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DIGITAL FLUENCY IN HIGHER EDUCATION: INVESTIGATING TECHNOLOGY INTEGRATION IN PEDAGOGICAL PRACTICES OF PORTUGUESE EDUCATORS

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Abstract

Higher Education has been the target of enormous transformations resulting from the use of technology given that the educational context is increasingly embedded in this ecosystem. In the academy, we have seen a growing concern about teaching and learning requiring digital fluency. Indeed, it is important to reinforce teachers' and students' digital skills with strategies that make learning appealing, safe, and effective, without forgetting that digital fluency can be the basis for better teaching. However, the following questions arise: Are higher education teachers in Portugal responding and adapting to these challenges? What actions and strategies have they developed to apply technologies in classrooms and to promote digital fluency among students? And what actions should be taken, given that the young public is not only a consumer, but also a producer of online information and, at the same time, the internet has become a privileged resource for searching for easy and immediate information? This is the basis for this exploratory study, which aims to analyze the actions and strategies that higher education teachers in Portugal have developed to promote digital fluency, through digital technologies. This work seeks to observe how professors have worked on digital skills and encouraged their development in the academic community, particularly among their students. This can be observed through their pedagogical practices, namely in the creative and responsible use of information, communication strategies, content creation, and problem-solving or academic well-being promotion. To this end, a questionnaire survey is carried out among higher education teachers in Portugal, adapted from European Digital Competence Framework for Educators – DigCompEdu. The results point to a conservative view of integrating technologies in pedagogical practices, with most teachers using and encouraging general office-type software, learning platforms such as Moodle, or some applications for active learning moments, like Mentimeter, Kahoot or other apps. This reinforces the idea of previous studies that reveal that there is still some hesitation in openly embracing technologies and integrating them not just as tools, but as part of learning.

Keywords: *Digital skills, digital fluency, higher education teachers, pedagogical practices, Portugal.*

1. Introduction

Digital competence extends beyond the mere technical operation of electronic devices. It encompasses the safe and critical use of technologies in professional, personal, and social contexts, including the ability to locate, evaluate, store, produce, and exchange information, as well as participate in digital networks (Clifford et al., 2020). Mastery of these competencies is essential for workplace success and active citizenship in a digital society. The concept of digital literacy builds on foundational literacies, such as library, media, and computer skills, but extends beyond technical proficiencies to encompass knowledge, perceptions, and attitudes. As Bawden (2001) emphasizes, digital literacy integrates a spectrum of skills, understanding, and attitudes, underscoring its multifaceted nature. In the context of education, fostering digital skills has become a priority, particularly as digital resources reshape interactions with information. Educators play a pivotal role in advancing digital literacy by addressing the digital needs of diverse student populations, and fostering them to use digital devices in a fluent and proficient manner. This competency encompasses problem-solving and cognitive skills, extending beyond basic technology and internet skills. Importantly, information literacy and digital literacy are interconnected, with the latter embedding technological fluency while emphasizing ethical information use, respect for intellectual

property, and active citizenship in the digital era (Karpat, 2011). Addressing gaps in digital competence across various population groups is essential for designing effective training programs that align with the digital transition. In higher education, teachers prioritize lessons to help students effectively navigate and utilize diverse information resources. These skills are particularly critical for research-oriented students, for whom the integration of information literacy with digital fluency is vital (Allan, 2010). In this context, the development of digital literacy and fluency is foundational to equipping individuals for meaningful participation in the information society. Higher education serves as critical arena for cultivating these competencies, ensuring that individuals can effectively harness digital tools to achieve their academic, professional, and personal goals. The European Digital Competence Framework for Citizens (DigComp) is an initiative for framing digital skills policy, developing, and measuring digital competence, ultimately contributing to the Commission's priority 'A Europe fit for the Digital Age' and to Next Generation EU (European Commission, 2020). It serves multiple purposes, including designing competence assessment tools, creating training courses and materials, and identifying professional digital profiles within the realms of employment, education and training, and social inclusion. Within this framework the European Digital Competence Framework for Educators (DigCompEdu) (Ferrari, Punie, & Bre, 2013) has been adopted in Portugal (Lucas & Moreira, 2018). This framework, in particular, targets educators across various levels. It encompasses both general and vocational training, special education, and non-formal learning environments, delineated among six areas of competence: (a) Professional Engagement, (b) Digital Resources, (c) Teaching and Learning, (d) Assessment, (e) Empowering Learners, and (f) Facilitating Learners' Digital Competence. To support educators, the framework also provides a progression model that allows them to evaluate and enhance their digital competencies systematically. From these six areas, particular emphasis has been placed on Facilitating Learners' Digital Competence, recognizing its importance in equipping students with the skills necessary to thrive in a digital society. This underscores the role of educators not only as transmitters of knowledge but as facilitators of students' digital skills development. In doing so, it highlights the evolving their responsibilities in adapting to and integrating digital tools and practices into pedagogical contexts. In this context, the present study aims to analyze the actions and strategies that higher education teachers, in Portugal, have been developing to promote digital fluency through digital technologies creatively and responsibly for information, communication, content creation, well-being and problem-solving (Ferrari, Punie, & Bre, 2013; Lucas & Moreira, 2018). It further aims to observe how teachers work on digital skills and encourage their development in the academic community, particularly with their students.

