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Digital Literacy Levels of Primary School Students: A Mixed-Methods Study

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Abstract

The increasing integration of digital technologies into educational settings has made it important to determine the students' levels of digital literacy. The aim of this study is to examine the digital literacy levels of fourth-grade primary school students in terms of various variables. In this study, an explanatory sequential design, one of the mixed-method approaches combining qualitative and quantitative research design, was employed. In the quantitative part of the study, a survey model was used, and 1390 students were reached through cluster sampling. The data were collected using a digital literacy scale. In the qualitative part of the study, the data were collected through semi-structured interviews conducted with 25 students who participated in the quantitative data collection process. Descriptive statistics, t-tests and one-way ANOVA were used in the analysis of the quantitative data, while qualitative data were analyzed through content analysis. According to quantitative findings, students had moderate level of digital literacy and there was no significant difference in the digital levels based on gender. However, students with internet access at home had higher levels of digital literacy. The qualitative data revealed that students mainly used digital tools for playing games, had insufficient technical knowledge, and possessed a basic level of understanding regarding privacy and security issues. Accordingly, it is recommended to increase practice-based activities in educational settings and develop programs aimed at improving students' digital skills in a multidimensional manner.

Keywords:

21st Century Skills, Digital Literacy, Mixed Methods, Primary School Students

Introduction

The advancement of information and communication technologies (ICT) and their widespread adoption across various domains, including education, healthcare, and communication, have brought significant changes to people's lives. The swift and ongoing progress of ICT technologies has made it essential for individuals to utilize a combination of technological knowledge, critical thinking, and social awareness to perform effectively and resolve issues in digital settings (Eshet-Alkalai, 2004). The demands of

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the digital age require individuals to develop a broad set of literacy skills to utilize modern technologies effectively and engage meaningfully in various aspects of contemporary life, including economic, social, and cultural domains. One of these literacy skills is digital literacy. It is seen as a vital skill for survival, allowing individuals to perform complex operations with ease and intuition within digital contexts (Eshet-Alkalai, 2012).

In its 2006 report, the European Parliament and the Council of the EU classified digital competence among the eight core competencies considered vital for lifelong learning (European Parliament & Council of the European Union, 2006). As a critical prerequisite for fostering creativity, innovation, and entrepreneurial thinking, digital literacy is essential; without it, people cannot actively participate in social life or gain the skills and knowledge required to thrive in the 21st century (European Commission, 2003, p. 3). Digital literacy was initially introduced as a term by Paul Gilster in his 1997 book, Digital Literacy. Gilster (1997) describes digital literacy as the capacity to comprehend, value, and utilize information presented in various digital formats accessible through computer technologies. According to the author, gaining digital literacy for effective Internet use necessitates the mastery of several fundamental competencies (1997, p. 2).

One of the common judgments about digital literacy today is that it encompasses a collection of interconnected skills and competencies essential for thriving in the digital era. To adjust effectively to the contemporary era, individuals must be able to utilize technological tools such as computers, tablets, televisions, and phones effectively (Özaydın & Kumral, 2021). Digital literacy is the ability to cope with the electronic infrastructures and tools that make the 21st-century world possible. It has also assumed a significant role in education due to various trends. The most important of these trends is the world's entry into the electronic domain (Martin, 2006). Similar to other social sectors, education is swiftly integrating electronic technologies. Our students need to learn how to properly access, evaluate, use, manage, and contribute to the vast amount of information and media available to them today (Trilling & Fadel, 2009).

In the 21st century, the education system plays a crucial role in the progress of societies by adapting to changing trends and embracing technological developments. Schools must provide students with subject-specific knowledge as well as twenty-first-century competencies necessary to respond to the demands of a swiftly evolving society (Kong, 2014; Chan, 2010). One of the essential skills to acquire in the digital age is digital literacy. The digital native generation especially those born in the 2000s and later, is highly active in using computers, phones or tablets (Boğa & Sağlam, 2021) and has a "native-like" command of the digital codes and conventions that govern computers, internet technologies, and gaming environments (Prensky, 2001). Regardless of whether we view young people as digital natives or not, it is not logical to think that they can develop their digital literacy without compatible learning programs (Fraillon et al., 2014, p.24). For this reason, providing digital literacy education to the digital generation, who live in close contact with technology, has been incorporated into the educational curricula and policies of numerous countries (Gökbulut, 2021). Many countries develop policies to increase the digital literacy levels of their citizens and carry out numerous studies by incorporating these skills into their educational programs. For example, Japan and South Korea both have broad-based access to social information and communication technologies as well as digital literacy strategies. At the same time, many countries, such as Canada, Australia, and the United Kingdom, have initiated studies to develop digital literacy (Murray & Pérez, 2014).

In Türkiye, the aim of educating individuals who can play a leading and effective role in the social and economic conditions of the age has necessitated the review of the implemented curricula. The Ministry of National Education included in its curriculum (2018) the statements that "the rapid change in science and technology directly affects the changing needs of the individual and society" and listed the competencies that students will need to manage the responsibilities in their personal, social, academic, and professional lives in the Turkish Qualifications Framework. One of the eight key competencies included in the framework has been determined as "digital competence". The concept of digital competence was explained in the Ministery of National Education (MoNE) 2018 curriculum as "It covers the safe and critical use of information and communication technologies for business, daily life and communication." In 2024, within the scope of the Türkiye Century Education Model, MoNE aims to provide literacy types in a holistic and spiral structure. Digital literacy is one of the literacy types emphasized in these programs (MoNE, 2024).

