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Can the Digital Skills of Higher Education Students Improve as They Progress Through Their Studies?

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Abstract. In recent years, there has been growing concern within the academic and scientific communities regarding the digital skills of teachers. However, it is our belief that the digital skills of students have been somewhat overlooked. We assert that it is not sufficient for teachers to possess digital skills in various areas; it is equally vital for students to develop and enhance their digital skills. This is essential for ensuring that the learning process is innovative, dynamic, and reflective of reality. Consequently, there has been a need to explore the digital skills of students in higher education. This article aims to present the findings of a questionnaire survey assessing the level of digital competence of students at the School of Education of the Polytechnic Institute of Bragança (Portugal). The questionnaire was adapted from the European Digital Competence Framework for Citizens (DigComp 2.2). The results were analyzed based on the students' level of study (Higher Professional Technical Course, Bachelor's Degree, and Master's Degree) and their level of digital proficiency (basic, intermediate, advanced, and highly specialized) to identify differences and similarities among the students. The results indicate that students at all three academic levels generally perceive themselves to possess an intermediate level of digital proficiency. Therefore, it is essential that students improve their digital skills to reach the highest level of digital proficiency.

Keywords: DigComp 2.2 · Digital Skills · Higher Education Students

1 Introduction

Digital skills are fundamental in contemporary education, as they prepare students to face the challenges of an increasingly digital and interconnected world [1, 2]. Developing these skills enables students to access, evaluate and use information critically and efficiently, which is essential for academic and professional success. In addition, digital proficiency promotes inclusion, ensuring that all students have equal access to learning opportunities, regardless of their socio-economic circumstances.

Thus, in the digital age, the ability to create, communicate and collaborate using technological tools is indispensable [3, 4]. Digital competencies enable students to actively participate in online learning communities, collaborate on distance projects and access

educational resources autonomously. This pushes the boundaries of traditional learning, allowing for a more personalized and adaptive education.

In addition to the United Nations Sustainable Development Goals [5] and the Government of Portugal's goals [6], especially for 2030, other studies also point to the urgency of equipping teachers with the necessary skills to teach students using technology. Over the last two decades in particular, several studies have appeared in the literature on the skills that teachers should have in order to exercise the teaching profession [7–17].

However, little is said about the digital skills that students should have today, especially when it comes to the teaching-learning process. It is precisely in this sense that this research arises.

This article aims to present the findings of a questionnaire survey assessing the level of digital competence of students at the School of Education of the Polytechnic Institute of Bragança (Portugal). The results indicate that students at all three academic levels generally perceive themselves to possess an intermediate level of digital proficiency. Therefore, it is essential that students improve their digital skills to reach the highest level of digital proficiency.

2 DigComp 2.2

DigComp 2.2 is the latest version of the Digital Competence Framework for Citizens, an initiative of the European Commission. This framework aims to provide a reference for the digital competences needed for citizens to be able to use digital technologies safely, critically and efficiently [18, 19].

This document presents version 2.2 of DigComp, which is an update of the examples of knowledge, skills and attitudes in the first version of the Framework [20]. This document presents the update of Dimension 4 of the European Digital Competence Framework for Citizens. The remaining dimensions remain identical to those published in version 2.1 of the Framework [20].

Digital competence is one of the key competences for lifelong learning. It was first defined in 2006 and, after an update of the Council Recommendation on May 22, 2018 [21], it is now worded as follows: *Digital competence involves the confident, critical and responsible use of and engagement with digital technologies for learning, working and participating in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), security (including digital wellbeing and cybersecurity-related skills), intellectual property issues, problem-solving and critical thinking* [21].

DigComp has been used in a variety of contexts; for example, from 2013 until now, DigComp has been used in the context of employment, education and training, and lifelong learning. This framework is also present in the construction of the Digital Skills Indicator (DSI), which is used to set policy targets and monitor the Digital Economy and Society Index (DESI). In addition to these, another example of implementation is the Europass CV, which allows citizens to assess their own digital competence and include this assessment in their Curriculum Vitae [20].

This framework covers five main areas of digital competences [8, 19]:

- The first area is information and data literacy, which includes the ability to locate, access, organize, evaluate and manage digital data critically and efficiently.
- The second area is communication and collaboration, which highlights the ability to interact and collaborate with others using digital technologies, managing digital identity and online reputation responsibly.
- The third area is digital content creation, which involves everything from creating and editing content to understanding copyright and licensing issues.
- The fourth area deals with security, encompassing everything from protecting personal data and devices to understanding the impacts of technology on physical and mental well-being, as well as raising awareness of the environmental impact of digital technologies.
- Finally, the fifth area focuses on problem solving, where the ability to identify and solve problems in digital environments is explored, as well as using digital tools to improve processes and keep up with technological developments (Fig. 1).

