018, p = 0.780). On the contrary, the mediating effect of "ethics and responsibility" was significant (H13: β =0.094, p = 0.023). Taking Table 10 into consideration, it is possible to conclude that, in total, lifelong learning tendency mediates around 56% of 21st-century skills. Moreover, around 45% of 21st-century skills are directly mediated by lifelong learning tendency. Considering the indirect effects of lifelong learning tendency on 21st-century skills, although social dimension, daily usage, privacy and security are not significant mediators, ethics and responsibility significantly mediate 21st-century skills. Below is the path model.

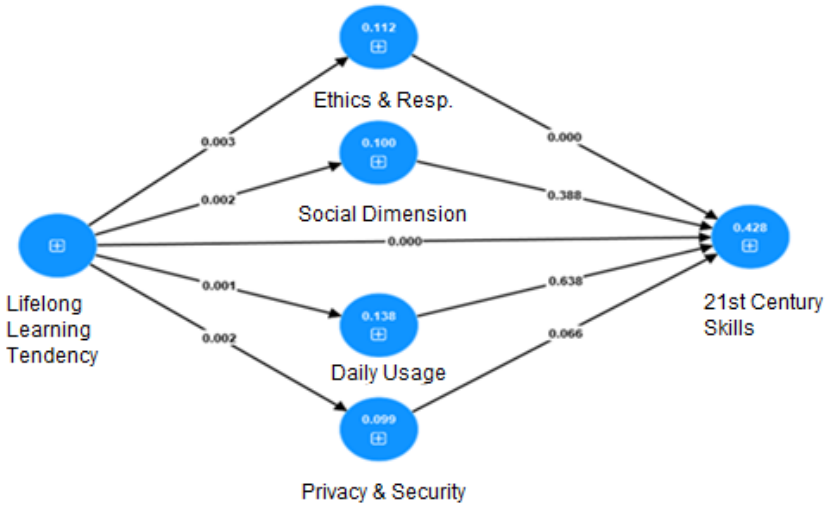

Figure 1. The path model

Discussion

The purpose of this research is to study the correlations among teachers' lifelong learning tendencies, 21st-century skills, and digital literacy levels. The outputs indicate that participants' lifelong learning tendencies were at a low, but digital literacy and 21st-century skills were at a medium level. According to the outputs, the effect of lifelong learning tendency on 21st-century skills, "ethics and responsibility", "privacy and security", "daily usage", and "social dimension" was significant. The effect of ethics and responsibility on 21st-century skills was significant even though the effect in terms of privacy and security on 21st-century skills was not significant. Similarly, the effect of daily usage on 21st-century skills and the effect of social dimension on 21st-century skills were not significant. The mediation analysis showed that the mediating role of digital literacy and its factors (privacy and security, daily usage, social dimension, and ethics and responsibility) between lifelong learning tendency and 21st-century skills was limited since only the mediating effect of ethics and responsibility was significant.

The literature reveals that the approach to defining digital skills has shifted from a technical orientation to a broader perspective that considers content-related or higher-level skills (Claro, Preiss, San Martín, Jara, Hinostroza, Valenzuela, Cortes & Nussbaum, 2012). A recent systematic review of academic literature identified 21st century digital skills as technical, information, communication, collaboration, creativity, critical thinking and problem solving (Van Laar, Helsper & Eynon, 2015). Although various components of digital skills have been identified in theory (Jara, Claro, Hinostroza, San Martín, Rodríguez, Ibieta & Labbé 2015; Siddiq, Gochyyev & Wilson, 2017; Van Deursen et al., 2015), which of these skills are influenced by which variables has not yet been sufficiently studied. Moreover, most of the articles on 21st century skills and digital skills define these skills at a conceptual level (Siddiq, Hatlevik, Olsen, Throndsen & Scherer, 2016). In the present study, the relationship between the variables that are thought to be related to digital literacy was tested. Since teachers are role models for their students, it is hoped that analysing the relationship between the skills they possess will contribute to the field of education.

Moreover, teachers' digital literacy is among the topics of interest. For example, research done in 2022 studied the relationship between English teachers' self-efficacy to integrate

technology, professional competencies and lifelong learning dispositions. As a result of the study, it was found that there was a positive relationship between English teachers' self-efficacy to integrate technology, professional competence and lifelong learning dispositions. It was concluded that teachers' technology integration, self-efficacy and professional competencies were predictors of their lifelong learning dispositions (Şen & Yıldız Durak, 2022). This finding is in line with the findings of the present study. Teachers must acquire the abovementioned skills which are important both to learn and teach. In this paper, a significant correlation came out between teachers' lifelong learning tendency and their digital literacy skills. There are similar findings in several studies done with teachers and teacher candidates in the literature as well (Demir, Aktı, Aslan & Demir, 2022; Gökbulut, 2021).

