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# DIGITAL LITERACY AS A SEGMENT OF DIGITAL PSYCHOLOGY: EMPIRICAL SKILLS ANALYSIS

**Abstract:** The modern market requires new skills and competencies from graduate students. Digital literacy, as a part of the broader concept of digital psychology, is certainly one of these skills. Few studies have been done about students' digital literacy, especially in Serbia. The aim of this study was to measure students' digital literacy and their awareness of their own digital skills in terms of the use of information and communication technologies. A survey in the form of a questionnaire was created using the technique of stratified random sampling, which included 136 students. The research results show the average level of digital literacy of students. There is no significant difference between male and female students in terms of general digital literacy. However, male students showed higher information literacy and data use skills than female students.

**Keywords:** digital literacy, digital psychology, communication, security, problem solving

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## 1. Introduction

The rapid development of information and digital technology has had a profound impact on all aspects of human life. Apart from negative consequences, such as certain types of addiction, social alienation, and security threats, technological development also brings many positive consequences in many fields, such as education and work (Singh, A. K. & Singh, P. K., 2019). The tendency to use online or digital media, as a substitute for personal and offline interaction, with pronounced cognitive, emotional, and behavioural consequences for the individual and his social life, especially came to the fore during the coronavirus pandemic (Kaurin & Mijović, 2021). With this impact and the fundamental changes it has brought, "we have entered a new era in the field of psychology" (Ancis, 2020, p. 9), where cyberpsychology emerges as a new discipline.

Until recently, graduate students possessed knowledge and skills that would be considered inadequate for the modern labour market, based on the knowledge economy, and demanding advanced professional competencies as well as proficient use of information and communication technologies. Today, they must possess digital literacy skills in addition to their professional skills. The Organization for Economic Cooperation and Development (OECD) defines them as necessary for young people to become effective workers today (Ananiadou & Claro, 2009). Many researchers (Van-Laar et al., 2017; Fullan & Langworthy, 2013; Anderson, 2010; Schwab, 2016) include communication, critical thinking, creativity, collaboration, problem-solving, and technological competencies among digital literacy skills. Van-Laar defines digital literacy skills as technical skills, information management, communication, collaboration, creativity, critical thinking, and problem-solving, in the context of digital technologies and digital psychology (Van-Laar et al., 2017).

Higher education institutions play an important role in promoting and developing digital literacy skills among university students. However, there is still a gap between the skills acquired in higher education and those needed in the manufacturing sector. Therefore, research into the digital literacy skills acquired in universities and those required by the labour market is extremely important for educational research. The

gap is more pronounced in developing countries, and this delays their preparations for full entry into the knowledge economy (Alfaki, 2016). Hence digital literacy skills have become an emerging topic in educational research.

## 2. Cyberpsychology and digital literacy

**Cyberpsychology**, in the most general sense, refers to the field of study of the human mind and behaviour in the context of human interaction with digital technology. It is a relatively new discipline that aims to understand the relationship and mutual influence between humans and emerging technologies such as digital devices, the Internet, virtual reality, augmented reality, and artificial intelligence (Singh, A. K. & Singh, P. K., 2019). It can be defined as a branch of applied psychology that studies the impact of new communication technologies on human behavior and subjectivity, as well as communication between users of digital technology (Harley, Morgan, & Frith, 2018). Cyberpsychology is also defined as a discipline that aims to understand the psychological processes associated with all aspects of the interaction between technology and human behaviour (Ancis, 2020). It is based on an interdisciplinary approach, combining computer science, engineering, and psychology. Cyberpsychology also refers to the topics related to different areas of learning, learning applications, and digital literacy, seen through the lens of psychology as a behavioural science (Ancis, 2020; Attrill-Smith, Fullwood, Keep, & Kuss, 2019).

**Digital literacy**, as a part of digital psychology (Ancis, 2020; Attrill-Smith, Fullwood, Keep, & Kuss, 2019), refers to the skills people need to live, learn, and work in a society in which communication and access to information are increasingly happening through digital technologies such as internet platforms, social media and mobile devices. It denotes an individual's ability to find, evaluate, and compile clear and accurate information through writing and other media on a variety of digital platforms. The level of digital literacy is assessed by an individual's grammar, composition, typing skills, and ability to produce text, images, audio, and design using technology. The Digital Literacy Task Force of

the American Library Association offers the following definition: "Digital literacy is the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive (psychological) and technical skills" (Visser, 2013). Hiller Spiers, professor of literacy and technology at North Carolina State University, sees digital literacy as consisting of three segments: 1) finding and consuming digital content; 2) creating digital content and 3) communicating or sharing. Research methodologist and digital sociologist at the Illinois Institute of Technology, Yuli Hsieh, states that digital literacy is "the ability to access, process, understand, and create information or media content in a digital environment" (Hsieh, 2012). Although digital literacy initially focused on digital skills and personal computers, the advent of the Internet and the use of social media has led to a shift in focus to mobile devices. Like other expanded definitions of literacy, which acknowledge cultural and historical ways of making meaning, (Rowsell & Pahl, 2020) digital literacy does not aim to replace traditional forms of literacy. Instead, it builds on and extends the skills that form the foundation of traditional forms of literacy. Digital literacy should be considered part of the path to knowledge (Reedy & Parker, 2018).