It has become inevitable for young children to use information and communication technologies in today's conditions. While parents emphasize many scary claims that screen time can cause physical and mental harm to their children, they do not want to give up the opportunities, pleasures, and conveniences offered by digital media in their daily lives (Blum-Ross & Livingstone, 2018). Research shows that children's first encounter with digital technology begins in infancy (Günüç & Atlı, 2018; Shakya et al., 2023). According to Harsh et al. (2018), approximately 30.4% of children under the age of one year use mobile devices daily, and this rate increases to 48.5%

in children aged 2-3 years. This suggests that children exposed to technology at a noticeably early age should also develop digital literacy skills at a very young age. An examination of existing literature indicates the presence of research examining digital literacy levels of university students, teachers and teacher candidates (Abdollahyan & Ahmadi, 2011; Aksoy et al., 2021; Aslan, 2021; Ata & Yıldırım, 2019; Bay, 2021; Can et al., 2020; Doğan & Benzer, 2023; Gökbulut, 2021; Gülay Ogelman et al, 2021; Kaarakainen et al., 2018; Ocak & Karakuş, 2019; Kozan & Bulut Özek, 2019; List, 2019; Özerbaş & Kuralbayeva, 2018; Samani et al., 2019; Şahin & Kalkan, 2022; Uyar, 2021; Yontar, 2019) and middle school and high school students (Dinçer, 2012; Hatlevik & Christophersen, 2013; Inan Karagul et al., 2021; Jan, 2018; Pala & Başıbüyük, 2020; Ritzhaupt et al., 2013; Umar & Jalil, 2012; Zhong, 2011). Although digital competencies are skills emphasized in the programs implemented in schools, a review of the literature reveals that studies conducted on children studying at the primary school level are limited. This study reveals the digital literacy levels of 4th-grade students. The results are important for evaluating the effectiveness of the current education system in acquiring digital skills. Furthermore, the spread of technology brings digital risks with it. This study determines students' self-efficacy levels in the face of these risks. Investigating the digital literacy levels of 4th-grade students will provide data for preventive guidance services. In light of these considerations, this study focuses on analyzing the digital literacy levels of primary school students, taking into account various factors. The research questions are addressed as follows:

1. What are the digital literacy levels of primary school 4th-grade students?
2. Do the digital literacy levels of primary school 4th-grade students differ according to
   - Gender
   - Internet access
   - Daily Internet usage time
   - The type of digital device they own
3. What are the views of primary school 4th-grade students on digital literacy?

Method

Research Design

A mixed-methods approach was employed in the current study, examining the digital literacy levels of fourth-grade primary school students in relation to several variables. In the current study, the "explanatory sequential design" was employed among mixed-methods research designs. The basic logic behind this design is the use of "qualitative data" to help explain "quantitative results" (Creswell & Plano Clark, 2011). The survey model was preferred in the quantitative part of the study. Survey models describe existing situations or events as they are without making any changes (Tuncer, 2020). The case study design was used in the qualitative part of the study. The case study is conducted in a natural environment, providing a holistic interpretation of the events under investigation (Yıldırım & Şimşek, 2011).

Participants

A sample and study group were created to collect quantitative and qualitative data. The population of study consists of fourth-grade primary school students in the central districts of Kayseri. The study sample was determined using the "cluster sampling" method, a type of probability-based sampling. Cluster sampling involves the researcher collecting data from large groups that make up the population, called clusters, instead of collecting data from individual members of the population (Fraenkel et al., 2012). In this study, 11 primary schools representing the population and representing different socioeconomic levels were randomly selected, and all fourth-grade students attending these schools were included in the study. All of the selected primary schools are public schools located in central districts and have smart boards and internet access in their classrooms.

Table 1 shows the frequency and percentage distributions for the selected sample.

Table 1.
Demographic characteristics of the participants

		f	%
Gender	Female	684	49,2
	Male	706	50,8
Access to the Internet	Yes	1279	92,0
	No	111	8.0
Daily internet usage time	0-1 hour	65	4,7
	1-2 hours	806	58,0
	2-3 hours	302	21,7
	3 hours or more	217	15,6
Digital device ownership	Tablet	391	28,1
	Smartphone	776	55,8
	Computer	128	9,2
	None	95	6,8
Years of experience with the Internet	0-1 year	47	3,4
	1-2 years	349	25,1
	2-3 years	306	22,0
	3 years or more	688	49,5
TOTAL		1390	100

The study included 1390 fourth-grade primary school students. The sample consisted of 49% female and 50.8% male participants. While the rate of students with Internet connection was 92%, 8% did not have an Internet connection. When the daily Internet usage times were examined, it was seen that 4.7%

of the students used the Internet for 0-1 hour, 58% for 1-2 hours, 21.7% for 2-3 hours, and 15.6% for 3 hours or more. Among the devices preferred for internet use, smartphones were the most commonly used tool, with 55.8% of the students using them. Tablets were used by 28.1%, computers by 9.2%, and no device by 6.8%. When the distribution of participants in terms of Internet usage duration was examined, it was determined that 3.4% of them had been acquainted with the Internet within the last year, 25.1% had been using the Internet for 1-2 years, 22% for 2-3 years and 49.5% for 3 years or more.

