

DIGITAL SKILLS AND COMPETENCES ACROSS EDUCATIONAL LEVELS IN BOSNIA AND HERZEGOVINA ¹

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Abstract

The presence of digital technologies in every aspect of contemporary life requires the development of skills and abilities suitable for digital, connected and knowledge-based societies. The need to develop these skills and abilities has taken on even greater importance with the COVID-19 pandemic, as it has clearly revealed the shortcomings of our society and our overall education system. The aim of this research is to help us understand whether there are differences between different education levels and knowledge and skills in digital media environment in Bosnia and Herzegovina. The data has been collected by surveying 502 respondents through structured questionnaire aligned in accordance with the EU Digital Skills Indicator framework. The results have been tested in SPSS and have showed that higher education graduates have advanced knowledge and problem-solving skills.

Keywords: Digital Literacy, Education, Digital Competences, Digital Skills, Bosnia and Herzegovina

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Introduction

We observe the fact that each new era brings technological, cultural, economic and social changes. As a society, we are trying to absorb and accept these changes and adapt to the dynamics of the new era. In a similar spirit as modernization and urbanization improve people's adaptability, expectations and need for constant change, information, digital and technological achievements encourage people to become an indispensable part of media, information, and digital environments. The presence of digital technologies in every aspect of contemporary life requires the development of skills and abilities suitable for digital, connected and knowledge-based societies. The need to develop these skills and abilities has taken on even greater importance with the COVID-19 pandemic, as it has clearly revealed the shortcomings of our society and our overall system.

Bosnia and Herzegovina, a country still in what has been called a transition period since the late 1990s, aims to revitalize its society (Ibraković, 2022). However, it faces the problem of not focusing enough on developing digital skills and capabilities. According to a study conducted by USAID in 2023, although the internet infrastructure covers 82% of Bosnia and Herzegovina's territory, the digitalization process is still in a political stalemate. For example, "Bosnia and Herzegovina remains the only European country without a state computer emergency team (CERT), a key central point of contact for cooperation with the European Union on cybersecurity" (DECA, 2023). However, there is a lack of common understanding and definition of Bosnia and Herzegovina's critical digital infrastructure.

Research on digital skills and abilities in Europe and around the world has attracted particular attention for the last twenty years (Ala-Mutka, 2011; Buckingham, 2007; Eshet-Alkalai, 2004; Ferrari, 2012, 2013; Hadjerrouit, 2010; Lankshear & Knobel, 2008). The terms digital literacy and digital skills have different conceptualizations. While some see digital skill as a broader concept (Ala-Mutka, 2011), others see digital literacy as the basis for the development of digital skill (Martin & Grudziecki, 2006).

Digital technologies have now become an indispensable part of many areas of our lives, such as learning, communication, work, and leisure. The ability to use and control these technologies correctly has become a fundamental skill for the 21st century. With the digitalization of society, developing digital literacy has become inevitable because it has the potential to increase economic development, competitiveness, and employment. It also has the potential to improve quality of life. The socio-cultural context of digital technologies leads to new concepts of literacy and new answers to the questions: What is literacy? What does it mean to be literate? UNESCO defines literacy as: The ability to identify, understand, interpret, create, communicate, calculate and use printed, and written materials associated with different contexts. Literacy involves the process of continuous learning for individuals to achieve their goals, develop their knowledge and potential, and participate fully in their communities and wider society (UNESCO, 2006). To adapt to the social changes of the digital age, the definition of literacy had to be updated to include digital technologies. Traditional understanding no longer fits contemporary educational needs, and, therefore, literacy has taken on a broader meaning as the ability to understand information regardless of the way the information is presented (Lanham, 1995). According to a new, sociocultural understanding of literacy, new literacies in the digital environment, especially digital literacy, are thought to enable many new ways in which digital technologies often mediate social interactions (Kress, 2003; Lankshear & Knobel, 2003). Considering the complexity of new literacy practices in the digital environment (Lankshear & Knobel, 2006), it should be noted that digital literacy is not limited to the use of digital technologies only, because the concept of literacy includes the versatility of skills, abilities and knowledge (Cope & Kalantzis, 2000) and a deep understanding. It includes operational, cultural and critical dimensions (Green, 1988; Durrant & Green, 2000).

One of the important problems encountered within the digital ecosystem of Bosnia and Herzegovina is insufficient institutional approach in educating citizens of how to develop digital skills and competences, which leads to inability to comprehend digital environment we are all part of (Opačak, 2021, pp. 34-38).

The ability to use digital technologies does not make a person digitally literate, a fact that must be acknowledged before any scientific analysis. The issue of digital literacy in Bosnia and Herzegovina has not been enough comprehensively researched and studied compared to other areas. Comprehensive data on the digital literacy of citizens of Bosnia and Herzegovina is scarce as no widespread or regular research has been conducted on this subject to date.

The aim of this research is to help us understand whether there are differences between different education levels and knowledge and skills in digital media environment in Bosnia and Herzegovina. Results will be a base for future analysis of digital literacy in our country.

Considering the nature of the research aims and problems, and in line with the European Commission's recently published framework on digital competence and literacy, the following research hypotheses were defined based on the identified objective and tasks of the research:

H1. Knowledge and skills in using digital media are higher in people with higher education levels.

H1a. There is a significant difference between higher education diploma holders than others in terms of knowledge and skills related to information literacy and data understanding.

