DEVELOPING STUDENTS' DIGITAL COMPETENCIES - 21ST CENTURY TEACHING SKILLS: BASED ON SELF-ASSESSMENT OF HIGHER EDUCATION TEACHERS

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Abstract

The rapid increase in the number of different strategies, methods, models, and tools for research and identification of digital competencies in recent years has fueled the growing presence and popularity of this topic in research projects and papers arguing for the need to assess digital competencies of higher education teachers and their students. Highly motivated teachers to improve their work have a publicly available EU tool "Higher Education SELFIEforTEACHERS" which allows them to self-assess digital competencies through 7 thematic areas, and which was used in the research "Digital Competences of Teachers - Higher Education" within the project "Digital.hr" (2020 - 2023) which addresses the needs of the development of digital competencies as one of the key competencies of modern society. The project is implemented in Croatia, co-financed by the European Union from the European Social Fund, and the University North participates in it as a partner of the Network for the Development of Digital Literacy under Objective # 2: Development of Digital Education. What activities, tools, and digital technology higher education teachers use as part of their digital competencies in working with students in order to enable the development and direction of students' digital skills, is the subject of this paper. Whether there is a harmonization of digital competencies of teachers, as one of the skills of the 21st century, and their teaching practice with the EU Action Plan for Digital Education 2022-2027 in Croatian higher education institutions, is the research question of this paper the aim of which is to design the information model of the development of digital competencies of higher education teachers. The research was conducted using the desk method and the standard tool "Higher Education SELFIEforTEACHERS" by applying the self-assessment test technique in the implementation of which 411 teachers from 75 higher education institutions teaching in different scientific fields participated. For the purpose of this paper, the results of research related to Area 5. Student empowerment and Area 6. Development of digital competencies of students were considered, the analysis of which determined the correlation between the development of digital competencies of students and the level of digital competencies of teachers. Most teachers consider themselves digitally competent enough to develop students' digital competencies, with social science teachers being considered more competent to develop students' digital competencies than teachers teaching technical, biomedical, and natural sciences. The results of this research will be used to create national recommendations in terms of structuring lifelong learning programs for higher education teachers in the field of developing and improving digital competencies, but also as an empirical starting point for the second phase of scientific research in which, in addition to teachers, their students will be involved, and the aim of which is to design a causal model for validating the impact of digital competencies on learning outcomes.

Keywords: Digital competencies, professor, student, higher education, 21st century skills.

1 INTRODUCTION

We are witnessing the time where the use of digital technologies has become inevitable, starting from everyday personal activities, through the acquisition of knowledge and education to activities related to carrying out certain professions, and the compilation of which created the digital society. Exactly in that digital society, all citizens are expected to be digitally literate, that is, viewed in a broader context, they are expected to be digitally competent, to have fully developed digital competence. All this implies the conclusion that the impact of digital technology is present in all aspects of human life, including higher education, which problematizes the need for systematic development of digital competencies through the formal education system, for both students and teachers, as one of the basic competencies of their lifelong learning and training. The concept of digital competencies, in addition to becoming a central part of our lives, as a set of skills has become the focus of consideration of several public national policies related to European policies. Tentatively, it is possible to assume that the concept of digital competence has become the focus of these policies due to its future-oriented nature, as it encompasses the skills expected of today's student workforce to operate effectively in the digital society in the near future.

Therefore, when considering the importance of developing digital competencies, it is important to explore not only the theoretical and conceptual framework but also to accept the need and find ways to evaluate them. Seen from a conceptual perspective, Bawden's statement [1] that the literature on digital skills is inconsistent is still acceptable today. Namely, when talking about digital competence, the authors use similar concepts, such as digital skills, digital literacy, media literacy, information literacy, transversal skills, new media literacy, e-skills, e-competences, and in some cases digital intelligence [2]. In addition, digital competencies are often discussed as 21st century skills. For example, Ala-Mutka [3] problematizes digital literacy in the context of 21st century skills necessary for participatory participation in the knowledge society, and Van Laar and associates [4] in the context of monitoring the development and innovation of business processes, products, and services.