2. Methods

To study the pedagogical strategies used in higher education student training across several dimensions, a survey was design based on the requirements for promoting digital competence (available in DigCompEdu), as detailed in Table 1. Surveys of a total of 30 higher education teachers were analyzed in this work. Based on their self-description, they were further divided by their age: younger than 45 years old (n=15) and between 45 and 60 years old (n=15); and by their scientific field: social sciences and humanities (SSH; n=16) and health sciences and technology (HST; n=14). All participants gave their informed consent before answering the survey and anonymity was guaranteed.

Table 1. Key areas for questions on teaching digital fluency.

Topic	Key Focus Areas
1. Differentiation and Personalization	Adapting teaching to students' individual needs, interests, and capabilities through digital technologies to ensure personalized and inclusive learning.
2. Active Involvement	Promoting student participation via interaction, collaboration, and autonomy, leveraging digital tools and innovative approaches.
3. Information and Media Literacy	Designing tasks that require students to identify, analyze, and critically evaluate information, ensuring credibility and effective processing.
4. Digital Communication & Collaboration	Encouraging responsible use of digital technologies for communication, teamwork, and civic engagement.
5. Digital Content Creation	Teaching students to create and modify digital content responsibly, applying copyright principles, referencing sources, and assigning licenses.
6. Responsible Use	Promoting safe, ethical, and healthy use of digital technologies, addressing physical, psychological, and social well-being.
7. Digital Problem Solving	Encouraging the identification and resolution of technical issues and the creative application of technological knowledge in new contexts.
8. Technological Resources; Additional Strategies; and Motivational Factors	Identifying the technological tools and platforms teachers use or recommend to students; Open-ended input on other pedagogical actions to promote digital fluency in academic contexts; Understanding what drives teachers to adopt digital pedagogical practices.

3. Results

3.1. Differentiation and personalization

More than one fourth of participants reported the use of pedagogical strategies to promote the use of digital technologies (26.7%; n=8/30). However, while the majority of younger participants followed this overall trend, none of the older participants reported doing so, albeit three promoted individual learning plans for the use of digital technologies. Most SSH (social sciences & humanities) teachers had a more rudimentary approach to digital technology differentiation, going only as far as implementing activities with digital technologies to promote different learning paths, levels and paces (62.5%; n= 10), while half HST (health sciences and technology) teachers reported promoting overall differentiated uses of digital technologies (28.6%; n=4), individual learning plans (14.3%; n=2) or even innovative formats to promote digital learning (7.1%, n=1).

3.2. Active involvement

Although more than one third of teachers encourages students to use digital technologies in motivating and engaging activities, such as games or quizzes (36.7%, n=11/30), in this parameter a significant difference was only observed between scientific fields, with most SSH teachers reporting the promotion of students' transversal skills development (43.8%; n=7), but only one uses innovative formats to actively engage students in digital technologies.

3.3. Information and/or media literacy

Enquired teachers were very heterogeneous regarding information and media literacy. Approximately one third reported the encouragement of students to use digital technologies to collect information (30%; n=9/30), but also a similar number of participants reported actively promoting information and/or media literacy (26.7%; n=8/30). This heterogenous trend was prevalent in younger teachers but not in older ones, where the majority declared to “promote information and/or media literacy” (46.7%; n=7). Once again, SSH teachers scored higher in information and/or media literacy, whereas half HST teachers declared they only “encourage students to use digital technologies to collect information”.