H1b. There is a significant difference between higher education diploma holders than others in terms of knowledge and skills related to communication and collaboration in digital media.

H1c. There is a significant difference between higher education diploma holders than others in terms of knowledge and skills related to creating digital content.

H1d. There is a significant difference between higher education diploma holders than others in terms of knowledge and skills related to security in digital environment.

H1e. There is a significant difference between higher education diploma holders than others in terms of knowledge and skills related to problem solving in digital media.

Contextualizing Digital Literacy in BiH

EU Digital Skills Indicators

The Digital Skills Indicator is an indicator used to monitor the digital skills development of European Union (EU) member states. The Digital Skills Indicator methodology is based on the European Commission's Digital Competence framework (DigComp) and its fourth edition (DigComp 2.2). The Digital Skills Indicator is used to monitor the EU's target for at least 80% of the EU population (defined as individuals aged 16-74) to have basic digital skills by 2030.

The digital competence debate started with Paul Gilster's book *Digital Competence*. Gilster has defined the term in different ways in this book, and as Belshaw (Belshaw, 2012) puts it, digital competence is "learning ideas, not keys" (Gilster, 1997, p. 1). This definition shows that digital literacy is not only limited to technical aspects such as the use of digital media, but it also includes a variety of other skills. In the spirit of Gilster's thought, when we talk about digital competence we are not just talking about technological skills, but also the concepts we learn. According to Bawden, competence in the digital age – the current form of literacy in general – is the ability to read, write and interact with information using available technology (Bawden, 2001, p. 2).

The view of digital competence as competence in the digital age reflects a view consistent with the sociocultural approach to literacy as part of social practices. This implies a wide range of social practices and interactions in the meaning-making process mediated by texts produced, received, disseminated, and exchanged through digital codes (Lankshear and Knobel, 2008, pp. 2-4). In this context, digital competence goes beyond technical skills to include critical understanding and participatory interaction with digital texts and technologies.

Within the scope of the European Commission project DigComp (Dig Comp 1.0 - Digital Competence), 15 existing frameworks in the fields of digital literacy were analysed and compared, and as a result, a comprehensive definition of digital competence was obtained. According to this project, “digital competence is the use of ICT to perform functions, solve problems, communicate, manage information, collaborate, create and share content, create knowledge in areas such as work, leisure, participation in society, learning, socializing, consuming and empowering”. It is a set of knowledge, skills, and attitudes (including skills, strategies, values and awareness) that are used effectively, efficiently, competently, critically, creatively, autonomously, flexibly, ethically and reflexively when using digital media” (Ferrari, 2012, pp. 3-4).

In the first phase of the project, five areas of digital competences were defined and a list of competences for these areas was created (Ferrari, 2013, p. 15). These competences were updated in the form of terms in line with the development of technology in the second stage of the DigComp 2.0 project and the descriptors of the competences were determined (Vuorikari et al., 2016). The list of competences is as follows (Ferrari, 2013, pp. 15-18; Vuorikari et al., 2016, pp. 8-9):

1. Information literacy and data understanding:

- 1.1. Navigating, searching and filtering data, information and digital content
- 1.2. Evaluation of data, information and digital content
- 1.3. Data, information and digital content management.

2. Communication and collaboration:

- 2.1. Interaction with digital technologies
- 2.2. Information exchange through digital technologies
- 2.3. Participation in society through digital technologies
- 2.4. Collaboration with digital technologies
- 2.5. Netiquette
- 2.6. Digital identity management.

3. Creating digital content:
 - 3.1. Creating digital content in different formats
 - 3.2. Integrating and remixing digital content
 - 3.3. Copyrights and permissions
 - 3.4. Programming.

4. Security:
 - 4.1. Protection of devices
 - 4.2. Protection of personal data and privacy
 - 4.3. Maintaining health and well-being
 - 4.4. Protection of the environment.

5. Problem solving:
 - 5.1. Solving technical problems
 - 5.2. Identifying needs and technological responses
 - 5.3. Using digital technologies creatively
 - 5.4. Setting your own digital competence boundaries.

This project is focused on improving achievement levels with its third phase called DigComp 2.1. At this stage, 8 achievement levels instead of 3 (basic, intermediate, and advanced) have been developed through learning outcomes. Two achievement levels are in 3 predefined levels: basic (first and second), intermediate (third and fourth) and advanced (fifth and sixth); higher specialization levels (seventh and eighth) have also been added. In addition to the number of achievement levels identified, the definition of levels in terms of task complexity, learner autonomy, and cognitive domain is also new. This broader range of achievement levels can facilitate the development of learning materials and digital competences, the creation of assessment and self-assessment tools, and their use in professional development and guidance.

The fourth and final phase of the project expands the previous version with the addition of new competences and a greater emphasis on the ethical and critical use of digital technologies.

DigComp 2.2, published in 2022, has been structured by adding four new competences to the previous version and updating existing ones. These four new competences are computational thinking, coding, virtual collaboration, and social media. The framework also places greater emphasis on the development of transversal skills such as creativity, empathy and flexibility, and the ethical and critical use of digital technologies. More information about each framework will be explained in the following sections.