Although until recently it was thought that the concept of digital competence mainly encompasses computer-related skills, today this concept is considered through a wider spectrum that encompasses knowledge, skills, and attitudes. How to evaluate them, and which methods and tools to use, considering a certain area of expertise, has emerged as a significant research problem, but also as a need in the context of the development of a digital economy and knowledge society. For these reasons, the evaluation of digital skills has proven to be a real challenge for scientists [5], but also for certain interest groups and organizations. In order to determine their level, different models and frameworks of digital competencies have been developed for different target groups. Thus, the European Commission Joint Research Center (JRC) has focused its efforts on mapping and understanding the assessment of digital competencies of citizens and teachers, resulting in the DigComp framework for evaluating digital competencies of citizens [6] and the DigCompEdu framework for evaluating digital competences of teachers [7].

While Zhao, Pinto Llorente, and Sanchez Gomez [8] provide an overview of methods, instruments, and tools for assessing digital competencies in higher education using a systematic review of the literature on practices and concepts for assessing digital competencies with an emphasis on instruments, which conclude potential opportunities and ideas for future directions of research on the evaluation of digital competencies of higher education teachers, the JRC tool Higher Education SELFIEforTEACHERS enables self-assessment of digital competencies through seven thematic areas: Professional engagement, Digital resources, Teaching and learning, Evaluation and feedback, Student empowerment, Developing digital student competencies, Open education. For the purposes of this paper, the results of research related to Area 5. Student empowerment and Area 6. Development of digital competencies of students are discussed. What activities, tools, and digital technology higher education teachers use as part of their digital competencies in working with students in order to enable the development and direction of students' digital skills, is the subject of this paper. Whether there is a harmonization of digital competencies of teachers, as one of the skills of the 21st century, and their teaching practice with the EU Action Plan for Digital Education 2022 - 2027 [9] in Croatian higher education institutions, is the research question of this paper, the aim of which is to design an information model for the development of digital competencies of higher education teachers.

2 METHODOLOGY

This paper starts from the assumption that one of the basic competencies important for lifelong learning is digital competence, the development of which must be accepted during all phases of education, especially during education at higher education institutions that prepare students for the labor market which is unimaginable today without the application of digital technologies. In addition, the paper starts from the fact that research on digital competencies of teachers is significantly represented in recent literature, but research related to digital competencies of higher education teachers and related development of digital competencies of students, especially in the context of national specifics, is a rarity [10].

The results used for the purposes of this paper were collected during the implementation of scientific research on "Digital competencies of teachers - higher education" conducted within the research project "Digitalna.hr" (01.09.2020 - 31.08.2023) which addresses the needs of digital competencies as one of the key competencies of modern society. The project is implemented in the Republic of Croatia, co-financed by the European Union from the European Social Fund, and the University North, and the author of this paper as a research leader, participate in it as a partner of the Digital Literacy Development Network within the Goal #2: Development of Digital Education.

The research was conducted in the period from February 15 to March 30, 2022, by desk method using the standard tool Higher Education SELFIEforTEACHERS [11] and the self-assessment test technique, conducted by 411 higher education teachers teaching in various scientific fields at 75 higher education institutions in the Republic of Croatia. The link to the tool, the content of which is shown in Figure 1 [11],

with an accompanying request and explanation of the reasons, purposes, and objectives of the research was sent by email to the publicly available e-mail address of Vice Dean or Vice-Rector for Teaching, and self-assessment results were collected via AAI@EduHr, the electronic identity of the respondents, which they voluntarily provided only for the purposes of the research

This self-reflection tool is based on the European Framework for the Digital Competence of Educators (DigCompEdu, JRC 2017). This model is comprised of 22 competences organised in six areas. The competences are described in 6 different levels of skills: A1, A2, B1, B2, C1, C2. In addition, it has been included a seventh area - Open Education. It is based on the OpenEdu Framework (JRC 2016, 2019), of which 3 dimensions have been addressed: Open Educational Resources (OER), Open Educational Practices (OEP) and Open Science. These frameworks support and motivate lecturers and researchers to use digital tools in order to improve their teaching and foster innovation in education. In total there are 25 self-reflection statements. The complexity in the answer options has been defined through: (1) The application of an adaptation of the Bloom's Digital taxonomy and (2) The application of progression levels based on the complexity of the proposed activities. [11]