3.4. Digital communication and collaboration

The higher number of answers was that teachers encourage students to “use digital technologies for communication and collaboration” (30%; n=9/30) and implementing “activities to promote digital communication and collaboration” (30%; n=9/30). Likewise, when analyzing both age groups and science fields, SSH reported higher echelons of digital communication and collaboration competence than their HST counterparts.

3.5. Digital content creation

Herein, although none admitted using “innovative formats to promote digital content creation”, the majority of the teachers showed to incentive students to use or create digital content (> 50%). Importantly, there were few differences between younger and older teachers.

3.6. Responsible use

In this regard, half of the teachers assumed not going beyond encouraging “students to use digital technologies safely and responsibly” and none developed “innovative approaches to promote students' capacity to use digital technologies for their own well-being”. Moreover, older teachers reported limited involvement in safety strategies, while younger teachers were more heterogeneous as the different degrees of involvement to promote a responsible use of digital technologies were all mentioned by the same number of participants. Most HST teachers admitted having a more hands-off approach regarding responsible use than SSH teachers, as most reported only encouraging student digital safety and responsibility (42.9%; n=6).

3.7. Digital problem solving

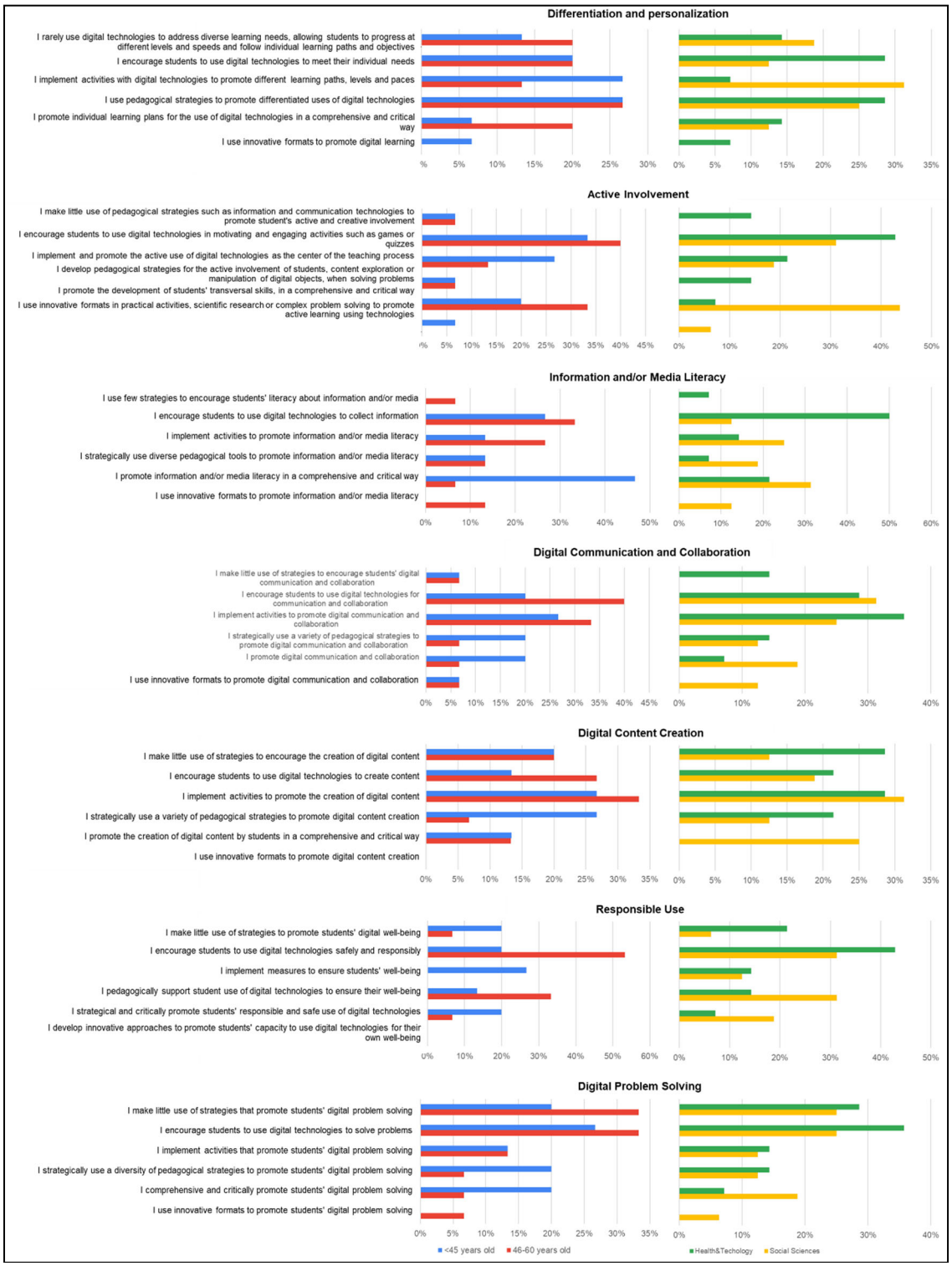
Overall, higher education teachers use little strategies to promote digital problem solving (26.7%; n=8/30) or only encourage students to use digital tools to solve problems (30%; n=9). This trend is also observed when considering both age groups and scientific fields.