Data from Bosnia and Herzegovina

In Bosnia and Herzegovina, the lack of consensus on key issues regarding media and digital literacy and the absence of a meaningful strategy are particularly evident in formal educational institutions. Some aspects of media literacy can be found in course curricula such as mother tongue, society, culture, religious education, but in strategic documents or normative regulations in the field of education and media, media literacy is not positioned in a more meaningful way and steps for its development and implementation are not planned. Moreover, the training of educators is rather weak and insufficient, which directly affects the quality of the educational offer for users. On the other hand, although local data on digital literacy and the use of new technologies are quite limited and insufficient, there are various initiatives and research that can form the basis for other research in the field of digital and media competences.

In January 2024, Association for Digital Transformation in Bosnia and Herzegovina, published the first systematic study on digital literacy aiming for understanding overall level of digital competences of Bosnia and Herzegovina citizens, as well as to get comparative analysis with other European countries (Turulja et al., 2024). For their research, they used Eurostat database for the year 2021, since data from 2023 were not available for Bosnia and Herzegovina. The authors used EU Digital Skills indicator framework to analyse Eurostat data. The results have shown that Bosnia and Herzegovina are significantly lagging behind European countries when it comes to overall digital literacy, but also according to individual indicators of information literacy and data understanding, communication and collaboration, digital content creation, safety and problem solving.

However, a particularly worrying aspect is the level of digital security skills among citizens in BiH. The country shows an extremely low level in this area compared to the EU average which indicates potential vulnerabilities in personal and national cyber security (Turulja et al., 2024, p. 37).

In 2021, Azra Habibija-Ražanica and Ensar Mekić conducted research aimed to understand if digital literacy is depending on employment status and education level of people in Bosnia and Herzegovina. They collected the data from 210 respondents and found that “difference in digital literacy of employed and unemployed respondents is statistically insignificant. On the other hand, differences in digital literacy at different education levels are found to be statistically significant” (Habibija-Ražanica & Mekić, 2021, pp. 71-80).

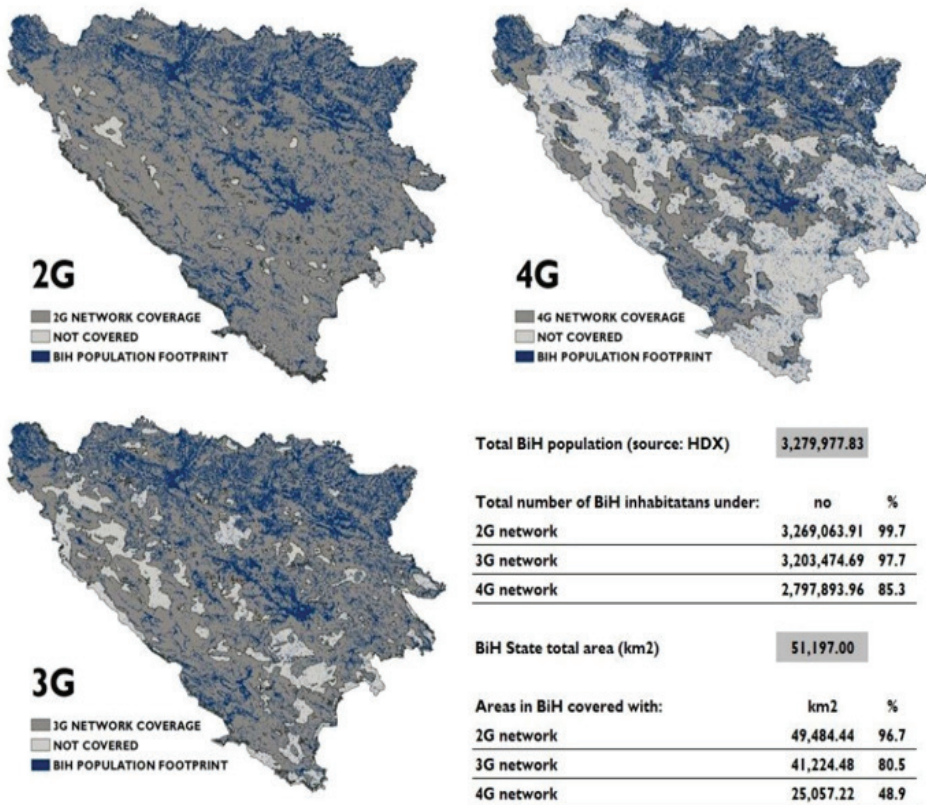
At the beginning of 2023, a digital ecosystem country assessment (DECA) final report was published, conducted entirely by the American Institutes for Research, in a project supported by the USAID Bosnia and Herzegovina Monitoring and Evaluation Support Activity (MEASURE II). The main findings confirmed that the connectivity infrastructure in Bosnia and Herzegovina is strong. Although the three main mobile network operators (MNOs) claim to have broad network coverage throughout the country, BH Telecom, HT Eronet and M:Tel each serve a specific ethnic group, particularly in the region of the country where that ethnic group is the majority. The internet service provider market is more diverse, especially with the growing presence of Telemach.

However, the infrastructure that the three dominant Internet Service Providers (ISP) inherited before the 1992-1995 war has an advantage over new market competitors, especially due to the lack of infrastructure sharing among internet service providers. Despite this, the internet infrastructure covers 82% of Bosnia and Herzegovina, with 99.7% of the population covered by at least a 2G mobile signal and 85.3% of residents covered by a 4G signal. The implementation of 5G is still in the planning stage (DECA, 2023, p. 2). BH Telecom started testing 5G technology in 2020, and the tests continue until 2022.