Digital literacy involves the reliable, critical, and responsible use of digital technologies for learning, work, and participation in society (European Council, 2018). The Commission appointed by the European Commission published the European Framework of Digital Competences for Citizens with the aim of contributing to a better understanding and development of digital literacy in Europe. The digital literacy framework consists of competencies divided into the following five areas: information and data literacy, communication and collaboration, digital content creation, security, and problem-solving.

### 2.1. Computer and Data Literacy

Computer and data literacy include a) articulating the need for information, b) finding and downloading digital data, information, and content, c) evaluating sources' relevance and content, and d) storing, managing, and organizing digital data, information, and content.

Computer literacy and data literacy include a) viewing, searching, and filtering data, information, and digital content, b) evaluating data, information, and digital content, and c) managing data, information, and digital content.

Browsing, searching, and filtering data, information and digital content refers to a) articulating information needs, b) searching for and accessing data, information and content in the digital environment and moving between them, and c) creating and updating personal search strategies.

Evaluation of data, information and digital content includes analysing, comparing, and critically evaluating the credibility and reliability of data, information and digital content and analysing, interpreting and critically evaluating the data, information and digital content themselves. Data, information and digital content management includes organizing, storing and retrieving data, information and content in digital environments and organizing and processing them in a structured environment.

### 2.2. Communication and Collaboration

Communication and collaboration bring together interaction, communication, and collaboration through digital technologies, with an awareness of cultural and generational diversity, participation in society using public and private digital services and participatory citizenship, and digital identity and reputation management.

Communication and collaboration involve interaction, sharing, social inclusion, and collaboration through digital technologies, online etiquette, and digital identity management. Interaction through digital technologies involves communication using different digital tools and understanding the appropriate means of digital communication for a given context.

Sharing through digital technologies refers to sharing data, information, and digital content with others through appropriate digital technologies, acting as an intermediary, and being aware of referencing and attribution practices.

Inclusion in society through digital technologies includes participating in society using public and private digital services and seeking opportunities for empowerment and participation in society by using appropriate digital tools.

Collaboration through digital technologies involves the use of digital tools and technologies for collaborative processes and for the joint construction and creation of resources and knowledge.

The rules of online behavior refer to the awareness of norms and ways of behaving when using digital technologies and interacting in a digital environment, adapting communication strategies to specific audiences, and awareness of cultural and generational diversity in the digital environment.

Digital identity management involves the creation and management of one or more digital identities to protect one's reputation when working with data created by using multiple digital tools, environments, and services.

### 2.3. Digital Content Creation

Digital content creation refers to the creation and editing of digital content, improving and integrating data and content into existing knowledge while understanding how to apply copyrights and licenses and knowing how to provide understandable instructions for a computer system.

Digital content creation includes digital content creation, digital content development, digital content integration and processing, copyright and licensing, and programming.

Digital content development is the creation and editing of digital content in various formats for expression through digital means.

Integrating and processing digital content involves modifying, refining, enhancing, and integrating information and content into existing knowledge in order to create new, original, and relevant content and expand knowledge. In addition, it is important to understand how copyrights and licenses apply to data, information, and digital content.

Programming involves planning and developing a series of understandable instructions for a computer system to solve a problem or perform a specific task.

### 2.4. Digital security

Security refers to the protection of devices, content, personal data, and privacy in the digital environment, protection of physical and mental health, awareness of the importance of digital technologies for social well-being and social inclusion, and the impact of digital technologies on the environment. Therefore, security includes the protection of devices, personal data and privacy, health and well-being, and the environment.

Device protection refers to the protection of the devices and the digital content stored on them, understanding the risks and threats in the digital environment, and applying security and protection measures while taking into account reliability and privacy.

Personal data and privacy protection in the digital environment refers to the understanding of how personally identifiable information is used and shared, while simultaneously protecting oneself and others from harm, and understanding how digital services use privacy policies to inform how personal data is used.

Health and well-being protection includes avoiding risks and threats to physical and mental health while using digital technologies, protecting oneself and others from possible dangers in the digital environment, and awareness of the impact of digital technologies on social well-being and social inclusion.

Environmental protection in this context is awareness of the impact of the use of digital technologies on the environment.

### 2.5. Problem-solving

Problem-solving means identifying needs and problems and solving conceptual problems in the digital environment, using digital tools to innovate processes and products, and tracking the digital evolution.

Problem-solving refers to solving technical problems, identifying needs and technology responses, creatively using digital technologies, and identifying digital competency gaps.

Solving technical problems involves identifying and solving technical problems when handling devices or accessing digital environments and adjusting digital environments to personal needs.

Creative use of digital technologies refers to using digital tools and technologies to create knowledge and innovate processes and products and applying them individually and collectively to understand and solve conceptual problems in the digital environment.

Determining gaps in digital competence involves identifying points where one's own digital competence needs to be improved or updated, supporting the digital competences development of others, and looking for opportunities for self-development and tracking and keeping up with the digital evolution.

## 3. Research Aim

The main aim of this research, on the one hand, is to objectively evaluate the level of students' digital literacy, and, on the other hand, to record their subjective assessment of their knowledge of IT terminology. In addition, we examined whether there are differences between male and female students in objective competences and their subjective assessment of those competences.