3.8. Digital resources and incentives for their use

Teachers from all fields and of all age groups declared using a plethora of digital resources, namely the internet as a whole, text and tools, digital spread sheets, academic search engines, automatic reference organizer and active learning resources (such as quizzes and games), to name some examples. Of note, only

a minority admitted having made little change in their pedagogical approach (16.7%; n=5/30). In contrast, the vast majority (80%; n=24/30) considers specific courses on this subject to be the driving force to implement digital technologies and incentivize their students to do so as well and some admitted that the COVID pandemic urged this transformation (40%; n=12/30).

Figure 1. Summary of survey results considering the following parameters: (a) Professional Engagement, (b) Digital Resources, (c) Teaching and Learning, (d) Assessment, (e) Empowering Learners, and (f) Facilitating Learners' Digital Competence. n = 30. HTS-health and technology Sciences; SSH-social sciences & humanities.



4. Discussion and conclusions

In an era where technologies permeate nearly every aspect of life, digital skills are increasingly recognized as transversal, extending across various professional and personal contexts. While traditional skills remain vital, the digital age demands new competencies, including critical thinking, problem-solving, collaboration, and digital fluency. For higher education faculty, digital fluency is particularly critical, as it directly influences their ability to design and deliver authentic, technology-enhanced learning experiences (Lucas & Moreira, 2018). Miller and Bartlett (2012) highlight issues such as misinformation, filter bubbles, and the superficial consumption of online content, all of which demand sophisticated digital strategies. Professors play a pivotal role in equipping students with these strategies by fostering inquiry-based learning and integrating digital fluency into their teaching practices. Through well-designed learning activities, they can encourage students to engage critically with digital tools, enhancing their ability to navigate, evaluate, and apply information effectively. Incorporating digital fluency into higher education teaching requires a shift toward authentic learning practices, where students engage in real-world tasks that simulate professional scenarios (Méndez Gijón, 2021). This approach promotes active engagement with digital tools, allowing students to build confidence and competence in navigating digital landscapes. Authentic learning activities, designed by digitally fluent professors, prepare students not only for academic success but also for active participation in an increasingly digital workforce and society. Importantly, at a time when the advance of artificial intelligence is already a reality in the classroom, there is an urgent need for training in the sense of distinguishing between pedagogical tools that can contribute to the quality of teaching and those that can compromise and facilitate the process of creativity and reflective thinking. At a time when the advance of artificial intelligence is already a reality in the classroom, there is an urgent need for training in the sense of distinguishing between pedagogical tools that can contribute to the quality of teaching and those that can compromise and facilitate the process of creativity and reflective thinking. By integrating digital tools into pedagogical practices and modeling critical and ethical digital engagement, professors can contribute to the development of digitally competent graduates capable of meeting the demands of the digital age. In this study, it is observed that while some higher education teachers may already be implementing innovative strategies, they may not fully recognize these efforts as innovative. Nevertheless, there is evidence of an emerging awareness of these topics, as reflected in how initial concepts are being incorporated into their teaching practices. This indicates that significant progress is still needed to enhance digital fluency, enabling teachers to better equip their students with the competencies required to navigate the digital academic landscape effectively.

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