However, according to the ITU, the lack of a national broadband strategy is “one of the most pressing issues for the market competitiveness of broadband in the country and growth in the ICT sector”. This has slowed down the introduction of 5G technology in the country (Halimić, 2021).

Figure 1

Mobile network coverage in BiH (DECA, 2022, p. 10)



According to data from the International Telecommunication Union and the Statistical Agency of Bosnia and Herzegovina on internet use and consumer preferences, 73.2% of the population in Bosnia and Herzegovina uses the internet (International Telecommunication Union, 2021) and approximately the same percentage of households have internet access at home (Bosnia and Herzegovina Statistical Agency, 2021). The probability of internet access for households in urban areas is up to approximately 75%, while for households in rural areas this rate is approximately 71% (Bosnia and Herzegovina Statistical Agency, 2021). Furthermore, 37% of Bosnia and Herzegovina's residents have basic IT skills, while only 2% have advanced skills. Men are more likely than women to have basic digital skills (19% men, 14% women); however, women are more likely than men to have advanced digital skills (10% women, 6% men). According to the Digital Global portal, citizens actively use social media, accounting for 55% of the total population in January 2021. However, using social media platforms does not always predict the ability to use skills such as creating and sharing media, link management (similar abilities that the ITU can use to classify individuals' degrees of digital literacy). For example, for most young people in Bosnia and Herzegovina (83.5%), accessing the internet is the most essential activity in their free time, more important than hanging out with friends or participating in sports. However, according to Eurostat statistics from 2019, Bosnia and Herzegovina is one of the lowest-performing countries in Europe when it comes to assessing young digital talent: only 57% of young people aged 16 to 24 have basic or high-level digital skills. This means that the frequency of internet use among young people does not predict their digital skills. This is in line with the concern expressed by the local NGOs questioned: they believe that citizens are not ready with the capacity to recognize and appreciate the consequences of technological misuse (DECA, 2023, p. 17).

Experts have frequently criticized the lack of formal digital literacy education in the country. While there is some digital literacy training for children, it is not integrated into the school curriculum, which does not allow students to start early and progress to increasingly complex concepts throughout the school years. For example, computer science is taught in primary schools in the Sarajevo Canton from the first grade.

However, in other cantons of the Federation of Bosnia and Herzegovina and Republika Srpska, computer science is not taught until the fifth or sixth grade. However, in September 2021, Republika Srpska launched the “Digital World” program, which provides basic digital literacy education to all second-grade students. Students participating in this course learn to recognize and respond to harmful online behaviour. However, there is no ongoing program for the remaining grades. Even if they offer formal training in digital literacy, schools in Bosnia and Herzegovina often lack the basic technology needed to provide high-quality education. According to the 2018 Program for International Student Assessment (PISA), only less than a third of schools in Bosnia and Herzegovina have sufficient digital devices or sufficient teaching software. Additionally, one in every two schools in Bosnia and Herzegovina does not have sufficient internet bandwidth to allow online learning (OECD, 2019).

Despite generally having a robust connectivity infrastructure, not all members of Bosnian and Herzegovinian society have equal access to or use of digital technologies. A digital divide exists between urban and rural areas. Households in urban areas are more likely to own computers than those in rural areas, with 65.6% versus 60.6% respectively (Bosnia and Herzegovina Statistical Agency, 2021). The same applies to having internet access: 77.8% of households in urban areas have it, while 73.8% of households in non-urban areas have this opportunity (Statistical Agency of Bosnia and Herzegovina, 2021).

Data from Bosnia and Herzegovina shows that older generations use digital technology less frequently. For example, 98.1% of children and 79.6% of adults own a smartphone. Youth of Bosnia and Herzegovina use digital technology more comfortably than adults. The biggest difference is seen in laptop use; 96.1% of teenagers and 82.6% of adults think they are somewhat or very skilled at using a laptop. According to the Statistical Agency of Bosnia and Herzegovina, all students in higher education use the internet, whereas approximately 58% of older people use the internet. Observing residents who only access the internet, 100% of 16 to 24-year-olds use the internet on a daily or near-daily basis; by contrast, 97% of those ages 25 to 54 and 88% of those ages 55 to 74 use it.

Age differences in access to necessary skills and equipment are also relevant to the use of online public services. Only about 12% of residents ages 55 to 74 use online public services; in contrast, 27% of those aged 25 to 54 and 23% of those aged 16 to 24 use it (Statistical Agency of Bosnia and Herzegovina, 2022).

While the leadership of the digital literacy path and fate in Bosnia and Herzegovina is still unknown, much of the digital transformation in Bosnia and Herzegovina has occurred because of the COVID-19 pandemic. The pandemic has not only forced families in Bosnia and Herzegovina to quickly adapt to remote work and learning, but has also driven them to online shopping and banking. The necessity to use digital technologies due to the lack of other options has increased the digital literacy of the population of Bosnia and Herzegovina, but no research has yet been conducted to confirm this.

Methodology

This study examines the digital literacy level of citizens of Bosnia and Herzegovina through a survey conducted in accordance with the Digital Skills Indicator framework². The Digital Skills Indicator is an indicator used to monitor the digital skills development of European Union (EU) member states. The Digital Skills Indicator methodology is based on the European Commission's Digital Competence framework (DigComp) and its fourth edition (DigComp 2.2). The Digital Skills Indicator is used to monitor the EU's target for at least 80% of the EU population (defined as individuals aged 16-74) to have basic digital skills by 2030.