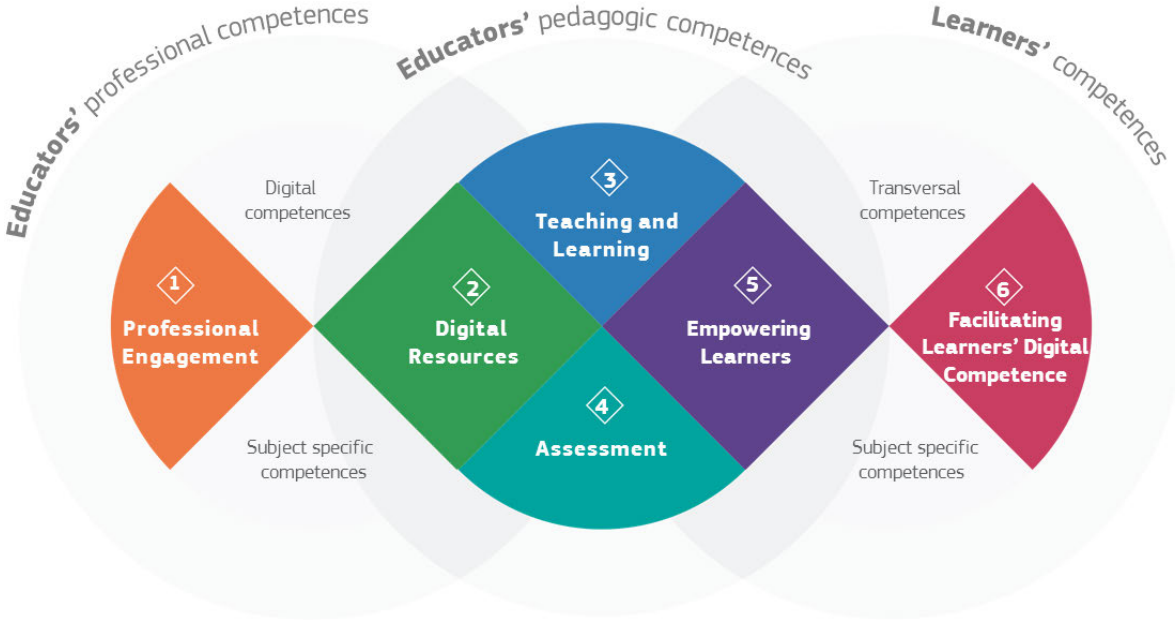

Figure 1. Self-reflection tool Higher Education SELFIEforTEACHERS.

The purpose of the research was twofold, (i) participatory, related to the creation of public policies in the field of higher education, and (ii) scientific, related to the design of a causal model of validation of the impact of digital competencies on learning outcomes. The obtained results were processed using statistical methods using IBM SPSS Statistics and Microsoft Power BI.

For the purposes of this paper, the results of research related to Area 5. Student Empowerment and Area 6. Development of digital competencies of students are considered, which are systematically presented in the next chapter.

3 RESULTS

Applying the self-assessment test technique and the Higher Education SELFIEforTEACHERS tool, 411 teachers from 75 higher education institutions participated in the research, teaching in different scientific fields. The structures are shown in Table 1 and the geographical representation in Fig. 2.

Table 1. Number of respondents by the scientific field of teaching.

Colour	Scientific field	Number of respondents	Percentage
	Social Sciences	173	42,09%
	Technical Sciences	83	20,19%
	Biomedicine and Health	41	9,98%
	Natural Sciences	40	9,73%
	Humanistic Sciences	29	7,06%
	Interdisciplinary fields of science	16	3,89%
	Biotechnical Sciences	13	3,16%
	Artistic field	10	2,43%
	I don't want to answer	5	1,22%
	Interdisciplinary fields of art	1	0,24%
	Total	**411**	**100,00%**