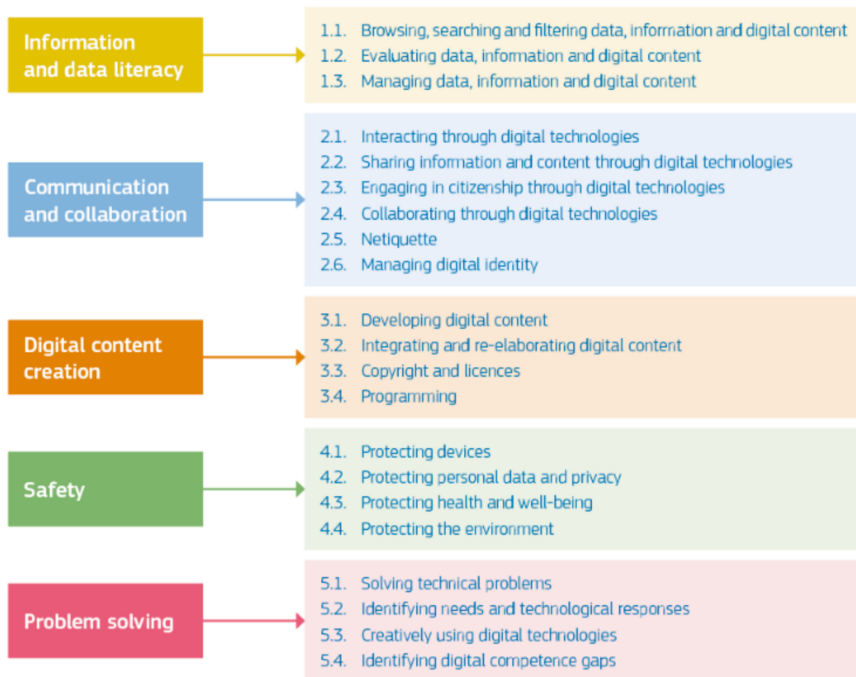


Fig. 1. DigComp 2.2 – The Digital Competence Framework for Citizens [19]

DigComp 2.2 is important for students because it provides a clear and structured framework of the digital competencies essential for academic, personal and professional life in the 21st century. By following this framework [19], students develop fundamental skills in five main areas: information and data literacy, communication and collaboration, digital content creation, security and problem solving. These competencies not only

improve students' ability to interact with digital technologies effectively and safely, but also prepare them for the future job market, where digital fluency is increasingly valued.

DigComp 2.2 is crucial for equipping students with the digital skills needed to thrive in an ever-evolving digital environment, ensuring that they are prepared for both academic challenges and the demands of an increasingly digitized job market.

3 Methodology

The purpose of the research is to assess the digital competencies of higher education students, with the support of the European Digital Competence Framework for Citizens [18].

The research adopted a case study methodology, focusing on students from the Higher School of Education of the Polytechnic Institute of Bragança in Portugal.

To gather data for the study, a questionnaire survey was used, and it was approved by the Ethics Committee of the Polytechnic Institute of Bragança. When administering the questionnaire to the students, it was essential to consider several ethical issues in order to protect their rights and well-being. Firstly, informed consent was ensured, where students needed to be fully aware of the purpose of the questionnaire, how their data would be used and that their participation would be voluntary.

In addition, it was crucial to ensure the confidentiality and anonymity of the participants, ensuring that their answers were not directly associated with them, thus protecting their privacy.

The survey includes questions corresponding to the skills outlined in the DigComp 2.2 and was distributed electronically via email to the target audience between June 2023 and March 2024, ensuring voluntary participation. Participants were informed about the objectives, ensuring the anonymity and confidentiality of the collected data. An intentional and non-probabilistic sample was used.

As a single questionnaire survey was applied to all students, the nature of the investigation is quantitative. Data was coded to ensure confidentiality. Both independent and dependent variables will be treated, categorized, and analyzed using Microsoft Excel through quantitative/statistical analysis.

4 Results

We conducted a study with 59 students and analyzed the results based on their level of study (Higher Professional Technical Course, Bachelor's Degree, and Master's Degree) and their level of digital proficiency (basic, intermediate, advanced, and highly specialized) considering in the 5 areas of digital competence (1. Information and data literacy; 2. Communication and collaboration; 3. Creation of digital content; 4. Security; 5. Problem-solving) outlined in the European Framework of Digital Competences for Citizens (DigComp 2.2). This analysis will allow us to pinpoint differences and similarities among the students.

4.1 Analysis of Results Considering the Level of Study and Level of Digital Proficiency

Higher Technical Professional Course

Considering the level of study students are attending and the relationship between their perceived level of digital competence, as shown in Table 1, there is an evident distribution of students across different levels of digital proficiency. Overall, participants from the Higher Technical Professional Course show an intermediate level in Areas 1, 2, 4, and 5, and advanced in Area 3: Digital Content Creation. This aligns with the level of study and the nature of the course.