## 4. Research Methodology

### 4.1. Sample

A suitable sample consisted of 136 students aged 20 to 38 (M = 22.23 years; SD = 2.29; 60% male) of the Faculty of Law and Business Studies Dr Lazar Vrkatić in Novi Sad. The data was collected in student cohorts, in class. Each respondent was required to fill out a digital questionnaire and take a competence test.

### 4.2. Instruments and Variables

For the purposes of this research, a digital competences test was specially constructed and operationalized through the knowledge of IT terminology.

The IT terminology test consists of 43 questions that cover five different domains of digital literacy: computer and data literacy, communication and cooperation, digital content creation, security, and problem-solving (see Appendix 1: General knowledge test – Computer science). All the items are multiple-choice questions with four possible answers, only one of which is correct. Each correct answer was scored with one point, and the total score was calculated by simply adding up the correct answers on the test. The test preparation time was not limited.

In addition to the general knowledge test, data on gender and age were also collected. Respondents were also asked to assess their level of *knowledge of IT terminology* on a five-point Likert scale (1 - very bad; 5 - very good), as well as to assess their *expected performance on the knowledge test*, i.e., the number of correct answers they expect to have on the test (between 0 and 43). As control variables, we registered *years of instruction in computer science* and *extracurricular IT courses taken*.

## 5. Results

The reliability of the IT knowledge test (Cronbach's α) is .84. The discriminativeness was also satisfactory (scores range from 10 to 43). Table 1. shows the percentage of respondents who gave the correct answer for each item.

Table 1. *Descriptive measures of expected and actual test performance, self-assessment of IT terminology knowledge level, and years of instruction in computer science*

| | M | SD | Theoretical range | Empirical range |
|---|---|---|---|---|
| Expected performance | 26.48 | 8.50 | 0 – 43 | 10 – 43 |
| Actual performance | 21.97 | 7.08 | 0 – 43 | 5 – 42 |
| Self-assessment of IT terminology knowledge level | 3.10 | 0.66 | 1 – 5 | 1 – 5 |
| Years of instruction in computer science | 4.62 | 2.91 | - | 0 – 15 |

We registered a general tendency to overestimate one's own achievement. On average, the respondents estimated that they would answer approximately 26 questions correctly, whereas they actually answered 22 questions correctly on average. Almost all respondents (95.6%) had instruction in computer science during their schooling. On the other hand, only 7.4% of respondents attended extracurricular IT/computer science courses.

Students who had instruction in computer science longer did not perform better on the IT terminology test ($r = .11$, $p = .212$). The correlation between the self-assessment of the level of knowledge of IT terminology and the expected performance on the knowledge test is $r = .48$ ($p < .01$). However, the actual achievement on the test is related only to the self-assessment of knowledge level ($r = .25$, $p < .01$), but not to the expected performance on the test ($r = .12$, $p = .169$). Students with higher achievement on the test did not expect to have higher achievement compared to students with lower achievement. On the other hand, students with a higher number of correct answers on the knowledge test did assess their knowledge of IT concepts as better.

Table 2. *Differences between male and female students*

| | Male M (SD) | Female M (SD) | t statistics | Confidence interval | |
|---|---|---|---|---|---|
| Expected performance | 27.70 (8.70) | 24.64 (7.91) | 2.06* | 0.12 | 6.00 |
| Actual performance | 22.59 (7.06) | 21.04 (7.06) | 1.254 | -0.90 | 4.01 |
| Self-assessment of IT terminology knowledge level | 3.09 (0.75) | 3.11 (0.51) | -0.22 | -0.26 | 0.21 |
| Years of instruction in computer science | 4.30 (2.69) | 5.11 (3.17) | -1.59 | -1.83 | 0.199 |

* $p < .05$. ** $p < .01$

Table 2 shows that male students have a greater tendency to overestimate their own achievement on the IT knowledge test than female students. A small gender effect was registered (Cohen's d = 0.36). No differences were found between male and female students in the objective achievement of the test, in the assessment of knowledge of IT terminology, or in the length of instruction in computer science.

Students on average answered 4.02 correctly out of a total of nine questions on the computer and data literacy tes, i.e., the percentage of correct answers was 45%.

Table 3. *Descriptive measures of actual performance on the computer and data literacy test*

| | M | SD | Theoretical range | Empirical range |
|---|---|---|---|---|
| Test performance | 4.02 | 1.84 | 0 - 9 | 0 - 9 |

Students who had instruction in computer science for a longer time did not achieve higher scores on the computer and data literacy test (r = .12, p = .17). The achievement on the computer and data literacy test is related to the assessment of knowledge of IT terminology (r = .23, p < .01), but not with the expected achievement on the test (r = .07, p = .451) ).

A statistically significant difference appears between female and male students in the achievement on the computer and data literacy test. On average, male students answered correctly to 4.36 and female students to 3.52 out of a total of nine questions.

Table 4. *Differences between female and male students on the computer and data literacy test*

| | Male M (SD) | Female M (SD) | t statistics | Confidence interval | |
|---|---|---|---|---|---|
| Test performance | 4.36 (1.79) | 3.52 (1.82) | 2.651 | 0.21 | 1.47 |

* $p < .05$

Students on average answered 6.47 correctly out of a total of twelve questions on the communication and collaboration test, i.e., the percentage of correct answers was 54%.