² <https://digital-skills-jobs.europa.eu/en/inspiration/resources/digital-skills-indicator-20-measuring-digital-skills-across-eu>

Data was collected online using Google Forms³ and manually collecting citizens' responses. Participants were approached by reaching out to relevant online groups and forums on various social media platforms and by visiting rural and urban areas across Bosnia and Herzegovina. A total of 502 participants completed the survey.

Table 1

Gender distribution

Category	Number of participants	%
Male	206	41.12
Female	295	58.87
Other	1	0.1

When the gender distribution of the participants was examined, 206 were male (41.12%), 295 were female (58.87%), and the number of participants who did not specify their gender was 1.

Table 2

Age distribution

Category	Age	Number of participants	%
1.	18-35	262	52.29
2.	36-50	108	21.56
3.	51-65	106	21.16
4.	66+	26	5.19

³ https://docs.google.com/forms/d/1G5_Vh91Up-fZfVrS54uEtUei7HZnu0-NSL2V-6JinAtA/edit

The age distribution is divided into four different categories: The first category is a group between the ages of 18-35 and includes 262 (52.29%) participants. The second category consists of 108 (21.56%) participants between the ages of 36-50. The third category consists of 106 (21.16%) participants between the ages of 51-65. Finally, the fourth category consists of 5.19% participants aged 66 and over and 26 participants.

Table 3

Education level distribution

Education level	Number of participants	%
Primary school	60	11.98
High School	194	38.72
Bachelor	148	29.54
Master	75	14.97
Ph.D	24	4.79

When it comes to education level, 501 participants filled the survey. Sixty (11.98%) respondents have a primary school education. The most dominant group consists of 194 (38.72%) respondents with a high school diploma. Additionally, 148 (29.54) respondents obtained a bachelor’s degree, while 75 (14.97%) respondents have a master’s degree, and there are 24 (4.79%) Ph.D. holders.

To measure digital literacy, researchers of the Digital Skills Indicator framework considered measuring this concept along five important dimensions: information and data literacy, communication and collaboration, digital content creation, security and problem solving.

The distributed survey contained questions in three different categories:

Part 1: Demographic Information

Part 2: Critical Questions About the Use of Information and
Communication Devices

Part 3: Digital Competences.

The first and second parts of the survey helped us delineate the demographic categories of the research and identify the digital devices used by the respondents. Additionally, these sections allowed us to assess their proficiency in using these devices and determine the frequency of their usage. The questions in Part 3 are grouped according to the DigComp dimensions mentioned above, which are the core elements of the given hypotheses: information and data literacy, communication and collaboration, digital content creation, security, and problem solving. The 27 statements in part 3 were examined on a three-point Likert scale: Agree, Somewhat Agree, and Disagree.

Results

The hypothesis aims to analyse knowledge and skills in the use of digital media according to educational level, where higher education is a normative measure for EU digital skills indicators (such as information literacy and data understanding, communication and collaboration, digital content creation, security and problem solving). While 247 of the 501 participants have a higher education diploma, 254 have a primary school and high school diploma. The margin of error in the analysis is less than 5%.

Table 4*Descriptive indicators*

		N	Mean	Std. Deviation	Std. Error
Information literacy and data understanding	Primary School	60	1,956	0,693	0,089
	High School	194	2,706	0,399	0,029
	Bachelor	148	2,851	0,222	0,018
	Masters	75	2,822	0,241	0,028
	Ph.D.	24	2,819	0,295	0,060
	Total	501	2,682	0,470	0,021
Communication and collaboration	Primary School	60	1,743	0,665	0,086
	High School	194	2,729	0,484	0,035
	Bachelor	148	2,938	0,130	0,011
	Masters	75	2,960	0,099	0,011
	Ph.D.	24	2,983	0,056	0,012
	Total	501	2,719	0,538	0,024
Digital content creation	Primary School	60	1,458	0,575	0,074
	High School	194	2,439	0,584	0,042
	Bachelor	147	2,709	0,373	0,031
	Masters	75	2,720	0,288	0,033
	Ph.D.	24	2,792	0,273	0,056
	Total	500	2,460	0,618	0,028
Security	Primary School	60	1,691	0,642	0,083
	High School	194	2,546	0,523	0,038
	Bachelor	148	2,736	0,263	0,022
	Masters	75	2,791	0,210	0,024
	Ph.D.	24	2,807	0,210	0,043
	Total	501	2,549	0,542	0,024
Problem solving	Primary School	60	1,383	0,687	0,089
	High School	194	2,527	0,628	0,045
	Bachelor	148	2,794	0,293	0,024
	Masters	75	2,779	0,282	0,033
	Ph.D.	24	2,813	0,332	0,068
	Total	501	2,520	0,664	0,030

H1a. It is predicted that individuals with higher education levels in terms of information literacy and data understanding may have higher digital media usage knowledge and skills.