The study group for the qualitative data consists of 25 fourth-grade students from primary school. These students were determined through maximum variation sampling. The students participated in the interview voluntarily. Fourteen of these students were male and eleven were female. The students were determined according to their daily Internet usage time. Six students reported using technology for 0-1 hour, 6 students for 1-2 hours, 7 students for 2-3 hours, and 6 students for 3-4 hours.

Data collection tool

In this study, the "Digital Literacy Scale", developed by Şahin et al. (2022), was used as the data collection tool. This scale, comprising a total of 16 items and three factors (purpose of use, technical knowledge, and privacy and security knowledge), employs a triple Likert-type rating system. The rating options are "Disagree = 1", "Partially Agree = 2", and "Agree = 3". The items on the scale were prepared to suit the language and comprehension level of primary school students, and necessary corrections were made by consulting a language expert to ensure the understandability of these items. The Cronbach's Alpha coefficient of the scale was originally 0.842, and within the scope of the research, the calculation of the Cronbach's Alpha coefficient, at 0.754, indicates that the scale has a reliable structure.

Qualitative data in the study were collected with a semi-structured interview form prepared by the researcher. Before preparing this form, the relevant literature was reviewed, and 16 questions were formulated, taking into consideration the research design. Afterwards, the opinions of three experts were sought to ensure internal validity. Necessary corrections were made to the interview form in accordance with the experts' opinions. The questions prepared were asked of five fourth-grade primary school students independently of the study group, and the clarity of the questions was tested. According to the results obtained from the pilot application, the interview form was finalized, and eight main questions were included in the final form.

Procedure

Quantitative data in the study were collected face-to-face from students in a classroom environment, and participation was completely voluntary. The researcher collected qualitative data, with interviews lasting 15-20 minutes. All participants were informed about the study before it began, and written consent was obtained from their families before data collection. No reward was given to the participants in the study, and no fee was paid.

Data analysis

In the first stage of data analysis, the conformity of the scales assessing the digital literacy levels of fourth-grade students to normal distribution was evaluated. For this purpose, skewness and kurtosis coefficients were calculated, and since the computed values were within the range of ±1.5, it was accepted that the data conformed to normal distribution. As a result, parametric tests were used in the data analysis, as the data provided evidence of normality.

Table 2.
Descriptive statistics of the digital literacy scale

Dimensions	Mean	Median	Mode	Sd	Skewness	Kurtosis
Intended Use	2,130	2,142	2,29	,355	-,025	-,253
Technical Knowledge	2,116	2,200	2,20	,504	-,084	-,780
Privacy and Security Knowledge	2,248	2,250	2,50	,515	-,348	-,617
Total Scale	2,155	2,187	2,19	,318	-,154	-,291

Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to analyze the demographic characteristics of the fourth-grade primary school students and their responses to the Digital Literacy Scale items. An independent sample t-test was used to evaluate whether the mean scores on the digital literacy scale differed significantly between genders and those with and without home Internet access. In addition, one-way ANOVA was used to examine whether the mean scores differed significantly in terms of daily digital device usage time, type of digital device owned, and duration of digital device usage.

Content analysis and descriptive analysis methods were used in qualitative data analysis. Content analysis scans the text for repetitive words or themes (Patton, 2014, p. 453). In descriptive analysis, direct quotations are frequently used to reflect the opinions of the interviewees (Yıldırım & Şimşek, 2011, p. 224). To protect the confidentiality of the participants, each student was assigned a code, denoted as S1, S2, and so on. To ensure reliability during the content analysis, the researcher and another expert in the field analyzed and coded the data separately. After the analyses were completed, the consistency between

the coding made by the researchers was calculated according to Miles and Huberman (1994), and the consistency between the coders was determined to be 87%. According to Yıldırım and Şimşek (2011), a consistency of over 70% of the researchers' opinions is sufficient for reliability. Accordingly, it can be said that reliability was achieved between the coders in the analysis of qualitative data in this study.

Findings

In this section, the data obtained regarding the digital literacy levels of primary school students are analyzed and presented. The descriptive statistics of the question "What are the digital literacy levels of primary school 4th grade students?" are presented in Table 3.

Table 3.
Arithmetic Mean and Standard Deviation of the Scores of primary school students regarding digital literacy

Dimensions	N	Min.	Max.	$\bar{X}$	Ss
Intended Use	1390	1,00	3,00	2,130	,355
Technical Knowledge	1390	1,00	3,00	2,116	,504
Privacy and Security Knowledge	1390	1,00	3,00	2,248	,515
Total scale	1390	1,06	2,94	2,155	,318

The findings presented in Table 3 indicate that 4th-grade primary school students have a moderate level of digital literacy ($\bar{x}$ = 2.155). The students have the highest average in the privacy dimension ($\bar{x}$ = 2.248) and the lowest average in the technical dimension of the scale. The average of the intended use dimension was calculated as 2.130.

