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Self-Assessment of Computer Literacy Competence Among Medical Undergraduates

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Abstract
In Romanian high schools, Information and Communications Technology is a required subject. The field of study in high school will determine the curriculum, which might be theoretical (science or humanities), technical, vocational, or services and economics. Our goal was to examine how first-year students perceived their pre-university education-based knowledge and abilities in computer literacy. We created an original, anonymous, online questionnaire regarding the students' perception of general computer use skills, Internet browsing, online information search skills, digital communication skills, and the use of programs from the Microsoft Office package. Eligible participants were first-year students (academic year 2022-2023) in the Romanian section at the Faculty of Medicine, Iuliu Haţieganu University of Medicine and Pharmacy Cluj-Napoca. All eligible participants were invited to self-evaluate their computer literacy skills. Two hundred and twenty-one students participated. About 88.69% of respondents declared that they have good skills in general computer use, but only 57.47% understand basic computer terminology at an average or expert level. Analyzing the statements about skills at the beginner-up-to-expert level: 95.93% have knowledge about using the Internet, 98.19% can use the keyboard well, 97.29% know how to use an e-mail, and 87.33% consider themselves suitable for computer-assisted training. The participants self-assessed their proficiency in the Microsoft Office suite, with the majority (97.74%) considering themselves beginner-up-to-expert level users in Word or PowerPoint. However, their proficiency in Excel was slightly lower, with only 89.59% claiming beginner-up-to-expert level. About half of the respondents understood basic computer terminology, even though most respondents said they had general computer skills. While most respondents have average-expert-level knowledge of PowerPoint, only about half are proficient in Excel.

Keywords: Computer literacy; Undergraduate medical students; Perception; Self-rate

Introduction

Digitalization has undergone remarkable advancements since the digital revolution started, leading to transformative changes in various aspects of society. As a result, technologies that were previously considered almost science fiction have become accessible and integrated into our professional and personal lives. Analysts predict that about half of all jobs will be automated due to technological advances, emphasizing the increasing importance of digital skills in the future [1]. The realization within society that individuals need to possess technology-related skills to succeed in the digital world of today has led to the emergence of the concept of "digital competence" (DC) [2].

According to the European Union (EU), digital competence is one of the eight core competencies for lifelong learning. It comprises five digital competency domains: information and data literacy, communication, security, problem-solving, content production, and active engagement with online communities [3,4].

Computer literacy is defined as the efficient use of computers and related technology, making it a crucial skill. A person who is computer literate should be able to use computers for multiple purposes, such as writing letters and reports, performing calculations and comparisons, and communicating through email or a web platform. These competencies should be adaptable to accommodate personal, professional, or educational needs as necessary [5]. Digital literacy, primarily focused on instrumental knowledge of hardware and software, should not be confused with computer literacy. However, in the present context, digital literacy encompasses the capacity to effectively comprehend and analyze media and replicate data and images using digital manipulation [6].

The COVID-19 pandemic has further underlined the importance of computer literacy, particularly in education, within our technology-driven society [7,8]. The impact of the digital era on teaching and learning has become an essential topic of discussion in education policy worldwide, particularly in underdeveloped nations [9,10]. Despite the potential benefits of technology, its efficient use is not always widespread among the general population. While new digital technologies have the potential to simplify students' lives and offer alternative learning opportunities beyond traditional classroom instruction, there is a pressing concern regarding students' need for more understanding of how to utilize such technologies effectively in the learning process [11].

Since 1990, the Romanian education system has undergone continuous and comprehensive reforms to align the system with European general education standards [12]. To achieve this, the Romanian National Curriculum for compulsory education has integrated the recommended guidelines provided by the EU and has introduced Information and Communication Technology (ICT) into the undergraduate curriculum. In Romanian high schools, the curriculum varies based on the chosen field of study. Students can opt for theoretical programs (science or humanities), technical programs, vocational programs, or services and economics programs [13].

Even though digital skills were considered optional in Romania, starting in 2005, ICT was made mandatory for all high school profiles. Subsequently, it became compulsory for secondary schools in 2011 [14,15]. Despite these efforts, a significant digital skills gap persists in Romania. According to the European Commission, in 2021, 28 % of Romanians between ages 16 and 74 had low digital skills, placing the nation at the bottom of the list among EU member states [16].