Table 5

Knowledge and skills in using digital media within the scope of information literacy and data understanding variable

Dependent Variable		Multiple Comparisons		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Information literacy and data understanding	P. School	H. School		-.750630011454754*	0,056	0,000	-0,862	-0,640
	P. School	Bachelor		-.895795795795796*	0,059	0,000	-1,011	-0,781
	P. School	Masters		-.866666666666665*	0,066	0,000	-0,997	-0,737
	P. School	Ph.D.		-.863888888888888*	0,092	0,000	-1,045	-0,682
	H. School	Bachelor		-.145165784341042*	0,042	0,001	-0,227	-0,063
	H. School	Masters		-.116036655211911*	0,052	0,026	-0,218	-0,014
	H. School	Ph.D.		-0,113258877434134	0,083	0,172	-0,276	0,049
	Bachelor	Masters		0,029129129129131	0,054	0,591	-0,077	0,136
	Bachelor	Ph.D.		0,031906906906908	0,084	0,705	-0,133	0,197
Masters	Ph.D.		0,002777777777777	0,090	0,975	-0,173	0,179	

Except for a few specific cases, Table 5 shows a clear statistical difference in information literacy and data understanding between individuals with primary and secondary education and those with higher education degrees. The data show that individuals with only primary school education have significantly lower levels of information literacy and data understanding than those with high school and higher education graduates (Bachelor, Master and Ph.D.). While those with a high school diploma demonstrate solid information literacy and data understanding, they are still lower than those with bachelor's and master's degrees. There is no significant statistical difference between high school graduates and those with a Ph.D. degree. This can be explained by the small number of people with a Ph.D. degree who participated in the survey and the fact that most of those with a Ph.D. degree are in the age group of 50 years and above. Additionally, the results showed that there was no significant statistical difference between higher levels of education degrees.

H1b. In terms of communication and collaboration, it is predicted that individuals with a higher level of education may have more knowledge and skills in using digital media.

Table 6

Knowledge and skills in using digital media within the scope of communication and collaboration variable

Multiple Comparisons							
LSD							
Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Communication and collaboration	P. School	H. School	-.9855*	0,057	0,000	-1,098	-0,873
	P. School	Bachelor	-1.1945*	0,059	0,000	-1,311	-1,078
	P. School	Masters	-1.2167*	0,067	0,000	-1,349	-1,085
	P. School	Ph.D.	-1.2400*	0,094	0,000	-1,424	-1,056
	H. School	Bachelor	-.2090*	0,042	0,000	-0,292	-0,126
	H. School	Masters	-.2311*	0,053	0,000	-0,335	-0,128
	H. School	Ph.D.	-.2545*	0,084	0,003	-0,419	-0,090
	Bachelor	Masters	-0,0222	0,055	0,687	-0,130	0,086
	Bachelor	Ph.D.	-0,0455	0,085	0,594	-0,213	0,122
	Masters	Ph.D.	-0,0233	0,091	0,798	-0,202	0,155

Table 6 shows a significant statistical difference in communication and collaboration between individuals with primary and high school diplomas and those with higher education diplomas. Individuals with only a primary school diploma face difficulties in communicating and collaborating with others using digital media. They use digital media less frequently for communication and collaboration. While those with a high school diploma use digital media for communication and collaboration, this shows a significant statistical difference compared to those with a higher education degree. The data show that there is no statistical difference in the skills and knowledge of using digital media for communication and collaboration between individuals with different higher education degrees.

H1c. In terms of creating digital content, it is predicted that individuals with higher education levels may have more knowledge and skills in using digital media.

Table 7

Knowledge and skills in using digital media within the scope of digital content creation variable

Multiple Comparisons							
LSD							
Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Digital content creation	P. School	H. School	-0.980240549828178*	0,071	0,000	-1,119	-0,841
	P. School	Bachelor	-1.250283446712018*	0,073	0,000	-1,394	-1,106
	P. School	Masters	-1.261666666666667*	0,083	0,000	-1,425	-1,099
	P. School	Ph.D.	-1.333333333333333*	0,116	0,000	-1,561	-1,106
	H. School	Bachelor	-0.270042896883840*	0,052	0,000	-0,373	-0,167
	H. School	Masters	-0.281426116838488*	0,065	0,000	-0,409	-0,153
	H. School	Ph.D.	-0.353092783505155*	0,104	0,001	-0,557	-0,150
	Bachelor	Masters	-0,0113832199546486	0,068	0,867	-0,145	0,122
	Bachelor	Ph.D.	-0,083049886621315	0,105	0,431	-0,290	0,124
	Masters	Ph.D.	-0,083049886621315	0,112	0,524	-0,292	0,149

Table 7 shows a statistical difference in digital content creation between individuals with primary and high school diplomas and those with higher education diplomas. Individuals who only have a primary school diploma are not actively involved in creating digital content. They use digital media for basic communication and less for content creation. While those with a high school diploma are involved in digital content creation, this shows a significant statistical difference compared to those with a higher education degree. Those with higher education degrees are more involved in creating digital content than other degree holders. The data shows that there is no statistical difference in the skills and knowledge of using digital media for content creation among people with bachelor’s, master’s, and doctoral degrees.

H1d. In terms of security, it is predicted that individuals with higher education levels may have more knowledge and skills in using digital media.

