

Examining Teacher Trainees' Use of Digital Tools From the Perspective of Learning and Teaching

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Abstract

The Teacher Training Institutes have a decisive role in training teacher candidates with an adequate level of digital competence, who can use the methods and techniques that help students develop their skills and abilities in order to acquire professional knowledge, creating their chances for active employment on the labor market. In our presentation we present the results of the second phase of a longitudinal study. The survey was launched in the academic year 2022/23 with the aim of examining whether first-year students entering teacher training have the level of digital competence necessary to be able to use digital learning materials effectively and professionally as future teachers and to develop the digital literacy of their students. In the first phase, a questionnaire was developed to measure the level of competence, based on the examples provided in the DigCompEdu and DigComp 2.1 frameworks for the development and interpretation of digital competence. In the second phase, we focused on examining how the students relate to the use of digital tools and technologies in the classroom, and how proficient they are in the areas of digital competence in information and data management, communication and collaboration, and the digital content creation. In the next phase of our research, we aim to elaborate developmental interventions that help in the development of digital competence during teacher training, and then to monitor whether the experimental attempts yield the expected results.

Keywords: Teacher Training, Digital Competence, Level of Competence, DigCompEdu, DigComp

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Introduction

The rapid advancement of information and communication technologies (ICT) has significantly impacted various aspects of life, including the realm of education (Casal, 2007; Shoraevna et al., 2021). Education systems around the world are faced with the challenge of how to prepare young people to participate in the information society. A fundamental component of this preparation is digital competence, which encompasses not only the ability to use digital tools but also the critical evaluation of information, the creation of digital content, and online communication skills (Pinto & Leite, 2020).

Teachers play a crucial role in enabling students to acquire these skills (Romero et al., 2021; Wang, 2024). However, this requires teachers themselves to possess a high level of digital competence. The experiences and knowledge gained during teacher training are pivotal in shaping how future educators meet these expectations. The European Union places particular emphasis on this issue, with initiatives like the DigCompEdu framework (Redecker, 2017) providing guidance for enhancing teachers' digital competence.

This study aims to investigate whether Hungarian teacher education students in Romania possess an adequate level of digital competence to facilitate effective knowledge transfer as future educators. The relevance of the study is that the modernization of teacher education and the conscious development of digital competences are essential not only for improving the quality of education, but also for social innovation and adaptability in the labour market.

Digital Competence in Teacher Education

National and international research has significantly contributed to measuring and developing the digital competencies of teacher training students. These studies emphasize that the tools for assessing digital competence go beyond technical skills to include pedagogical and ethical dimensions, ensuring future teachers can effectively adapt to digital learning environments. Numerous frameworks and models highlight various aspects of digital competency and aim to support its evaluation and enhancement:

- UNESCO ICT Competency Framework for Teachers (ICT-CFT): This widely used international framework facilitates the definition and measurement of digital competencies in teacher education. It focuses on the pedagogical integration of information and communication technologies (ICTs) and encompasses skills such as ethical technology use, pedagogical innovation, and classroom application of ICTs (UNESCO, 2018; Falloon, 2020; Anaza, 2021).
- European Framework (DigCompEdu): Developed by the European Union, this framework outlines six areas of digital competency for teachers, including educational planning, assessment, and using digital tools in learning environments. It emphasizes lifelong learning and classifies educators' competencies into levels (e.g., novice, advanced, expert) (Reisoğlu & Cebi, 2020; Cabero-Almenara et al., 2023).
- ISTE Standards: Created in the USA, the ISTE (International Society for Technology in Education) standards have significantly influenced the measurement and development of digital skills in teacher education. These standards focus on the innovative use of technology for educational purposes (Vucaj, 2020; Crompton, 2023).
- International comparisons: Some studies compare different national frameworks, such as the European Teachers Competency and Qualifications Framework (eTQF). This project defines competencies and levels emphasizing technological skills and

pedagogical tools development. Such comparisons aid in creating tools better suited for educational professionals (Caena, 2014; Ngao et al., 2022).

Several significant studies have been conducted domestically to measure the digital competencies of teacher education students, employing various approaches. One important study involved the Hungarian-language adaptation of the DigCompEdu framework, which was implemented among participants in teacher training programs. This framework analyzes educators' digital competencies in terms of their applicability in educational practice. During the research, in addition to self-reflection, institutional support, and individual strengths, areas requiring development were also identified. The study placed particular emphasis on evaluating the state of teacher education, such as the use of tools and methodological integration (Horváth et al., 2020).