An Independent Samples t-test was performed to determine whether students' digital literacy levels differ statistically based on gender. The results are shown in Table 4.

Table 4.
t-test results regarding the statistical differentiation of the digital literacy of the students according to their gender

Dimensions	Gender	N	$\bar{X}$	Ss	T	P
Intended Use	Male	684	2,132	,359	,227	,820
	Female	706	2,128	,351		
Technical Knowledge	Male	684	2,090	,484	-1,854	,064
	Female	706	2,140	,522		
Privacy and Security Knowledge	Male	684	2,223	,520	-1,823	,069
	Female	706	2,273	,510		
Total scale	Male	684	2,142	,311	-1,544	,123
	Female	706	2,168	,325		

As seen in Table 4, no significant change was found in participants' digital literacy levels based on their gender. In the "Intended use" dimension, the t-test result comparing male ($\bar{X}$ = 2.132) and female ($\bar{X}$ = 2.128) participants yielded a value of t = 0.227, p = 0.820, indicating that this difference is not statistically significant (p > 0.05). In the "technical knowledge" dimension, the difference between male ($\bar{X}$ = 2.090) and female ($\bar{X}$ = 2.140) participants was calculated as t = -1.854, p = 0.064. Since the p-value was not less than 0.05, it was not found to be statistically significant. In the Privacy dimension, the difference between male ($\bar{X}$ = 2.223) and female ($\bar{X}$ = 2.273) participants was calculated as t = -1.823, p = 0.069, and this difference is not statistically significant (p > 0.05). Finally, in the evaluation made on the Total Scale, the difference between male ($\bar{X}$ = 2.142) and female ($\bar{X}$ = 2.168) participants was found to be t = -1.544, p = 0.123, and this difference is not statistically significant.

Whether the digital literacy levels of the students differ according to their internet access was examined with an independent samples t-test, and the findings are presented in Table 5.

Table 5.
t-test results regarding the statistical differentiation of digital literacy levels of students according to their access to the internet

Dimensions	Access to the Internet	N	X	Ss	T	P
Intended Use	Yes	1279	2,132	,356	,922	,348
	No	111	2,100	,347		
Technical Knowledge	Yes	1279	2,122	,505	1,508	,132
	No	111	2,046	,497		
Privacy and Security Knowledge	Yes	1279	2,260	,512	2,805	,005
	No	111	2,117	,534		
Total scale	Yes	1279	2,161	,319	2,333	,020
	No	111	2,087	,300		

The results show that Internet access has a significant effect on the digital literacy levels of students. In the purpose dimension, the difference between students with internet access ($\bar{X}$ = 2.132) and those without Internet access ($\bar{X}$ = 2.100) was found to be t = 0.922, p = 0.348, indicating that this difference was not statistically significant (p > 0.05). In the technical dimension, the difference between students with Internet access ($\bar{X}$ = 2.122) and those without Internet access ($\bar{X}$ = 2.046) was calculated as t = 1.508, p = 0.132. This difference was also not statistically significant (p > 0.05). In the Privacy dimension, the difference between students with Internet access ($\bar{X}$ = 2.260) and students without Internet access ($\bar{X}$ = 2.117) was found to be t = 2.805, p = 0.005, and this difference is statistically significant (p < 0.05). This result suggests that internet access has a significant impact on the level of digital literacy

related to privacy. In the evaluation made on the Total Scale, the difference between students with internet access ($\bar{X}$ = 2.161) and students without internet access ($\bar{X}$ = 2.087) was found to be t = 2.333, p = 0.020, and this difference is also statistically significant (p < 0.05). This finding indicates that internet access has a significant impact on the overall digital literacy levels of students.

A one-way ANOVA test was conducted to determine the effect of students' daily Internet usage time on their digital literacy. The results are presented in Table 6.

In the ANOVA analyses, it was determined that the digital literacy levels of primary school students changed significantly according to the daily internet usage time. As seen in Table 6, the highest average was observed in students who used the Internet for 2-3 hours across all sub-dimensions and the total score of the scale, while the lowest average was found in students who used the Internet for 0-1 hour. In the intended use sub-dimension of the scale, the averages for those who used the Internet for 0-1 hours were found to be lower compared to the other groups, and this difference was statistically significant (F (3,1386) = 3.248, p = 0.021). Statistically significant differences were also found between the groups in the technical dimension (F (3,1386) = 11.178, p = 0.000). The averages of those who used the Internet for 0-1 hours were found to be statistically significantly lower than the other groups. Additionally, the averages for those who used the Internet for 1-2 hours were lower than for those who used it for 2-3 hours and more than 3 hours. In the privacy dimension, a statistical difference was found between the mean scores of the groups (F (3,1386) = 4.594, p = 0.000). According to the Tukey test results, individuals who used the Internet for 0-1 hours and 1-2 hours were significantly lower than those who used the Internet for 2-3 hours. When the total scale scores were examined, a significant difference was found between the group means according to daily Internet usage time (F (3,1386) = 9.841, p = 0.000). The means of those who used the Internet for 0-1 hours were found to be lower than the other groups and the means of those who used the Internet for 1-2 hours were found to be lower than those who used the Internet for 2-3 hours. This difference was found to be statistically significant.