Table 8

Knowledge and ability to use digital media within the scope of security variable

Multiple Comparisons							
LSD							
Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Security	P. School	H. School	-.854732895970010*	0,063	0,000	-0,979	-0,730
	P. School	Bachelor	-1.044594594594595*	0,066	0,000	-1,174	-0,915
	P. School	Masters	-1.100484848484847*	0,074	0,000	-1,247	-0,954
	P. School	Ph.D.	-1.115909090909091*	0,104	0,000	-1,320	-0,912
	H. School	Bachelor	-.189861698624585*	0,047	0,000	-0,282	-0,098
	H. School	Masters	-.245751952514837*	0,058	0,000	-0,361	-0,131
	H. School	Ph.D.	-.261176194939082*	0,093	0,005	-0,444	-0,078
	Bachelor	Masters	-0,055890253890252	0,061	0,359	-0,176	0,064
	Bachelor	Ph.D.	-0,071314496314496	0,095	0,451	-0,257	0,115
	Masters	Ph.D.	-0,015424242424244	0,101	0,878	-0,213	0,183

Table 8 shows data on knowledge and skills regarding the security variable, especially the level of awareness of risks and threats in the use of digital media. A significant statistical difference is observed between individuals with primary and high school diplomas and those with higher education diplomas. Individuals with only a primary school diploma have the least developed awareness of the risks and threats in digital media use, making them more vulnerable targets for digital predators. Individuals with a high school diploma show a slightly increased level of awareness of risks and threats, but this is still significantly lower compared to those with a bachelor's, master's, and doctoral degree. Those with a higher education degree are aware of the risks and threats associated with the use of digital media. The data show that there is no statistical difference in the level of knowledge and awareness of risks and threats among people with bachelor's, master's, and doctoral degrees.

H1e. It is predicted that individuals with higher education levels may have more knowledge and skills in using digital media in terms of problem solving.

Table 9

Knowledge and skills in using digital media within the scope of problem-solving variable

Multiple Comparisons							
LSD							
Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Problem Solution	P. School	H. School	-1.143943298969072*	0,074	0,000	-1,290	-0,998
	P. School	Bachelor	-1.410585585585585*	0,077	0,000	-1,561	-1,260
	P. School	Masters	-1.395555555555556*	0,087	0,000	-1,566	-1,225
	P. School	Ph.D.	-1.429166666666667*	0,121	0,000	-1,667	-1,191
	H. School	Bachelor	-.266642286616514*	0,055	0,000	-0,374	-0,159
	H. School	Masters	-.251612256586484*	0,068	0,000	-0,386	-0,118
	H. School	Ph.D.	-.285223367697595*	0,109	0,009	-0,499	-0,072
	Bachelor	Masters	0,015030030030030	0,071	0,833	-0,125	0,155
	Bachelor	Ph.D.	-0,018581081081081	0,110	0,866	-0,236	0,198
	Masters	Ph.D.	-0,033611111111111	0,118	0,775	-0,265	0,198

Table 9 presents data on problem-solving skills and shows that there is a significant statistical difference between those with primary and high school diplomas and those with a higher education diploma. Individuals who only have a primary school diploma are not equipped to solve the problems they encounter when using digital media. They are easily lost when problems arise when using digital media. Compared to those with a high school diploma and higher education graduates, those with a high school diploma use digital media more frequently and increase their problem-solving skills. However, compared to those with higher education diplomas, their problem-solving skills are significantly lower than those with higher education diplomas. Those with higher education degrees have advanced knowledge and problem-solving skills. The data show that there is no statistical difference in problem-solving skills and knowledge between individuals with bachelor's, master's, and doctoral degrees.

Discussion

The study aimed to understand whether there are differences between different education levels and knowledge and skills in digital media environment in Bosnia and Herzegovina. Total of 502 respondents filled the survey and the data was processed using SPSS.

In recent years, in 2021 (Habibija-Ražanica & Mekić) and 2024 (Turulja et al.), first analyses of digital literacy in Bosnia and Herzegovina were conducted. Azra Habibija-Ražanica and Ensar Mekić conducted research aimed to understand if digital literacy is depending on employment status and education level of people in Bosnia and Herzegovina. They collected the data from 210 respondents during the COVID-19 pandemic and found that “difference in digital literacy of employed and unemployed respondents is statistically insignificant. On the other hand, differences in digital literacy at different education levels are found to be statistically significant” (Habibija-Ražanica & Mekić, 2021, pp. 71-80). More comprehensive and systematic research was carried out by Association for Digital Transformation in Bosnia and Herzegovina in 2024. For their research, they used Eurostat database for the year 2021. The authors used EU Digital Skills indicator framework to analyse Eurostat data. The results have shown that Bosnia and Herzegovina is significantly lagging behind European countries when it comes to overall digital literacy, but also according to individual indicators of information literacy and data understanding, communication and collaboration, digital content creation, safety and problem solving.

For the purpose of this research data was collected in period from December 2023- January 2024. A total of 502 respondents filled out the survey, and results were analysed through 5 areas of EU digital skills indicator framework (information literacy and data understanding, communication and collaboration, digital content creation, safety, and problem solving) focusing mainly on educational segment and its impact on skills and competences in digital media and within mentioned EU indicators. The results showed that individuals with a higher level of education demonstrate superior digital literacy skills compared to those with a lower level of education.

The fact that level of digital skills and competences depend on the level of education highlights a strong need for a comprehensive approach to design a model for enhancing digital literacy among citizens in Bosnia and Herzegovina. Recommendations for the development of digital skills and competences through the education sector includes the systematic integration of digital literacy into the curricula of primary, secondary, and higher education institutions in Bosnia and Herzegovina. Giving priority to the development and systematic improvement of digital skills and competences is crucial. Additionally, it is essential to provide professional development opportunities to teachers at all levels and in all subjects to equip them with the necessary skills to effectively utilize digital tools in teaching practices. Relevant institutions should allocate funds to support digital literacy-focused education programs for elderly generations and individuals living in rural areas. Furthermore, the development of online courses targeting digital competences for all age groups should also be considered.