Another notable study examined the ICT competencies of instructors in teacher training institutions. The research analyzed educators' attitudes, activities, the types of tools and applications they used, as well as the level of institutional support across multiple dimensions. The findings highlighted the necessity for more effective integration of ICT tools, especially in university environments and across different training institutions (Komló, 2020; Tódor, 2022).

These studies provide valuable insights into the current state of digital competencies among future educators and underscore the importance of targeted support and training to enhance their ability to effectively incorporate digital technologies into their teaching practices.

Presentation of the Survey

Our research was conducted over two consecutive academic years, starting in 2022–2023, with the aim of assessing whether students possess the appropriate level of digital competence and identifying the support needed during their training to confidently use digital technologies in the future. For both surveys, we utilized custom-designed questionnaires.

In the first phase, we based our questionnaire on examples from the DigCompEdu and DigComp 2.1 frameworks. Questions were grouped into three areas: (1) What is the students' level of digital competence for learning based on the DigCompEdu framework, (2) What is their digital competence level according to the DigComp 2.1 framework, (3) What is the expected level of digital competence for school teachers, as outlined in the DigCompEdu framework.

The results indicated that most students could integrate digital technologies into their studies. However, 5–6% felt they lacked adequate knowledge for effective learning. Students rated their knowledge of the competence areas from the DigComp frameworks as above average, with only 1% considering their digital competence intermediate. Additionally, they agreed that schoolteachers should possess high levels of digital competence. The digital competence areas where there were gaps in knowledge were Problem Solving and Digital Content Creation (Harangus & Kovács, 2022).

The questions in our second survey were based on the findings of the first survey, and we focused on three main areas: (1) How students evaluated the use of digital technologies based on their prior experiences, and how much these technologies helped them in learning, (2)

How reliable they considered the information and data available on the internet, (3) How they perceive the role of digital learning materials in the teaching-learning process.

This phase emphasized students' attitudes toward using digital tools and technologies in classroom settings and their proficiency in information and data management, communication and collaboration, and digital content creation.

Presentation of the Sample

The survey involved students from the Teacher Training at the Sapientia Hungarian University of Transylvania, location Faculty of Technical and Human Sciences Târgu Mureş, with a total sample size of 106 participants. The gender distribution was fairly balanced, with 51% male and 49% female students. The distribution by academic major was as follows: 33.7% in engineering-related fields (including engineering and computer science), 27.9% in agriculture, 24% in humanities, and 14.4% in social sciences. The higher proportion of engineering students (62%) reflects the educational offerings at the Târgu Mureş campus.

In terms of permanent residence, the sample distribution was: 31.7% from rural areas, 14.4% from villages, 11.5% from county seats, and 32.7% from cities, while 9.6% of participants did not provide this information. Therefore, 46% of the students came from rural environments, and 44% from urban areas. Regionally, the distribution was as follows: 1.9% from Braşov and Alba counties (minority areas), 1% from Bihor and Satu Mare counties (transitional areas), 23.1% from Harghita, 15.4% from Covasna, and 46.2% from Mureş county (majority area). The regional data clearly reflects the dominance of students from the Mureş county, which is consistent with the student population profile at the faculty.

Evaluation of Results

(1) The Role of Electronic Devices and Digital Content in Education

In the first phase, we measured how students assess the presence of electronic devices and digital content in education. The students were asked to rate their responses on a scale from 1 to 7 (1 = not at all and 7 = to a full extent).

Table 1: Electronic Devices, Digital Learning Materials in Teaching and Learning

	Mean	SD
How much it aided the learning process		
the use of electronic devices	5.88	1.07
the use of digital learning materials	5.95	1.10
How useful do you find education		
electronic devices	6.02	0.99
digital learning materials	5.91	1.11
How useful do you find electronic devices in learning		
electronic devices	6.11	1.05
digital learning materials	6.11	0.98

The table below (Table 1.) shows that, overall, students found the use of electronic devices and digital content to be highly useful, assisting them in the teaching-learning process. However, by analyzing the distribution of the data, it is also noticeable that approximately 8-

14% of students believe that the use of digital tools does not help them in effective knowledge acquisition and retention, or in maintaining their attention.