Table 5. *Descriptive measures of actual performance on the communication and collaboration test*

| | M | SD | Theoretical range | Empirical range |
|---|---|---|---|---|
| Test performance | 6.47 | 2.30 | 0 – 12 | 1 – 12 |

Students who had instruction in computer science for a longer time did not achieve higher scores on the communication and collaboration test (r = .05, p = .58). The achievement on the communication and collaboration test is unrelated to the assessment of knowledge of IT terminology ($r = .14$, $p = .12$), or with the expected achievement on the test ($r = .17$, $p < .05$).

There was no statistically significant difference between female and male students in the achievement on the communication and collaboration test. On average, male students answered correctly to 6.58 and female students to 6.31 out of a total of twelve questions.

Table 6. *Differences between female and male students on the communication and collaboration test*

| | Male M (SD) | Female M (SD) | t statistics | Confidence interval | |
|---|---|---|---|---|---|
| Test performance | 6.58 (2.34) | 6.31 (2.25) | 0.656 | -0.53 | 1.07 |

* $p < .05$

On the digital content creation test, students on average answered 4.01 correctly out of a total of seven questions, i.e., the percentage of correct answers was 57%.

Table 7. *Descriptive measures of actual performance on the digital content creation test*

| | M | SD | Theoretical range | Empirical range |
|---|---|---|---|---|
| Test performance | 4.01 | 1.49 | 0 – 7 | 1 – 7 |

Students who had instruction in computer science for a longer time did not achieve higher scores on the digital content creation test (r = .13, p = .14). The achievement on the digital content creation test is unrelated to the assessment of knowledge of IT terminology ($r$ = .16, $p$ = .07), or with the expected achievement on the test ($r$ = .003, $p$ = .97).

There was no statistically significant difference between female and male students in the achievement on the digital content creation test. On average, male students answered correctly to 4.07 and female students to 3.93 out of a total of seven questions.

Table 8. Differences between female and male students on the digital content creation test

| | Male M (SD) | Female M (SD) | t statistics | Confidence interval | |
|---|---|---|---|---|---|
| Test performance | 4.07 (1.44) | 3.93 (1.58) | 0.564 | -0.37 | 0.67 |

* $p < .05$

On the security test, students on average answered 4.38 correctly out of a total of nine questions, i.e., the percentage of correct answers was 49%.

Table 9. *Descriptive measures of actual performance on the security test*

| | M | SD | Theoretical range | Empirical range |
|---|---|---|---|---|
| Test performance | 4.38 | 2.28 | 0 – 9 | 0 – 9 |

Students who had instruction in computer science for a longer time did not achieve higher scores on the security test (r = .11, p = .20). The achievement on the security test is correlated to the assessment of knowledge of IT terminology ($r = .26$, $p < .05$), but not to the expected achievement on the test ($r = .06$, $p = .46$).

There was no statistically significant difference between female and male students in the achievement on the security test. On average, male students answered correctly to 4.40 and female students to 4.38 out of a total of nine questions.

Table 10. *Differences between female and male students on the security test*

| | Male M (SD) | Female M (SD) | t statistics | Confidence interval | |
|---|---|---|---|---|---|
| Test performance | 4.40 (2.18) | 4.35 (2.43) | 0.108 | -0.75 | 0.84 |

* $p < .05$

On the problem-solving test, students on average answered 6.47 correctly out of a total of six questions, i.e., the percentage of correct answers was 51%.

Table 11. *Descriptive measures of actual performance on the problem-solving test*

| | M | SD | Theoretical range | Empirical range |
|---|---|---|---|---|
| Test performance | 3.08 | 1.30 | 0 – 6 | 0 – 6 |

Students who had instruction in computer science for a longer time did not achieve higher scores on the problem-solving test (r = .003, p = .97). The achievement on the problem-solving test is unrelated to the assessment of knowledge of IT terminology ($r$ = .13, $p$ = .15), or to the expected achievement on the test ($r$ = .15, $p$ = .09).

There was no statistically significant difference between female and male students in the achievement on the problem-solving test. On average, male students answered correctly to 3.19 and female students to 2.93 out of a total of six questions.

Table 12. *Differences between female and male students on the problem-solving test*

| | Male M (SD) | Female M (SD) | t statistics | Confidence interval | |
|---|---|---|---|---|---|
| Test performance | 3.19 (1.16) | 2.93 (1.48) | 1.137 | -0.19 | 0.71 |