Conclusion

The aim of this research was to understand the current state of digital literacy by examining the correlation between different education levels and knowledge and skills in the digital media environment of Bosnia and Herzegovina. The EU Digital Skills Indicator framework served as the foundation for this study. Data collected through surveys were analysed across five variables within the EU framework: information literacy and data understanding, communication and collaboration, digital content creation, security, and problem-solving.

Out of the five hypotheses tested, four were fully supported, and one was partially supported by the collected data. The conclusions drawn are as follows:

- (1) Individuals with higher education degrees demonstrate partially more advanced information literacy and data understanding.
- (2) Education level strongly influences skills and knowledge in using digital media for communication and collaboration.
- (3) Education level strongly influences skills and knowledge in using digital media for digital content creation.
- (4) The level of education affects knowledge and skills and increases awareness of risks and threats in the use of digital media.
- (5) Education level impacts problem-solving skills and knowledge when using digital media.

In conclusion, individuals with higher education levels exhibit superior digital literacy skills compared to those with lower education levels. This is evident in their proficiency in information literacy, data interpretation, digital content creation, and problem-solving abilities.

References

- Ala-Mutka, K. (2011). *Mapping digital competence: Towards a conceptual understanding*. JRC Scientific and Technical Reports. European Commission.
- Buckingham, D. (2007). *Digital Media Literacies: rethinking media education in the age of the Internet*. *Research in comparative and international education*, 2(1), 43-55.
- Belshaw, D. (2012). *What is 'digital literacy'? A Pragmatic investigation*. Ed.D. thesis, Durham University
- Bawden, D. (2001). *Information and digital literacies: A review of concepts*. *Journal of Documentation*, 57(2), 218-259.
- Bosnia and Herzegovina Statistical Agency. (2021). *Household usage of information and communication technologies survey results*.
- Cope, B., & Kalantzis, M. (2000). *Multiliteracies: Literacy learning and the design of social futures*. Routledge.
- Durrant, C., & Green, B. (2000). Literacy and the new technologies in school education: meeting the I (IT) eracy challenge?. *Australian Journal of Language and Literacy*, 23(2), 89-108.
- 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.
- Ferrari, A. (2012). *Digital competence in practice: An analysis of frameworks*. JRC Scientific and Technical Reports. European Commission.
- Ferrari, A. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe*. Publications Office of the European Union.
- Gilster, P. (1997). *Digital literacy*. John Wiley & Sons.
- Green, B. (1988). *Subject-specific literacy and school learning: A focus on writing*. Australian Council for Educational Research.

- Habibija-Ražanica, A., & Mekić, E. (2021). *Digital Literacy, Education and Employment Status: Evidence from Bosnia and Herzegovina*. *Open Journal for Sociological Studies*, 2021, 5(2), 71-80.
- Halimić, A. (2021). *National broadband strategy as a determinant of 5G technology deployment in Bosnia and Herzegovina: A comparative analysis*. *Journal of Information Technology Policy*, 10(2), 123-138
- Hadjerrouit, S. (2010). *Digital literacy 2.0: Towards a definition and framework*. *International Journal of Education and Development using Information and Communication Technology*, 6(2), 78-93.
- Ibraković, M. (2022). *Bosnia and Herzegovina: dismantling monopolies in the green transition*. *Perspectives Southeastern Europe #10: Green transition and social (in)justice*. Heinrich Böll Stiftung.
- International Telecommunication Union. (2021). *ICT facts and figures*.
- Kress, G. (2003). *Literacy in the new media age*. Routledge.
- Lanham, R. A. (1995). *The electronic word: Democracy, technology, and the arts*. University of Chicago Press.
- Lankshear, C., & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Buckingham: Open University Press.
- Lankshear, C., & Knobel, M. (2006). *New literacies: Everyday practices and classroom learning*. Open University Press.
- Lankshear, C., & Knobel, M. (2008). *Digital Literacies: Concepts, Policies and Practices* (Cover plus Introduction).
- Martin, A., & Grudziecki, J. (2006). *DigEuLit: Concepts and tools for digital literacy development*. *Innovation in Teaching and Learning in Information and Computer Sciences*, 5(4), 249-267.
- OECD. (2019). *OECD Reviews of Digital Transformation: Going Digital in Bosnia and Herzegovina*. OECD Publishing.
- Opačak, A. (2021). *Medijska pismenost u obrazovnom sistemu Bosne i Hercegovine*, Master Thesis, University of Sarajevo, Faculty of Political Sciences, Department of Communicology.

Turulja, L., Alagić, A., & Kačapor, K. (2024). Digitalna pismenost stanovništva Bosne i Hercegovine. Analiza indikatora digitalnih vještina. *Udruženje za digitalnu transformaciju u Bosni i Hercegovini*.

UNESCO. (2006). *Literacy for life: Education for all*. UNESCO Publishing

Vuorikari, R., Punie, Y., Carretero Gomez, S., & Van den Brande, G. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens with Eight Proficiency Levels and Examples of Use*. JRC Science for Policy Report.