We also explored students' views on the extent to which 21st-century teachers should use electronic devices and digital content in classroom teaching, as well as their own intended use as future educators. Comparisons to data collected in the 2015-2016 academic year (Harangus et al., 2017a, 2017b) reveal a significant shift. Previously, students believed that teachers did not need to be proficient in digital tool usage. Current data, however, underscore the importance students now place on teachers possessing strong digital competencies. This evolution highlights a growing recognition of the role of digital skills in effective education and the integration of technology into teaching methodologies.

(2) Reliability and Use of Information Available on the Internet

Assessing the reliability of internet-sourced information and its correct application is crucial because the online space hosts both credible, scientifically validated resources and misleading, inaccurate, or manipulated data. With the overwhelming volume of information available online, students must develop the ability to distinguish reliable sources from deceptive ones. This capability is a core component of digital literacy, essential for navigating an information-rich society. Additionally, improper use of information can result in legal issues, such as copyright infringements.

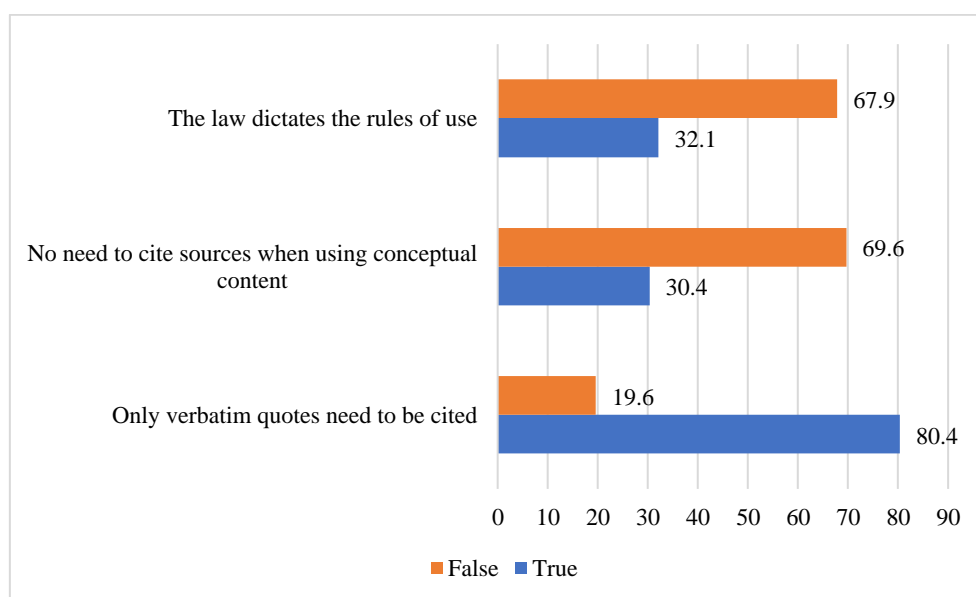


Figure 1: Knowledge of Reference Modes (%)

We sought to understand how reliable students perceive online information to be by asking them to evaluate the credibility of internet-based resources based on their experiences. More than half of the students consider about half of the information, data, and content available online to be reliable. They recognize that not all information accessible on the internet can be deemed trustworthy. Although they perceive themselves as conscious information seekers, responses to knowledge-specific questions reveal that they are not always aware of which sources provide reliable information.

Despite having to prepare several essays, papers, and presentations during their studies, which required sourcing materials, nearly one-third of students are unaware that failing to cite

sources—whether from online or print materials—violates copyright laws. Specifically, 32.1% do not know that citing a source is mandatory for direct quotations, and 30.4% are unaware that the same applies when using content-based elements. Additionally, not all students (19.6%) understand that copyright law and intellectual property protection regulate and define the rules for content usage (Figure 1). For example, when using visual creations such as images, graphics, paintings, photographs, videos, animations, and so on, the author's permission and payment of royalties are required unless the work is freely available or classified as public content. About one-third of students (33%) are unfamiliar with these regulations, mistakenly believing that no specific permissions are needed or that simply notifying the creator is sufficient.

(3) The Role of Digital Learning Materials in the Teaching-Learning Process

The knowledge and application of digital learning materials are crucial in the teaching-learning process, especially in the 21st-century educational environment. Digital learning resources serve as effective tools for knowledge transfer, increasing student engagement, and innovating pedagogical practices. They provide quick and flexible access to information while offering interactive opportunities that support individual learning processes. For educators, these materials create opportunities to expand teaching methods, such as integrating visual and interactive elements, which promote active student participation and engagement in the educational process.