* $p < .05$

Table 13. *Percentage of respondents who answered correctly (per item)*

| Item no. | IT terminology test item | Correct answers |
|---|---|---|
| 1 | Popular Internet browsers are | 11.10% |
| 33 | Ethical hacking is best described as | 14.10% |
| 39 | MOOC denotes | 19.30% |
| 43 | The latest MS Office version is Office 365 | 19.30% |
| 18 | It is usual to have computers in an organization networked so that all employees can use shared resources. What do we call this type of network? | 22.20% |
| 15 | Which of the following devices is both input and output? | 23.00% |
| 19 | Which of the following is a private network that can be accessed by users outside the organization? | 25.20% |
| 35 | Which of the following may present a security threat when opening an e-mail attachment? | 25.90% |
| 32 | Which of the following is an example of cybercrime? | 30.40% |
| 17 | We add an e-mail address in a BCC field if we want to | 34.80% |
| 31 | End User Licence Agreement provides the user with: | 34.80% |
| 38 | E-government advantages are | 34.80% |
| 24 | Microsoft Word is a WYSIWYG program, meaning that: | 37.80% |
| 41 | End users can access the cloud data via | 41.50% |
| 20 | Which of the following statements about the Internet is true? | 42.20% |
| 2 | When you type in a keyword into a search engine, a list of word combinations related to your search appears. They are: | 43.00% |
| 23 | Which of the following best describes shareware? | 43.00% |
| 25 | Which of the following statements describes a sound approach to data security in an organization? | 45.90% |

| | | |
|---|---|---|
| 37 | Files deleted from the hard disk and the Recycle Bin are safely removed and cannot be retrieved. | 47.40% |
| 29 | Which of the following should be done to protect data in the case of main file damage? | 49.60% |
| 34 | Ethical hacking is best described as | 49.60% |
| 13 | Which of the following is computer hardware? | 51.10% |
| 6 | What type of Internet access is still in use? | 51.90% |
| 5 | When this symbol appears in the lower-left corner of the program icon, it's | 53.30% |
| 12 | An operating system is: | 54.80% |
| 9 | A Word text is memorized | 55.60% |
| 21 | Which of the following is textual communication between two or more people via the Internet? | 56.30% |
| 40 | Using social networks for marketing purposes is | 56.30% |
| 28 | Why is a strong password policy important for organizations? | 60% |
| 36 | Which of the following is NOT a characteristic of e-business? | 62.20% |
| 22 | Communication via the Internet services is | 65.20% |
| 26 | Which of the following is a major rule when creating passwords? | 65.90% |
| 4 | How many files/folders are there in the picture? | 68.90% |
| 27 | Which of the following is the best way to protect the PC from viruses? | 70.40% |
| 42 | Google Drive provides users with | 71.90% |
| 11 | What can you use as memory space to store data? | 72.60% |
| 16 | An e-mail address can look like this: | 75.60% |
| 30 | Which of the following can enable a virus to enter the device? | 75.60% |
| 7 | This is a drop-down menu that appears | 84.40% |
| 8 | A Word document can be attached to an e-mail message. | 86.70% |
| 3 | The data obtained by using the search engine are | 87.40% |
| 10 | One of the programs used for tables and calculations is | 87.40% |
| 14 | Which of the following can improve computer performance? | 88.90% |

## 6. Concluding Remarks and Discussion

The primary aim of this research was to assess students' digital literacy as one of the basic segments of learning psychology of learning and, in a broader sense, cyberpsychology. Another aim was to register students' subjective assessment of their own knowledge of IT terminology. Differences between male and female students in objective knowledge and subjective assessment of knowledge were examined. Nearly all respondents received instruction in computer science during their schooling, but a few of them also attended extracurricular IT courses. The results point to the following conclusions:

**1) The students exhibit a general tendency to overestimate their own digital literacy skills. This tendency is greater among male students.** This result can be interpreted in relation to the concept of self-efficacy, which refers to the respondents' self-confidence and personal expectations regarding the final performance. Rohatgi, Scherer, and Hatlevik (2016) found a positive relationship between information and communication technology (ICT) self-efficacy and an increase in an individual's ability to use computer skills for research, creation, and communication (CIL) in a Norwegian sample. In our case, this means that the overestimation of one's own digital literacy skills reflects the respondent's more frequent use of computers in everyday activities.

**2) There is no significant difference between female and male students in terms of overall digital literacy skills, except regarding the segment of information and data literacy, where male students show higher competence.** Research has shown that self-efficacy beliefs can be related to gender and culture and that gender, self-efficacy, and socioeconomic conditions play an important role in understanding information literacy (cf. Hatlevik, O. E., Throndsen, I., Loic, M., Gudmundsdottir, 2018). Although girls perform equally well or better than boys in various domains, they tend to report lower self-efficacy (Schunk, Meece, & Pintrich, 2014), which has been confirmed in this study.

**3) Students who received instruction in computer science for a longer time did not have better results on the IT terminology test.** This can be explained by the results of studies that examined the impact of ICT use in school on student learning outcomes and on digital competence effects. Achievement did not improve with the increased use of computers in the school curriculum. Conversely, there was a negative correlation between the two (OECD, 2011). Other studies also did not show a significant correlation between digital competence and computer use at school (Hatlevik, Gudmundsdottir, & Loi, 2015). On the other hand, it was found that the intensity of computer use outside of school and students' self-efficacy related to computer use are positively correlated (Meelisen and Drent, 2008, qtd. in Hatlevik, O.E., Throndsen, I., Loic, M., Gudmundsdottir, 2018).

The actual achievement on the digital skills test is only related to the assessment of knowledge of IT concepts, but not to the expected achievement on the test. The results of earlier research reveal a clear difference between ICT self-efficacy (the respondent's self-assessment regarding the ICT knowledge and the resulting self-confidence regarding the final performance) and objective computer and information literacy (cf. Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014), which is also the case in this study.