Table 1. Digital proficiency of Higher Technical Professional Course.

Level of study	Digital proficiency level	Basic		Intermediate		Advanced		Highly specialized		Total	
		N	%	N	%	N	%	N	%	N	%
Higher Technical Professional Course	1. Information and data literacy	1	25%	6	25%	4	18.2%	1	10%	12	78%
	2. Communication and collaboration	0	0%	5	20.8%	5	22.7%	2	20%	12	64%
	3. Digital content creation	1	25%	2	8.3%	6	27.3%	3	30%	12	91%
	4. Security	1	25%	6	25.0%	3	13.6%	2	20%	12	84%
	5. Problem-solving	1	25%	5	20.8%	4	18.2%	2	20%	12	84%
	Total	4	100%	24	100%	22	100%	10	100%	60	400%

Bachelor's Degree

At the bachelor's degree level, as shown in Table 2, participants are only represented in basic, intermediate, and advanced levels of digital proficiency, with the intermediate level being the most prominent for competencies in Areas 2 to 5. The basic level is chosen for Area 1, and the advanced level has little significance. It's important to note that no bachelor's degree student considered themselves to have highly specialized digital proficiency.

Master's Degree

Looking at the master's degree level, in general, the most representative levels of digital proficiency are intermediate (for Areas 1, 4, and 5) and advanced (for Areas 2 and 3), followed by highly specialized, and finally, basic level, as illustrated in Table 3.

Table 2. Digital proficiency of bachelor's degree.

Level of study	Digital proficiency level	Basic		Intermediate		Advanced		Highly specialized		Total	
		N	%	N	%	N	%	N	%	N	%
Bachelor's degree	1. Information and data literacy	6	33.3%	2	8.3%	3	23.1%	0	0%	11	64.7%
	2. Communication and collaboration	1	5.6%	6	25.0%	4	30.8%	0	0%	11	61.4%
	3. Digital content creation	4	22.2%	6	25.0%	1	7.7%	0	0%	11	54.9%
	4. Security	4	22.2%	4	16.7%	3	23.1%	0	0%	11	62.0%
	5. Problem-solving	3	16.7%	6	25.0%	2	15.4%	0	0%	11	57.1%
	Total	18	100%	24	100%	13	100%	0	0%	55	300%

Table 3. Digital proficiency of master's degree.

Level of study	Digital proficiency level	Basic		Intermediate		Advanced		Highly specialized		Total	
		N	%	N	%	N	%	N	%	N	%
Master's Degree	1. Information and data literacy	5	25.0%	20	26.7%	7	11.1%	4	18.2%	36	81.0%
	2. Communication and collaboration	1	5.0%	12	16.0%	18	28.6%	5	22.7%	36	72.3%
	3. Digital content creation	5	25.0%	11	14.7%	16	25.4%	4	18.2%	36	83.3%
	4. Security	5	25.0%	17	22.7%	10	15.9%	4	18.2%	36	81.8%
	5. Problem-solving	4	20.0%	15	20.0%	12	19.0%	5	22.7%	36	81.7%
	Total	20	100%	75	100%	63	100%	22	100%	180	400%

5 Conclusion

In this article, our primary objective was to present the findings of a questionnaire survey based on the European Framework of Digital Competencies for Citizens (DigComp 2.2). The survey aimed to gauge the level of digital proficiency among students at various stages of their academic journey, including those enrolled in Higher Professional Technical Courses, Bachelor's Degree programs, and Master's Degree programs at ESE/IPB. Our focus was to understand how students perceive their digital competency levels and identify any similarities or differences among the various academic levels.

Upon analyzing the survey results concerning the participant's level of study and their self-assessed level of digital proficiency, we found that students across all three academic levels generally consider themselves to possess an intermediate level of digital proficiency.

However, reflecting on these results, we found that students do not always demonstrate in the classroom that they have these digital skills or this level of digital proficiency.

Therefore, we believe it is imperative to gain a thorough understanding of our students' digital competencies to effectively support and empower them during their academic journey, so that they are digitally competent to face current adversities and future challenges.

In conclusion, while the study showed promising results, we acknowledge the vital importance of fostering ongoing learning in digital proficiency. Given the undeniable centrality of digital technologies in 21st-century society, it is crucial to support students at all levels of study in attaining various levels of digital proficiency, intending to enable everyone to reach advanced and/or highly specialized levels.

6 Limitations and Future Research

It's worth noting that our study was limited by the relatively small sample size of 59 responses from respondents. Expanding the scope of our study to include the entire institution, rather than just one school, would provide a more comprehensive understanding of students' digital proficiency at the higher education level.

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