In the first phase of our research, students indicated that their proficiency level in the area of digital content creation was inadequate. With our questions, we aimed to gain an understanding of how they would relate to the use of digital resources during teaching. 86% of the students consider it useful for students to use digital sources when solving homework, and 70% agree that homework should be completed digitally. Although they stated that they do not consider all information available on the internet to be reliable, 41% of them would still recommend using data from Wikipedia for students when preparing essays or homework.

The design and evaluation of the parameters of digital teaching materials are crucial, as these characteristics significantly influence the students' learning experience and the teachers' effectiveness in instruction. In the following, a seven-point Likert scale (1 – not at all, 7 – completely) was used to evaluate the importance of various characteristics that define the parameters of a digital learning material. Positive characteristics listed included: playful, humorous, interactive, varied, and engaging. All of these characteristics were rated above average with high scores. The most important factors for students were that the digital learning material be interesting, structured, and motivating, while playful elements and humor were considered significantly less essential.

They were also asked to evaluate, using a seven-point Likert scale (1 – not at all, 7 – completely), how important they considered certain elements that could form part of digital teaching materials. The listed elements were: audio tasks, links to reference sources, textual content, interactivity options, tests, multimedia elements, images, and animations. In this case, all elements were rated above average, although their opinions differed significantly regarding which elements should be included in digital learning materials. The visual presentation of digital content was considered the most important, while the options for interactivity—such as tests, branching paths, and choices—were deemed at least equally important components of a digital learning material.

Surprisingly, the importance of textual content was rated highly, even though, as educators, we continuously observe that students tend to avoid learning materials consisting of longer texts. Even if they do read them, these texts do not capture their attention. This evaluation indicates that our prospective educators recognize that a digital teaching material is successful if it includes well-developed and structured textual content. Surprisingly, many students did not fully understand the role of audio tasks. Mainly, translation major students were the ones who provided examples of how they would use such tasks in a classroom setting: “Audio tasks are necessary from time to time for variety, and because they evoke more realistic situations, making the learning experience a little more personal, interesting, and engaging for students, compared to silent work with text. They are necessary in language lessons because they teach the correct use of foreign or even native languages.”

They were most open to using multimedia elements, images, or animations, particularly in biology, mathematics, and physics classes, where they saw them as most useful. However, several students also suggested using them in history and geography classes to capture attention, illustrate concepts, make the lesson more interesting and engaging, and provide a quicker and simpler overview of the material. They were creative when providing examples of how they would use these elements: “showing a short film about the historical background of the lesson,” “in history, I see it as very useful, for example, pictures of the given period,” “understanding algorithms,” etc. The responses reflect that they see the application of multimedia teaching elements as beneficial in the teaching and learning process “in every case.”

Conclusions

One of the goals of this research was to explore how students perceive the role of electronic devices and digital content in education. The findings reveal that the majority of participants found digital tools to be highly beneficial in the teaching-learning process. However, data analysis also highlighted that some respondents felt these tools did not effectively contribute to knowledge acquisition or sustaining attention.

The research also examined students' opinions on the extent to which 21st-century teachers should use digital tools and how they themselves, as future educators, plan to incorporate such tools in classroom instruction. A significant change was observed compared to previous measurements: whereas earlier surveys indicated that students did not see digital proficiency as essential for teachers, the latest data underscore the growing importance students place on teachers' digital competencies.

Another objective of the study was to assess how reliable students consider online information and their awareness of credibility criteria. While over half of the participants regarded online content as somewhat reliable, questions testing specific knowledge revealed difficulties in distinguishing credible sources. Nearly a third of the students were unfamiliar with intellectual property regulations, particularly regarding the use of visual materials. A significant proportion (about one-third) incorrectly believed that no permission was needed to use such materials, or that merely notifying the author sufficed. These findings highlight the need to enhance digital literacy in higher education.

Digital learning materials play a crucial role in the teaching-learning process. Results show that students recognize the importance of various components of digital content, emphasizing the role of visual elements, such as images and animations, particularly in science and social

studies. They prioritize the structured and motivational aspects of digital materials but place less emphasis on gamified or humorous elements. The use of multimedia content, such as films or historical images, was suggested for their illustrative and engaging qualities, which make learning more accessible and interesting.

In summary, the findings shed light on the challenges and opportunities associated with developing digital competencies. They provide a solid foundation for future improvements in this area.

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