**4) Students showed an average level of digital literacy.** Since the sample of respondents belongs to the so-called "millennials" and "the Internet generation"[5], a higher level of performance was expected. However, studies have shown that such generalizations are unjustified (Attrill-Smith, A., Fullwood, C., Keep, M., & Kuss, D.J., 2019). Does the average achievement mean that they are (in) sufficiently prepared for the labor market and for using modern educational and work tools in a digital environment? Contrary to assumptions about the enthusiasm of young people and the belief that they easily adopt and adapt technologies from one context (e.g., everyday life) to another (e.g., academic life), research shows that they are not necessarily focused on increased integration with

[5] In literature, media, and academia.

digital technology in educational and work purposes (Corrin, L., Apps, T., Beckman, K. & Bennett, S., 2019). Many young people express a tendency to separate the personal aspect (e.g., social networks) from the academic use of digital technology at the expense of educational needs. There is also evidence that some young people prefer the integration of technologies in different contexts to improve personal comfort (Prescott, J., Wilson, S., & Becket, G., 2013, qtd. in Corrin, L., Apps, T., Beckman, K. & Bennett, S., 2019).

The question remains whether the results of this research (average level of digital literacy despite many years of instruction in computer science and overestimating one's abilities in this area) are the consequences of the incompatibility of outdated education methods with new educational trends based on the progress of digital technology. Higher education has an important role in preparing young people to acquire the knowledge and skills to perform tasks in academic settings, one of these skills being digital literacy. Like the large 2017 UK survey[6] (Nevman & Beetham, 2017, qtd. in Hatlevik, O.E., Throndsen, I., Loic, M., Gudmundsdottir, 2018), our research has shown that young people need better pedagogical support to develop digital literacy skills not only for academic settings but also for the transition to the world of work.

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## APPENDIX: GENERAL KNOWLEDGE TEST – COMPUTER SCIENCE
## Prilog: Test informisanosti – oblast informatika

Pred Vama se nalazi test poznavanja informatičkih pojmova. Popunjavanje je anonimno, a rezultati će biti korišćeni isključivo u naučno-istraživačke svrhe. Molimo Vas da test rešavate samostalno. Hvala na učešću.

**Podaci o ispitaniku**

- **Pol:**
  1) muški
  2) ženski
- **Starosna dob:**
  *Napišite koliko imate godina* _____

⊡ **Procenite svoj nivo poznavanja informatičkih pojmova zaokruživanjem odgovarajućeg broja na skali od 1 do 5 gde je:**

*1 - izuzetno loše;*

*2 - ispod proseka;*

*3 - prosečno;*

*4 - iznad proseka;*

*5 -izuzetno dobro.*

⊡ **Test koji sledi sadrži 43 pitanja. Koliko tačnih odgovora očekujete da ćete imati na testu?**

*Upišite broj od 0 do 43:* _____

§ **Da li ste tokom školovanja imali nastavu iz informatičke grupe predmeta?**

1) Da. *Upišite koliko godina:* _____

2) He.

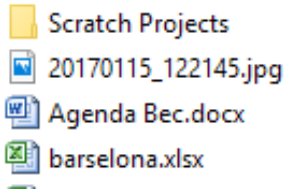
§ **Da li ste pohađali neku vrstu informatičkih kurseva?**

1) Da. *Navedite nazive kurseva ili sertifikata koje posedujete*

2) Ne.

**TEST (zaokružite tačan odgovor)**

1. **Poznatiji Internet pretraživači su:**
   A. Google i Explorer.
   **B. Google i Bing.**
   C. Yahoo i Outlook.
   D. Apple i Microsoft.
2. **Kada u pretraživaču kucate ključnu reč pojavljuje se pomoć u vidu liste kombinacija reči koje su vezane za Vašu pretragu. To su:**
   A. Reči koje ste već pretraživali, pa ih je računar memorisao.
   B. Plaćene reklame koje imaju za cilj da Vas odvedu do njihovog proizvoda.
   **C. Reči koje su najsličnije traženom upitu i trenutno najpopularnije u pretraživaču.**
   D. Kombinacija svega navedenog.
3. **Informacije koje na internetu dobijamo pretragom su:**
   A. Uvek tačne.
   B. Tačne samo na sajtovima koji se nalaze među prvima na listi.
   C. Tačne samo na sponzorisanim sajtovima.
   **D. Tačne samo kod proverenih izvora.**
4. **Koliko fajlova/foldera vidimo na priloženoj slici?**
   A. 1 fajl i 3 foldera
   **B. 1 folder i 3 fajla**
   C. 4 fajla
   D. Nemoguće je precizno odgovoriti bez klika na njih.