Our study focused on information and data literacy, specifically examining first-year medical students' perceptions regarding their computer skills proficiency. An essential aspect of assessing their computer literacy skills was to evaluate their self-assessed proficiency and perceptions considering their pre-university education and knowledge base. Most medical students in Romania come from a theoretical high school background and tend to have a solid foundation in scientific subjects, critical thinking skills, and interdisciplinary understanding. By understanding their perceptions and self-assessed proficiency in computer literacy, we can identify areas that require additional attention and support in curriculum development and training initiatives [6]. We aimed to examine how first-year medical students perceived their pre-university education-based knowledge and abilities in computer literacy.

Material and Method

Participants

A cross-sectional study with retrospective data collection was used to assess students' knowledge perceptions of their digital literacy. Students willingly and anonymously responded to an online questionnaire that enabled this. This study included only the first-year students at the "Iuliu Haţieganu" University of Medicine and Pharmacy in Cluj-Napoca's Faculty of Medicine, Romanian division (the academic year 2022–2023). We included only the students who provided answers to all

items in the study's questionnaire, but students who did not graduate from a Romanian high school were excluded.

Method

All first-year students in the Romanian-taught medical study program were asked to complete the questionnaire during the first week of the academic year (3-7 October 2022). We developed an original online questionnaire, and its link was available to students on the Department of Medical Informatics and Biostatistics website. This questionnaire assessed some of the topics students were taught in high school and are also fundamental requirements for the disciplines taught in the Department mentioned above. Its 43 items were used to gather students' demographic data, general impressions of their computer/digital abilities, and specific digital knowledge and skills information.

The questions evaluated six forms of literacy to examine students' perceptions of general knowledge and specific skills. They specifically assessed the respondents by their:

- basic knowledge of computer terminology (general computer literacy)
- efficient keyboard skills
- basic knowledge of Internet use
- skills using e-mails
- experience with computer-assisted learning
- proficiency with Microsoft Office software (Word, PowerPoint, and Excel).

To assess how students perceive their **general knowledge and skills**, respondents were asked to rank themselves based on their level of expertise from 1 (expert level) to 4 (no experience), while 5 meant that they did not understand the requirement. The questions evaluating **specific knowledge and skills** had these answers to choose from: Yes /No/ I don't know.

Statistics

Descriptive methods such as frequencies and percentages were used to analyze qualitative data (demographic, general perceptions, and specific knowledge/skills data). Quantitative data were described using average and standard deviation (SD). The collected data were statistically analyzed using the Microsoft Office 365 Excel program.

Results

Of the 403 eligible students, just 224 (55.58%) completed all questionnaire items, but three of these students graduated from a non-Romanian high school and were therefore excluded from further research. Of the 221 respondents, 73% (n=164) were female (but two respondents preferred not to answer the gender question); 52% (n=116) of respondents came from the west or north part of Romania, while 17% came from the counties in the country's centerThe average age of the respondents was 19 (±1.1 SD), ranging from 17 to 28 years.

All respondents declared having a computer (or a tablet) and an Internet connection.

Since all 221 respondents graduated from a Romanian high school, the Information and Communication Technology (ICT) courses they attended in high school covered all six forms of computer literacy we evaluated.

Perception of Respondents' General Knowledge and Skills

When asked how they typically acquired computer literacy, the respondents gave one or more answers; the frequency for each of these answers was depicted in Figure 1.

The respondents' perceptions of their general knowledge and skills are shown in Figure 2, where students ranked themselves from 1 to 5.

Perception of Respondents' Specific Knowledge and Skills

Students were asked to respond to 28 items with "yes," "no," or "I don't know" when given more

direct questions that were on point or within a clear context. Each of these items belonged to one of the six distinct forms of digital literacy we assessed before and presented in Table 1.