To determine the effect of the type of device students use on their digital literacy, a one-way ANOVA test was conducted. The results are presented in Table 7.

Table 6.

ANOVA results of students' digital literacy levels according to their daily internet usage time

Dimensions	Daily internet usage time	N	X	ss	Sd	F	P	Tukey
Intended Use	a) 0-1 hour	65	1,997	,287	3	3,248	,021	a<b
	b) 1-2 hours	806	2,136	,360	1386			a<c
	c) 2-3 hours	302	2,142	,361	1389			a<d
	d) 3 hours or more	217	2,127	,340				
Technical Knowledge	a) 0-1 hour	65	1,898	,520	3	11,178	,000	a<b
	b) 1-2 hours	806	2,076	,500	1386			a<c
	c) 2-3 hours	302	2,207	,480	1389			a<d
	d) 3 hours or more	217	2,199	,514				b<c
								b<d
Privacy and Security Knowledge	a) 0-1 hour	65	2,103	,537	3	4,594	,003	a<c
	b) 1-2 hours	806	2,228	,511	1386			b<c
	c) 2-3 hours	302	2,328	,519	1389			
	d) 3 hours or more	217	2,255	,509				
Total scale	a) 0-1 hour	65	1,993	,301	3	9,841	,000	a<b
	b) 1-2 hours	806	2,141	,319	1386			a<c
	c) 2-3 hours	302	2,209	,311	1389			a<d
	d) 3 hours or more	217	2,182	,311				b<c

Table 7.

ANOVA results of students' digital literacy levels according to the type of digital device they have

Dimensions	Digital device	N	X	Ss	sd	F	P	Tukey
Intended Use	a) Tablet	391	2,165	,341	3	7,783	,000	a>d
	b) Smartphone	776	2,126	,355	1386			b>d
	c) Computer	128	2,157	,358	1389			c>d
	d) None	95	1,974	,365				
Technical Knowledge	a) Tablet	391	2,132	,526	3	8,918	,000	a>d
	b) Smartphone	776	2,119	,482	1386			b>d
	c) Computer	128	2,220	,539	1389			c>d
	d) None	95	1,882	,484				
Privacy and Security Knowledge	a) Tablet	391	2,271	,530	3	6,283	,000	a>d
	b) Smartphone	776	2,237	,496	1386			b>d
	c) Computer	128	2,371	,550	1389			c>d
	d) None	95	2,078	,519				c>b
Total scale	a) Tablet	391	2,181	,324	3	14,206	,000	a>d
	b) Smartphone	776	2,152	,304	1386			b>d
	c) Computer	128	2,230	,342	1389			c>d
	d) None	95	1,971	,312				c>b

The ANOVA findings in Table 7 reveal the effect of the type of digital devices used by students on digital literacy levels. First, a significant difference was found between the groups in the Intended Use dimension (F = 7.783, p < 0.000). According to the post-hoc analysis results, the groups using tablets, smartphones, and computers scored significantly higher than the group not using devices ("None"). There was also a significant difference between the groups in the Technical Knowledge dimension (F = 8.918, p < 0.000). It was determined that the groups using tablets, smartphones, and computers had significantly higher technical knowledge than the group not using any devices. Significant differences were also observed between the groups in the Privacy and Security Knowledge dimension (F = 6.283, p < 0.000). The groups using tablets, smartphones, and computers scored significantly higher than the group not using devices ("None"). In addition, the Privacy and Security Knowledge of the group using computers was considerably higher in those using smartphones. Finally, a significant difference was found between the groups in terms of Total Scale scores (F = 14.206, p < 0.000). Tablet, smartphone, and computer users had significantly higher total scores than those who did not use devices. Computer users had higher total scale scores than smartphone users.

Qualitative Findings

The questions used to assess fourth-grade primary school students' opinions on digital literacy were categorized into three themes: "intended use," "technical knowledge," and "privacy and security knowledge."

Intended Use

When fourth-grade primary school students were asked for what purposes they used technological devices, they stated that they mostly used them to play games (n = 21). Students also indicated that they did research (n = 14), did homework (n = 10), and watched videos (n = 9) using these devices. Using them for listening to music (n = 5), studying (n = 3), accessing social media (n = 2), and communication (n = 2) were less preferred activities among students. One student stated that they used technological devices for software development. Some student opinions on this subject are as follows: S1 *"I do homework research and software, I opened a site, even a virtual game site, its name is Windows 93."*; S3 *"I use it to listen to music, to look for the answers of the questions I couldn't solve and to watch videos"*; S7 *"I play games, do research, sometimes spend time on social media and use it to listen to music"*; S18 *"I use it to communicate and to do my homework and research"*; S22 *"I watch videos on YouTube, play games, and do my homework and research."*; S24 *"I play games, look up things I am curious about, do homework."*