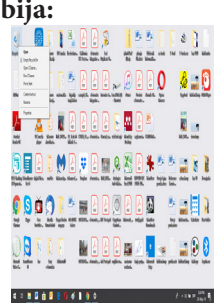



5. **Kada se ovaj simbol**  **nalazi u donjem levom uglu ikone programa, predstavlja:**
   A. Back-door.
   B. Speed-dial.
   C. Quick-launch.
   **D. Short-cut.**

**6. Koji način povezivanja na internet se i dalje koristi?**

A. Kablovski.
B. Bežični.
C. DSL
**D. Svi navedeni.**

**7. Ovo je izgled padajućeg menija koji se dobija:**



A. Levim klikom na ikonu.
B. Dvostrukim klikom na ikonu.
**C. Desnim klikom na ikonu.**
D. Pritiskom tastera Enter.

**8. Word dokument može biti prilog (attachment) u e-mail poruci.**

**A. Da.**
B. Ne.
C. Zavisi od toga da li primalac takođe ima instaliran Word.
D. Zavisi od mejl adrese primaoca.

**9. Tekst otkucan u Wordu se memoriše:**

A. U samom programu Wordu.
**B. Na hard disku računara.**
C. U RAM memoriji računara.
D. U MS Windows operativnom sistemu.

**10. Jedan od programa u kome je moguće uraditi tabelarne kalkulacije je:**

A. PowerPoint.
**B. Excel.**
C. Access.
D. Acrobat Reader.

**11. Šta se može koristiti kao memorijski prostor za skladištenje željenih podataka?**

A. Hard disk.
B. USB disk.
C. Memorijska kartica.
**D. Sve navedeno.**

**12. Operativni sistem je:**

A. Softver koji može da primi informacije iz baze podataka.
B. Hardver koji može da skenira i konvertuje fotografiju u digitalni fajl.
**C. Softver koji kontroliše korišćenje i raspodelu hardvera.**
D. Hardver koji može da snima i šalje fotografije putem interneta.

**13. Šta od navedenog predstavlja hardversku komponentu računara?**

A. Antivirus program.
B. Aplikacija za tabelarni prikaz.
**C. Miš.**
D. World Wide Web.

**14. Šta od navedenog utiče na poboljšanje performansi računara?**

A. Korišćenje velikog monitora.
B. Povećanje broja aplikacija za rad.
C. Korišćenje bržeg štampača.
**D. Povećanje veličine RAM memorije.**

**15. Koji je od navedenih uređaja i ulazni i izlazni?**

**A. Touchscreen**
B. Tastatura.
C. Štampač.
D. Skener.

**16. E-mail adresa može izgledati ovako:**

A. Ime123.gmail.com

**B. Ime123@yahoo.com**

C. Ime123@gmail

D. Sve navedeno

**17. Prilikom slanja e-mail dodajemo adresu u BCC ukoliko želimo da:**

A. Kriptujemo našu poruku samo za tog primaoca.

B. Ukažemo na urgentnost poruke.

**C. Pošaljemo kopiju poruke skrivajući to od ostalih primalaca.**

D. Pošaljemo kopiju poruke bez skrivanja od ostalih primaoca.

**18. Obično su računari u poslovnim objektima umreženi kako bi svi zaposleni mogli da koriste zajedničke resurse. Kako se naziva ovaj način povezivanja računara?**