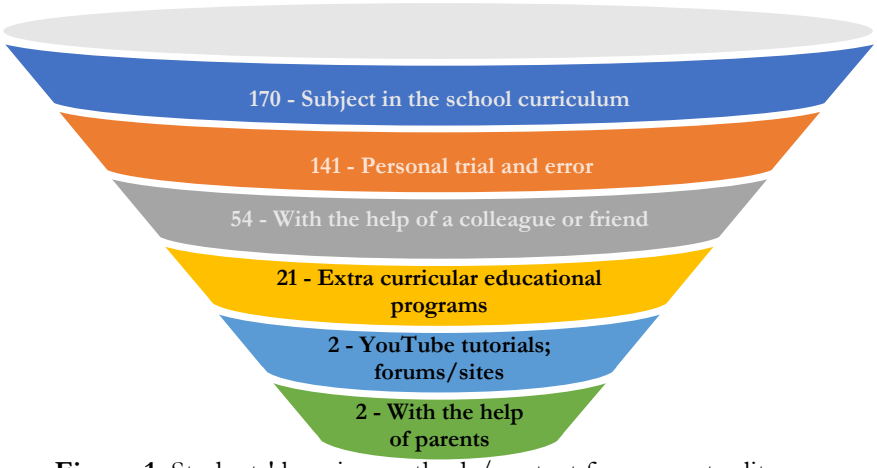

Figure 1. Students' learning methods/context for computer literacy

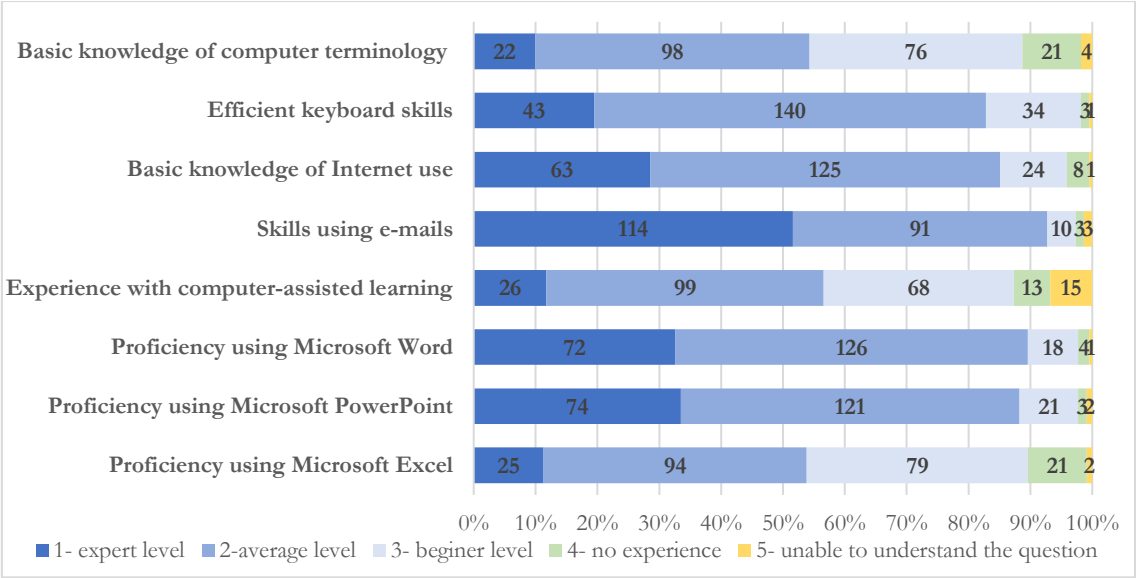

Figure 2. Students' self-evaluation of general computer proficiency

Several students answered "I don't know " to some questions: three did not know if they used keyboard shortcuts, seven did not know if they had a personal web page, and seventy did not know if they were using a webmail service.

In addition to the data from Table 1, another item from the 5th category (Experience with computer-assisted learning) asked students to state what they would require to attend an online meeting. Their answers are presented in Figure 3, all choosing only devices and none mentioning the need for an Internet connection.

Contrasting Respondents' Differences in Perception of Their General and Specific Knowledge and Skills

1. **Basic knowledge** (understanding) **of computer terminology** was self-rated at a beginner-expert level by 88.69% of respondents. Contrary to what most students believed, just 57.47% of students understood how to utilize basic computer hardware, 86.43% affirmatively knew how to transfer a file from a hard drive to a USB drive, 55.66% affirmatively knew how to install software, and only 42.08% affirmatively could perform a virus scan on a disk or file.