When the participants were asked which websites they used to search for information on the Internet, they stated that they mostly used Google (n = 20) and YouTube (n = 11). A smaller number of students stated that they searched for information on Wikipedia (n = 3), e-Homework (n = 2), ChatGPT (n = 1) and Google Gemini (n = 1). Some student opinions on this issue are as follows: S2 *"I mostly use YouTube; there is a lot of information there. I learned how to draw and play the piano."*; S5 *"I usually use Google. Sometimes when I don't understand what the teacher is explaining, my mother opens a video on YouTube and I watch it there."*; S9 *"I use Google and YouTube to search for information. There are no good things in the others. In other words, I do not know whether the information in other sites is correct and I cannot trust it."*; S15 *"I use Google or YouTube. They show the results very quickly. Besides, my mother doesn't trust other places and doesn't let me use them."*; S21 *"I use Wikipedia and Google. The information here seems real, not made up. I write on YouTube, I think it is better"*; S25 *"I use YouTube and Google, everything I research is there."*

When asked which applications they used to learn in a digital environment, the students stated that they mostly used Duolingo (n = 9), football games (such as EA Sports) (n = 7), and Brawl Stars (n = 6). A smaller number of students stated that they learn while using applications such as YouTube (n = 4), Google (n = 2), ChatGPT (n = 2), lichess (n = 2), paint (n = 1), car games (n = 1), Word wall (n = 1), and WOW (Worlds of Wonders) (n = 1). Some student opinions on this subject are as follows: S4 *"I use Google to learn; I play EA Sports and Brawl Stars for games. These games contribute to my learning and I have fun too."*; S13 *"I use Duolingo to learn English, it teaches me some words and helps me form sentences and speak English."*; S17 *"There is a word-deriving application called Wow that I learn words I do not know"*; S19 *"I use artificial intelligence tools like ChatGPT, I play Brawl Stars and e-Football to pass the time. Games help me have fun. I ask ChatGPT about the parts I don't understand in my homework, I ask about the things I'm curious about."*; S21 *"There is a chess application called Lichess, I play a football game to learn how to play chess, it helps with providing technical support about football."*

Technical Knowledge

When the students were asked which tools they used to create videos, pictures, presentations, etc., they mostly mentioned their experiences in preparing presentations (PowerPoint, Canva) (n = 8), CapCut (n = 7), and creating videos (TikTok, YouTube) (n = 6). Three students stated that they never used these tools, and two students indicated that they made football edits. Students individually mentioned their experiences with having their own websites, turning their own drawings into videos, using Excel, Alight Motion, ibis

Paint, creating graphics, creating logos, and Picsart. Some student opinions on this subject are as follows: S1 *"I prepared presentations, videos, pictures; I used PowerPoint, CapCut. I even have my own website."*; S3 *"I prepared a presentation for the assignment my teacher gave me, and I took photos related to the topic and used them in the presentation"*; S4 *"I make football edits, I take pictures from Pinterest and turn them into videos with CapCut."*; S10 *"I turned my own drawings into videos, I made it on my phone, I can't remember the name of the application"*; S15 *"I do video editing using CapCut. I make videos about game characters."* S23 *"I prepare videos, pictures, and presentations. I use Capcut, Alight Motion, and Ibis paint."*

Regarding how to save a photo, file, etc., the most common responses were using a flash drive (*n* = 6) and pressing "Save" on the file (*n* = 5). A smaller number of students stated their views as taking a screenshot (*n* = 4), using WhatsApp (*n* = 4), using Bluetooth (*n* = 3), using USB (*n* = 3), and I can't do it (*n* = 3). Students expressed their views by taking photos individually, using Spotify, asking for help from their parents, and copying and pasting. Some student views on this issue are as follows: S2 *"I take a photo with my phone, use a USB, take a photo and save it on my phone. I find it on Spotify for music."*; S4 *"For example, there are 3 dots on a photo from Pinterest. When I click on it, it says download, I press it, and it saves it to the computer."*; S18 *"I press save on a file I see on the Internet. It uploads it to the computer or I can save it to another computer or phone using a flash drive."*; S20 *"When I send a photo from one phone to another, I send it using WhatsApp. This way, it is recorded on the phone."*

When the participants were asked which formats they knew, such as .doc, .pdf, and .jpg, the majority of students stated that they did not know (*n* = 15). Nine students indicated that they knew PDF, two students said DOC, and one student said JPEG. Some student opinions on this subject are as follows: S1 *"I need to use some applications to save, I know PDF, doc, jpeg. PDF shows the pages in a book"*; S7 *"I know PDF, I know because of my mother's job."*; S11 *"I do not use a computer, I have heard of doc but I do not know what it is"*; S19 *"I can open a file and put a song or book in it, I have heard of PDF but I do not know what it is."*

Privacy and Security

On what they do to stay safe on the Internet, the students mostly stated their views as using passwords (*n* = 20) and not sharing personal information (*n* = 16). A smaller number of students stated their views as using antivirus programs (*n* = 2); making security settings (n=2), not installing too many games (*n* = 1), not entering unknown places (*n* = 1), asking their mother (n=1), using parental lock (*n* = 1), using privacy mode (*n* = 1). Some student views on this issue are as follows: S6 *"I don't enter unknown sites, I use passwords, I don't share my personal information. I get permission from my mother."*; S7 *"I turn on privacy mode from the game settings, no one can see me. I set a password on my computer."*; S13 *"I use passwords, I use security applications, I don't share my personal information."*; S16 *"If a password needs to be created, I ask a family member, if I need to enter my personal information, I write something else like a different name"*; S25 *"I put a password on my phone, I don't send videos showing myself, I say I'm older, I try not to talk to strangers."*