Digital literacy is a skill or competence that people should have to adapt to the new world or to access accurate and up-to-date information. Digital literacy is adapting to new or developing technologies, using the necessary methods and tools to reach the right information effectively both in real and virtual environments (Demir at all, 2022). It is related to information processing, using media and technological skills, and it is among the fundamental skills that people should have in the 21st century (Partnership For 21st Century Learning, 2019). According to Martzoukou, Fulton, Kostagiolas and Lavranos (2020), the need to develop digitally competent, literate, resourceful, skilled people in an ever-changing technological and online environment has been emphasized by different studies in recent years. Current definitions and perspectives in this area go beyond the use of technological tools or media to the creation of a digital literacy mindset that develops throughout one's life. This requires revisiting digital competencies with emphasis on the diversity of the contexts where it develops and of the learners involved, in the overall continuum of learning for life.

On the other side, lifelong learning skills include a sustainable approach under the title of "learning to learn". It is promising that this skill, which is expected to be possessed by World citizens gained through digital literacy, is associated with teachers and teacher candidates. One should always keep in mind that lifelong learning is neither a single-purpose nor a situational skill. Lifelong learning involves planned and purposeful learning requiring personal willingness and active participation (Smith & Spurling, 1999, as cited in Sogor, 2021). In this regard, the production-oriented approaches of the last century have been replaced by 21st-century skills due to economic and social developments (van Laar, van Deursen, van Dijk & de Haan, 2017).

A significant output of the paper is the mediating role of ethics and responsibility between lifelong learning tendency and 21st-century skills. This finding is not surprising considering that compliance with the principles of digital ethics by every individual, (Moor, 1985, as cited in Özbay, Doğan, Yıldız & Seferoğlu, 2021). Regarding teachers, it is essential to be able to access reliable information and resources, to protect intellectual property by proper quoting, and to be aware of digital ethics principles when using information technologies (Özbay et al., 2021).

Digital ethics are the rules that encourage the right behaviour in order not to harm others in technology-enhanced media, and to ensure the maintenance of the system for the best in all kinds of human actions on digital platforms (Özcan, 2021). On the other hand, people who can easily access information, who are aware of security problems and his/her responsibilities, who maintain conscious behaviour in the digital environment and act considering ethical rules are called digital citizens (Çubukçu & Bayzan, 2013). A digital citizen can communicate with people in a respectful and empathic manner on the Internet, distinguishes the accuracy and

validity of online information, protects himself/herself from misinformation, uses technology as a force for civic responsibility and goodness, organizes his/her online and offline activities in a way that s/he does not waste his/her time, and ensures his/her safety online and does not harm others (The International Society for Technology in Education, 2020). While it is essential for teachers to have these characteristics, it is also necessary for them to be role models for the students and to share the right information. Therefore, in light of all these explanations, the finding of the mediating role of digital ethics and responsibility between teachers' lifelong learning tendency and 21st-century skills is crucial and promising.

Conclusions and Recommendations

In brief, this paper has studied the correlations among teachers' digital literacy skills, their perceptions of 21st-century skills, and their lifelong learning tendencies. It has come out that participant teachers have lifelong learning tendencies and digital literacy skills, which are among the 21st-century learner and teacher characteristics. One should keep in mind that all these skills may be considered personality traits, indeed. In other words, people who are curious about technology or who follow technology more closely may also have higher digital literacy. Similarly, innovative individuals who are open to change may have more developed lifelong learning skills.

In addition to correlations between the variables, the ethics and responsibility factor of digital literacy was a mediator between lifelong learning and 21st-century skills. It can be concluded that these features, internationally emphasized as teaching qualifications, have become more important once they are combined with the concept of digital citizenship. Prospective studies can be designed with teachers who are eager to teach these skills to their students. Lastly, taking the research findings into account, the following recommendations can be made:

- Teachers should be encouraged to engage in self-motivated learning activities. Online courses, workshops and access to digital libraries can facilitate this process.
- To help teachers integrate digital literacy into their daily teaching practices, in-service training activities with practical applications and real-life scenarios should be organized. This hands-on approach is expected to make them more competent in using digital tools and resources effectively.
- To improve teachers' understanding of digital ethics and responsibility, training activities can be organized since teachers should be knowledgeable about ethical issues related to the use of technology, including privacy, security and intellectual property.
- Teachers should be role models for their students by demonstrating ethical behavior in their use of technology, including properly citing sources, protecting student data, and promoting a positive digital footprint.

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