Table 1. Students' self-evaluation of specific computer proficiency (knowledge and skills)

Item type	Question/Item	Yes n (%)	No n (%)
1. Basic knowledge of computer terminology	Do you understand the essential functions of computer hardware? (e.g., CPU and hard drive)	127 (57.47)	94 (42.54)
	Can you turn on and off a computer properly?	221 (100)	(0)
	Can you start and close a computer program?	218 (98.65)	3 (1.36)
	Can you print a document using a printer?	211 (95.48)	10 (4.53)
	Do you know how to move a file from a hard drive to a USB drive?	191 (86.43)	30 (13.58)
	Can you change the brightness and contrast of the monitor?	202 (91.41)	19 (8.60)
	Can you minimize, maximize, and move windows on your desktop?	216 (97.74)	5 (2.27)
	Can you perform file management (deleting and renaming files, etc.)?	219 (99.10)	2 (0.91)
	Can you install a software program?	123 (55.66)	98 (44.35)
	Can you write files to a CD?	82 (37.11)	139 (62.9)
	Can you resize a photo?	193 (87.34)	28 (12.67)
	Can you scan a disk or file for viruses?	93 (42.09)	128 (57.92)
	Can you record and edit sounds?	74 (33.49)	147 (66.52)
2. Efficient keyboard skills	When working with the keyboard, do you use shortcuts?	165 (74.67)	53 (23.99)
3. Basic knowledge of Internet use	Do you have a personal web page?	14 (6.34)	200 (90.50)
	Do you use websites to understand better the subject you have to learn?	204 (92.31)	17 (7.70)
	Can you search for information using a web search engine?	210 (95.03)	11 (4.98)
	Do you know how to download and save files from the web?	218 (98.65)	3 (1.36)
4. Skills using e-mails	Do you have an email account?	221 (100)	0 (0)
	Do you use a webmail service?	133 (60.19)	18 (8.15)
	Can you send and receive email attachments?	221 (100)	(0)
5. Experience with computer-assisted learning	Do you find it easy to learn something by reading from a computer/laptop/tablet/phone screen?	135 (61.09)	86 (38.92)
	Can you use an online video conferencing tool?	211 (95.48)	10 (4.53)
6. Proficiency using Microsoft Office	Can you create a Microsoft Word document?	219 (99.10)	2 (0.91)
	Can you create a PowerPoint presentation?	220 (99.55)	1 (0.46)
	Can you create an Excel database?	187 (84.62)	34 (15.39)
	Can you copy, cut, and paste text/image/table in a document (Word, PowerPoint, Excel)?	220 (99.55)	1 (0.46)
	Can you change a document's font style and size (Word, PowerPoint, Excel)?	216 (97.74)	5 (2.27)

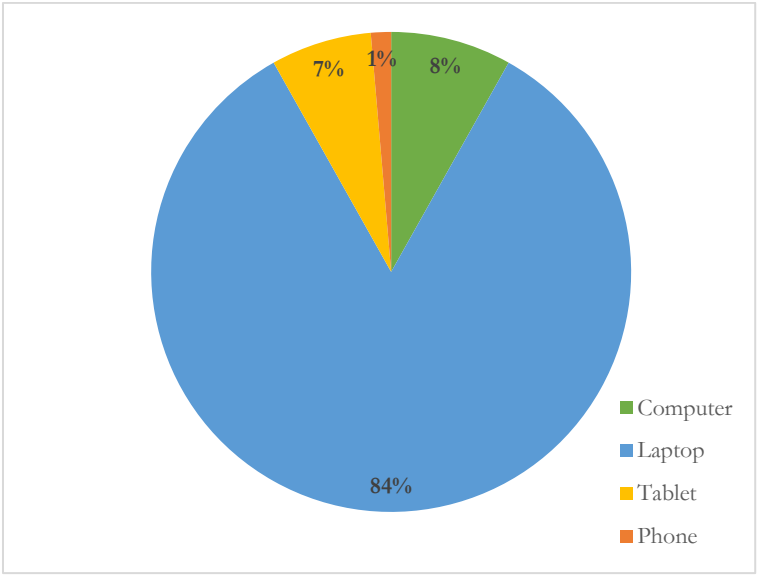

Figure 3. Students' choice of technology when attending a meeting online

2. The general self-assessment of respondents' *keyboard proficiency* placed **98.19%** of them between **beginner and expert levels,** but only 76.66% of students stated using keyboard shortcuts.