The students were also asked what they pay attention to in online games or applications, and they mostly stated that they do not chat in games (*n* = 13) and do not share personal information (*n* = 10). A smaller number of students expressed their opinions on the subject as using another name (*n* = 6), using a password (*n* = 3), not sharing the password (*n* = 2), not playing with unknown people (*n* = 2), using a security application (*n* = 2), not sharing images (*n* = 2), asking mother (*n* = 2), turning on privacy mode (*n* = 1). Some student opinions on this subject are as follows: S4 *"I do not share my personal information, I turn on privacy mode and play with real players but I do not chat."; S6 "There is a security application and I use it, I do not participate in chats in games, I only play with my real-life friends."; S17 "I try not to trust the people there; I do not share images, sounds, etc. I talk about the game in chats."; S22 "I very rarely participate in chats; I do not share my personal information."*

Discussion

The lives of young people are increasingly shaped by the influence of information and communication technologies, both at home and in their social lives, as well as in their educational settings. With the increasing use of ICT in education worldwide, students need to develop new skills and competencies to learn effectively (Hew & Leong, 2011). The importance of digital literacy, one of these competencies, is increasing today. For this reason, this study aimed to determine the digital literacy levels of 4th-grade students and to investigate the relationship between these skills and various variables. The study's findings indicate that 4th-grade primary school students generally possess a moderate level of digital literacy. Similarly, Yılmaz and Yiğit (2024) determined the digital literacy levels of 3rd- and 4th-grade students as X=2.02. Since their study was conducted on similar dates and at the same level, it is not surprising that this study is close to the average value of the current study (x=2.1554). In a study by Ünal and Korkmaz (2023), it was also determined that high school students have a medium level of digital literacy. Unlike the findings of this study, other studies have shown that 5th-grade students (Pala & Başıbüyük, 2020) and secondary school students (Çelik & Kılıçoğlu, 2022; Dinçer, 2012;

Seçkin-Kapucu et al., 2021) possess an elevated level of digital literacy. Contrary to the results of these studies, according to Nagaraju et al. (2020), the digital literacy level of the majority of middle school students is exceptionally low and insufficient. The fourth-grade students have the highest score in privacy and security knowledge sub-dimension ($\bar{x}$ = 2.2486) while the lowest score belongs to the technical knowledge ($\bar{x}$ = 2.1161). The findings suggest that young children have a better sense of security, despite their limited technical knowledge. This may be a direct result of their parents' and teachers' advice to use the Internet safely. In a similar study, Yılmaz and Yiğit (2024) also demonstrated that 3rd and 4th grade students scored higher in the privacy and security knowledge dimension than in the other dimensions, with the technical knowledge dimension scoring the lowest, yielding lower scores than the other dimensions.

The results showed that both the total scores and sub-dimension scores of the digital literacy scale for female and male participants were similar and did not differ significantly by gender. This finding shows that gender does not hurt digital literacy. Jan (2018) argues that the reason digital literacy levels are similar between male and female students is that school systems and families provide female students with equal opportunities to interact with technology. There are many studies in the literature that reach comparable results with this research (Bunz et al., 2007; Hatlevik & Christophersen, 2013; Jan, 2018; Lee et al., 2015; Liang et al., 2021; Pala & Başıbüyük, 2020; Seçkin-Kapucu et al., 2021; Umar & Jalil, 2012). According to Miller et al. (2001), the rapid advancement of technology and the widespread use of computers in daily life have contributed to a decrease in the gender gap in computer use and literacy. While some studies suggest that girls exhibit higher levels of digital literacy compared to boys (Ritzhaupt et al., 2013; Tran et al., 2020), others indicate that boys perform better than girls in this area (Abdollahyan & Ahmadi, 2011; Aslan, 2021; Braak & Kavadias, 2005; Göldağ, 2021; Inan Karagul et al., 2021; Kaarakainen et al., 2018; Liu & Sun, 2012; Nagaraju et al., 2020; Özerbaş & Kuralbayeva, 2018; Samani et al., 2019; Young, 2000; Zhong, 2011).

In the Digital Literacy Scale analyses conducted considering the presence of an Internet connection at home, it was determined that there was a significant difference in the overall scale and privacy dimension in favor of students with an Internet connection. 92% of the students participating in this study have an Internet connection at home. Studies have shown that having an Internet connection at home contributes to students' digital competence, as observed in the current study (Fraillon et al., 2014; Klomsri & Tedre, 2016; Namukasa et al., 2024). Çelik and Kılıçoğlu (2022) and Pala and Başıbüyük (2020) reached a similar conclusion with middle school students stating that the digital literacy scores of students who had an internet connection at home were higher than those who did not have Internet at home. In addition, according to Kuhlemeier and Hemker (2007) and Braak and Kavadias (2005), information and communication technology skills are mostly acquired at home through "learning by doing," and therefore, having access to digital devices and the Internet at home contributes to the development of digital literacy. Tran et al. (2020) suggest that students with greater Internet access have an advantage in improving their digital literacy.