A. Internet.

**B. Intranet.**

C. World Wide Web.

D. Mrežni port.

**19. Šta od navedenog predstavlja privatnu mrežu kojoj imaju pravo pristupa i korisnici izvan organizacije?**

A. Intranet.

B. WorldNet

C. E-mail.

**D. Extranet**

**20. Koja je od sledećih izjava vezanih za internet tačna?**

**A. Internet je globalna mreža koja povezuje veliki broj računara.**

B. Internet je isto što i www.

C. Internet je vizuelno predstavljanje linkovanih dokumenata.

D. Internet je mrežni operativni sistem.

**21. Šta od navedenog predstavlja tekstualnu komunikaciju između dvoje ili više ljudi putem interneta?**

A. Podcasting.

B. RSS - Really Simple Syndication.

C. VoIP - Voice over Internet Protocol

**D. Instant poruke.**

**22. Komunikacija preko internet servisa je:**

A. Namenjena isključivo poslovnim korisnicima.

B. U upotrebi isključivo za privatne svrhe.

**C. Prihvatljiva za poslovne i privatne svrhe.**

D. Nemoguća. Internet servisi nisu namenjeni za komunikaciju.

**23. Koja je od sledećih izjava opisuje shareware?**

A. Potpuno besplatan softver koji je dostupan samo na internetu.

B. Komercijalni softver koji se mora platiti.

**C. Sofver koji je besplatan samo određeni period nakon koga se mora plaćati nadoknada za njegovo korišćenje**

D. Softver zaštićen autorskim pravima - dozvoljeno neograničeno korišćenje i distribucija.

**24. Microsoft Word je program tipa vizivig (eng. *wysiwyg)* što znači:**

A. Vidljiv je kod i moguće ga je menjati.

**B. Tokom same obrade tekst se prikazuje upravo onako kako će izgledati kada se odštampa.**

C. Moguće mu je dodavati nove mogućnosti koristeći makroe.

D. Pisan je u *Visual Basic* jeziku.

**25. Koja od navedenih izjava opisuje dobar pristup za bezbednost informacija na nivou organizacije?**

A. Ne postoje procedure za izveštavanje o sigurnosnim propustima.

B. Šifre zaposlenih se ne menjaju redovno.

C. Važni podaci su dostupni svima.

**D. Redovno pravljenje kopije (*backup*) podataka.**

**26. Šta od navedenog predstavlja važno pravilo kada su u pitanju lozinke?**

**A. Šifre se menjaju redovno.**

B. Šifre se nikad ne menjaju.

C. Šifre sadrže manje od 4 karaktera.

D. Šifre sadrže manje od 4 broja.

**27. Koji je od navedenih načina najbolji za zaštitu računara od virusa?**

A. Dovoljno je proveravati da li su prilozi u mejlu zaraženi virusom.

**B. Redovno ažuriranje antivirus softvera.**

C. Redovno ažuriranje operativnog sistema.

D. Preuzimati fajlove sa interneta preko administratorskog naloga.

**28. Zašto je za svaku organizaciju važna politika kreiranja jakih lozinki?**

A. Obezbeđuje deljenje fajlova preko mreže kompanije

B. Obezbeđuje lakši pristup priključivanja računara na mrežu.

**C. Zaštita fajlova od neovlašćenog korišćenja.**

D. Obezbeđuje lakše pronalaženje fajlova na računaru.

**29. Šta bi od navedenog trebalo uraditi da bi se zaštitili podaci od gubitaka u slučaju oštećenja glavnog fajla?**

A. Redovno ažuriranje operativnog sistema i svih aplikacija.

B. Instalirati program za bezbednost šifri.

**C. Redovno čuvanje fajlova na drugom računaru ili mediju**

D. Instalirati firewall.

**30. Šta od navedenog može dovesti do ulaska virusa u računar?**

**A. Preuzimanje fajlova sa interneta**

B. Povezivanje novog štampača na računar.

C. Upotreba programa za skeniranje virusa na računaru.

D. Podešavanje monitora na slabiju rezoluciju.

**31. Pravo korišćenja (End User License Agreement) korisniku obezbeđuje:**

A. Potpuno vlasništvo nad softverom.

B. Ekskluzivno pravo da kopira i prodaje softver drugim korisnicima.

C. Pravo da modifikuje softver.

**D. Pravo da instalira i koristi softver na određenom broju računara.**

**32. Šta je od navedenog primer sajber kriminala?**

A. Dešifrovanje (decryption).

**B. Pecanje (Phishing)**

C. Viša sila.

D. Etičko hakovanje.

**33. Šta od navedenog najbolje opisuje termin Etičko hakovanje?**

A. Navođenje grupe ljudi da izvrše neovlašćene radnje.

B. Navođenje ljudi da otkriju poverljive informacije.

C. Pretnja poverljivim podacima od strane internog osoblja.

**D. Ovlašćeno testiranje za utvrđivanje eventualnih sigurnosnih sistemskih problema.**

**34. Šta od navedenog ukazuje na bezbedan veb sajt?**

A. .org

B. .edu

**C. https**

D. www

**35. Šta od navedenog može biti pretnja za sigurnost pri otvaranju e-mail priloga?**

A. Fajl koji sadrži digitalni potpis.

B. Fajl koji može da obriše kolačiće (cookies) po otvaranju poruke.

C. Fajl koji zahteva jednokratnu šifru.

**D. Fajl koji sadrži makro naredbe.**

**36. Šta od navedenog NIJE odlika elektronskog poslovanja (e-business)?**

A. Roba se može reklamirati i cene se mogu upoređivati.

**B. Postoji fizički kontakt između kupca i prodavca.**

C. Transakcije se brzo obavljaju.

D. Usluge su dostupne 24 časa dnevno.

**37. Fajlovi koji su obrisani sa hard-diska i uklonjeni iz kantice (Recucle Bin) su bezbedno uklonjeni sa računara i nemoguće je povratiti ih.**

A. Tačno.

**B. Netačno.**

C. Zavisi od tipa fajla.

D. Zavisi od vrste softvera.

**38. Prednost e-uprave (e-gouvernement) je:**

A. Ubrzavanje procesa administrativnih postupaka.

B. Lakši pristup administrativnim informacijama.

C. Transparentnost ogranaka administracije.

**D. Sve navedeno.**

**39. Akronim MOOC se odnosi na:**

**A. Masovne otvorene internet kurseve.**

B. Međunarodne online offshore kompanije.

C. Milionske open-office kalkulacije

D. Digitalnu valutu.

**40. Upotreba društvenih mreža za marketinške svrhe je:**

A. Primenjiva samo za mala preduzeća

B. Neozbiljna i nije preporučljiva.

**C. Jeftina i može dati dobre rezultate.**

D. Skupa i neisplativa.

**41. Podacima koji se nalaze u „oblaku“ (*cloud*) krajnji korisnici pristupaju preko:**

**A. Veb pregledača.**

B. Mejla.

C. Enkripicije.

D. Svega navedenog.

**42. Gugl disk (*Google Drive*) omogućava korisnicima da:**

**A. Skladište i dele podatke.**

B. Skladište podatke bez mogućnosti deljenja.

C. Skladište fotografije uz naplatu.

D. Sarađuju na izradi Google dokumenata.

**43. Najnovija verzija MS Office je Office 365.**

A. Nije tačno, pod tim nazivom nema Office paketa.

B. Tačno, to je verzija koja je izašla nakon MS Office 2019.

**C. Office 365 je verzija isključivo za Cloud okruženje.**

D. Office 365 je prva (najstarija) verzija Office paketa.