3. Basic knowledge of Internet use was self-rated at a beginner-expert level by **95.93%**. Similarly to what most students thought, more than 95% of students could download and store files from the web and utilize a search engine.

4. **Skills using e-mails** were self-rated between beginner and expert levels by **97.29% of respondents**. Even though every student had an email account, just 60.18 % claimed to utilize a webmail service.

5. **Experience with computer-assisted learning** was self-rated between beginner and expert levels by **87.33% of respondents**. Even though 95.48% of students claimed to be able to use a video conferencing tool, only 60.18% found it easy to learn by reading from a computer screen.

6. **Proficiency using Microsoft Office Word and PowerPoint** was self-rated between beginner and expert levels by **97.74% of respondents**. Almost all students (more than 99%) claimed to be able to create a Word/ PowerPoint document, but only 97.74% knew how to change the font style and size.

7. **Proficiency using Microsoft Office Excel** was self-rated between beginner and expert levels by **89.59%** of respondents. Only 84.62% of students claimed to be able to develop an Excel database, even though 99.55% claimed to be able to copy, cut, and paste text, images, and tables in such a document.

Discussion

We succeeded in examining how first-year medical students perceive their computer literacy as level of proficiency: we compared the perceived general knowledge to specifically stated skills, thus conducting a comprehensive examination of how first-year students perceived their pre-university education-based knowledge and abilities in computer literacy.

By including only students who graduated from a Romanian high school (theoretical, technological, or vocational branch/specialization), we ensured our method was reliable because all questionnaire items evaluated knowledge or abilities taught in ninth and tenth grades[17], thus at least two years of ICT classes. In our study, the 221 respondents learned computer skills mainly through high school courses, relying primarily on one's trial and error and occasionally seeking assistance from colleagues or close friends (Figure 1). They all stated to have a computer or laptop and Internet access.

First-year medical students self-assessed from beginning to expert levels their general proficiency very highly in each of the six categories of computer literacy, ranging from 87% to 98% (Figure 2). Even when focusing exclusively on average and expert levels, the overall self-evaluation was still high, exceeding 80%, but only in three of the six categories. Those that presented the greatest challenges (50%-60%) were Basic knowledge of computer terminology, Experience with computer-assisted learning, and Proficiency with Microsoft Excel (Figure 2), exactly the fundamentals required for the disciplines taught in the Department of Informatics and Biostatistics at our Faculty of Medicine. Furthermore, the three above-mentioned low proportion categories stood out when comparing the general to the specific proficiency self-assessment of the students who see themselves at a beginner to expert level. According to Figure 2 and Table 1, the following areas showed the greatest disparities between perceptions of general and specific computer literacy, ranging from 4.98% to 46.61%. Such large differences in the fundamental computer literacy requirements for the disciplines taught at our department give us reason to wonder whether students possess the abilities required to handle the faculty's requirements with ease, as is expected, given that they have taken at least two years of ICT classes beforehand. Additionally, it offers us justification for conducting an additional study to compare perception with real practice of computer literacy to determine the degree of matching between the two and to assess the levels of stress and anxiety real practice examination may cause.

Such in-depth research was done on student digital literacy and found that students who believed they were proficient (expert level) in digital literacy performed at an excellent level when evaluated by experts, as opposed to students who thought they were average or poor performers, both subgroups performed at a low level according to expert assessment [18]. Similarly, a research on junior high school students compared participants' assessed levels of digital literacy with how well they performed on digital tasks and found that they considerably overestimated their abilities, showing strong confidence in their digital literacy [19]. Based on our results, there is a high chance that the students in our study overestimated their abilities as well.

Another study assessed in 2016 medical students' digital literacy and found that, just as in our study, the higher levels of digital skills were in using e-mail, a Web browser, and proficiency with Microsoft Word. In contrast, proficiency with Microsoft Excel had lower scores [20].

Adding to the intricacy of technological skills, a more recent study (2020) on medical students from 39 European countries found that about 53% of the respondents self-rated having poor e-Health skills. About 85% agreed that more digital health education should be implemented in the medical curriculum, such as practical training in data management and public health systems [21].