The results of this study indicate that the amount of daily internet usage significantly impacts the DL levels of primary school students, with students' digital literacy improving as their daily internet usage time increases. These findings are supported by studies highlighting the connection between digital literacy and technology use (Çelik & Kılıçoğlu, 2022; Özerbaş & Kuralbayeva, 2018). Cicha et al. (2021) investigated the link between students' Internet usage time and their digital skill levels, concluding that DL skills significantly improved with more frequent Internet access. According to Namukasa et al. (2024), experience with technology is linked to higher digital competence. People who engage more frequently with technological tools and applications have greater opportunities to enhance their digital skills. Hargittai (2005) states that the time spent on computer use at home and the frequency of computer use have a positive effect on digital literacy and attitudes towards digital tools. Unlike the findings of this study, Barboutidis and Stiakakis (2023) found that participants with less Internet use time had higher digital competence scores than participants who used the Internet more intensively.

The research results show that digital device ownership affects the DL level of the students. The fact that individuals who own any digital device have significantly higher scores in all sub-dimensions and the total scale than those who do not shows the effect of using these devices on DL. Notably, the higher overall scores of computer users compared to smartphone users suggest that using a computer facilitates the development of a broader spectrum of digital skills. Studies in the literature support the findings of the current research (Doungpitak et al., 2023; Göldağ, 2021; Ritzhaupt et al., 2013; Ocak & Karakuş, 2019; Seyal et al., 2002; Van Deursen & Van Dijk, 2019). According to Lauman (2000), students who have access to computers at home are at an advantage compared to their peers. Barboutidis and Stiakakis (2023) likewise identified a statistically significant relationship between computer ownership and digital skill levels. Lörz et al. (2024) suggest that children in households with a comprehensive digital infrastructure (i.e., Internet access and computer availability) are expected to possess higher digital skills. Similarly, Fraillon et al. (2014, p.116) also found that

students with more computers at home generally have higher computer and information literacy scores. According to Namukasa et al. (2024), access to technology has a significant impact on digital competence because the development of digital skills depends on the level of access to technological tools and resources.

Qualitative data derived from interviews conducted with a portion of the students in the quantitative strand are consistent with and supportive of the quantitative results of the research. According to the qualitative findings obtained from the research, it was determined that fourth-grade primary school students primarily use digital tools for entertainment, with educational purposes taking a secondary role. This reveals that students' interactions with digital media are focused on having fun. It was observed that students prefer sites such as Google and YouTube, where information can be easily accessed, while academic information sources are used less. Additionally, students prefer game-oriented and entertaining applications, while the use of education-oriented applications remains relatively low. This situation reveals that children lack the necessary knowledge to use digital tools effectively. Karabacak and Sezgin (2019) emphasized that training, lessons, and applications should be carried out to increase children's digital literacy. Ihmeideh and Alkhawaldeh (2017) stated that children need training on digital literacy. It was determined that students mostly have experience in preparing presentations and creating videos. This situation highlights the efforts of primary school students to create content in digital media. However, it was concluded that students do not know either how to save files or the file formats. This situation shows that students' technical knowledge is weak. According to Eshet-Alkalai (2012), creating new products in digital environments and questioning the accuracy and validity of information in digital environments are among digital literacy practices. Students mostly stated that they set passwords and do not share their personal information to stay safe online. This indicates that students possess a basic understanding of privacy and security in digital environments, but lack knowledge of advanced security measures. Jan (2018) found in his research that secondary school students have deficiencies in security when using the Internet and computers. As a result, it was revealed that students' primary purposes for using digital tools are for gaming, their technical knowledge is lacking, and they have a basic understanding of privacy and security. According to this result, the importance of digital literacy education at the primary school level for the conscious use of digital tools emerges.

Limitations and directions for future research

The current study has several limitations. First, the quantitative data were collected through a single scale, which may be inadequate in capturing the multidimensional nature of digital literacy. Secondly, a self-report measurement tool was utilized in the study to determine the participants' perceptions of their own digital literacy levels. Therefore, the responses obtained may not accurately reflect the participants' actual literacy levels due to such factors as exaggeration or desire to present themselves positively. Different data collection tools may be used in future research. In addition, the use of cluster sampling in the study may limit the generalizability of the findings. For this reason, employing different sampling methods in future studies may help obtain more representative samples. Moreover, the research was conducted in a specific region. In future research, participants form different regions and various socio-economic levels may be included. Finally, although qualitative data provide in-depth information, the fact that the qualitative data were limited to 25 students may restrict their representativeness. It is recommended that future studies collect data from a larger and more diverse group.

AI Disclosure Statement

The author did not use any artificial intelligence (AI) tools in the preparation of this manuscript.

Ethical Approval

The study protocol was approved by the Erciyes University Social and Humanities Sciences Ethics Committee (approval date: 25.04.2023, Application No: 163).

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Informed consent was obtained from all individual participants in the study.

Conflict of Interest

No conflict of interest exists for this manuscript for any of the author.

Availability of Data and Materials

Data will be available upon request.

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