To sum up, medical students still need to greatly increase their computer abilities, digital literacy, and e-Health skills, especially in Romania. The European Commission's 2022 report placed Romania at the bottom of the EU ranking. In terms of "at least basic digital skills," Romania scored 28% in contrast with 54% for the EU, and "above basic digital skills," it scored 9% vs. 26% for the EU [22]. The European Commission's reports before the COVID-19 pandemic (2017-2019) showed similar percentages when evaluating at least and above basic digital skills [23]. Since our study focused just on first-year students (average age 19±1.1 years with 100% access to a computer with Internet) and these reports assessed all the adult age groups in the population, we expected that first-year students' digital literacy perception would be much higher than the 28% presented in the EU report [22]. During the Covid-19 pandemic lockdown and restrictions, many universities switched to online teaching, leading to several issues regarding digital literacy. A study revealed a strong link between students' involvement in technology-based learning and their digital literacy [24].

According to specialized literature, the factors that most frequently influence the level of digital skills among young people were the type of studies and computer experience [25], while gender was not [26,25]. Some studies have shown that students' digital literacy can improve learning methods and academic success [27].

Moving beyond the medical undergraduate level, a study interviewing medical residents (junior doctors) highlighted that they felt generally unprepared to use digital technologies due to their limited experience throughout medical school and due to the slow adoption of digital technologies in the healthcare industry [28]. Moving beyond digital literacy to Artificial Intelligence (AI) in the medical field, a research on medical students from Germany showed that male undergraduate students had the most favorable opinions of AI in medicine compared to female students, and they believed that

AI solutions could produce better diagnoses than those made by doctors [29]. Additionally, a different study examined how medical students perceived the effects of Artificial Intelligence/Machine Learning (AI/ML) technologies and concluded that the medical curriculum should be expanded to include advanced AI/ML medical tools to prevent self-preserving biases and the undervaluing of technological advancements in the medical field [30].

To succeed in an era in which digital technologies are used in almost every aspect of life, formal and informal spaces, institutions must place more value on digital literacy and better prepare their students and internal organizational systems.

In light of the chance the quick growth of technology offers for improving, augmenting, and positively influencing healthcare, medical graduates must acquire the understanding, skills, and mindsets required to make effective use of the technology and data at their disposal.

Hence, there is a need to improve accessibility to digital devices and expand opportunities to access technology to create equity [31]. Therefore, to achieve equity, it is necessary to reduce this digital gap, and a strong partnership between national and European governments is required [32].

Limitations

We devised a questionnaire that focused on the fundamental abilities and competencies that first-year medical students should have to meet the requirements of the courses provided by the Department of Informatics and Biostatistics. Since tests and evaluations from high school were primarily used to determine the students' computer knowledge and skills, the questionnaire was not intended to serve that purpose. We should have asked the students which branch of high school they graduated from since there are some differences in the ICT curricula depending on branch/specialization. Without this knowledge, we were unable to extend the questionnaire items to the digital literacy definition, limiting our ability to tailor the questions to evaluate solely the computer knowledge and skills that they were expected to acquire in that setting.

In order to make improvements in the future, we propose a study to compare perception with practical abilities in computer literacy, where the high school branch the students graduated from is evaluated, as well as known factors of influence such as estimated daily computer use. For a more accurate evaluation of medical students' perceived digital literacy in our country, expanding the number of respondents and medical schools would also be necessary.

Conclusions

After taking classes in information and communication technology, students tended to overestimate their knowledge of basic computer literacy, particularly in the areas that were most useful during faculty courses. To better understand the state of computer literacy among medical students, we advise conducting research that contrasts perceptions with real abilities that have been tested.

In the context of the digital literacy program started by the European Union, we consider it auspicious to create university activities and courses to promote developing a wide range of skills in searching, identifying, critically evaluating, and using information, and developing a more independent and creative behavior in the digital environment.

Conflict of Interest

The authors declare that they have no conflict of interest.

Authors' Contributions

AEUC defined the research's aim and the experiment's design. AEUC and IAGR carried out the experiments. AEUC participated in the design of the study and performed the statistical analysis.

AEUC and IAGR coordinated and helped to draft the manuscript. All authors read and approved the final manuscript.

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