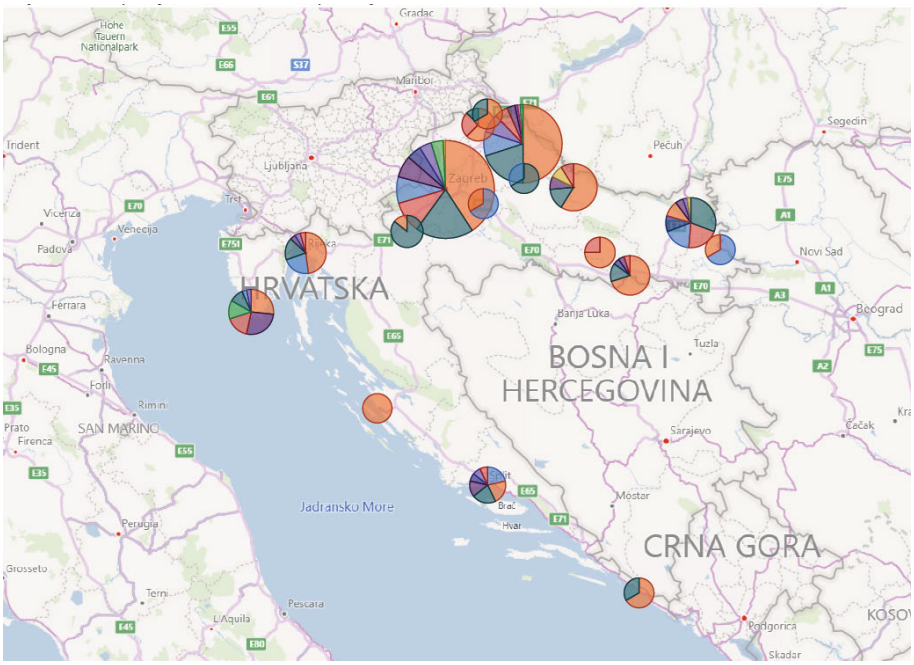

Figure 2. Number of respondents by location of the institution and scientific field of teaching.

3.1 Area 5: Empowering Learners / Student Empowerment

"One of the key strengths of digital technologies in education is their potential for boosting the active involvement of students in the learning process and their ownership of it. Digital technologies can furthermore be used to offer learning activities adapted to each individual student's level of competence, their interests and learning needs. At the same time, however, care must be taken not to exacerbate existing inequalities and to ensure accessibility for all students. Area 5 tackles these issues." [11]

3.1.1 When I create digital assignments for learners I take into account and address potential practical or technical difficulties

Fig. 3 shows that respondents who teach in the social field of science to a greater extent opt for the offered answers *"I adapt the task so as to minimize difficulties"* and *"I adapt the task, discuss solutions and provide alternative ways for completing the task"* compared to their colleagues in other fields of science.

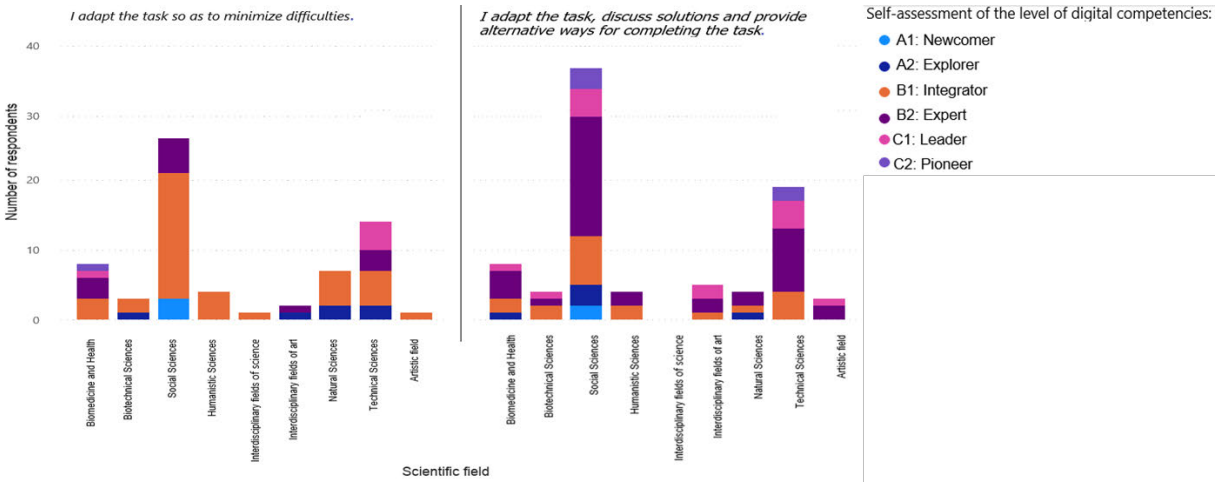

Figure 3. Creating digital assignments for students.

3.1.2 I use digital technologies to offer students personalised learning opportunities

Fig. 4 shows that respondents who teach in the social field of science to a greater extent opt for the answers offered "I adapt my teaching to link to learners' individual learning needs, preferences and interests" and "I provide learners with recommendations of additional resources" compared to their colleagues in other fields of science.

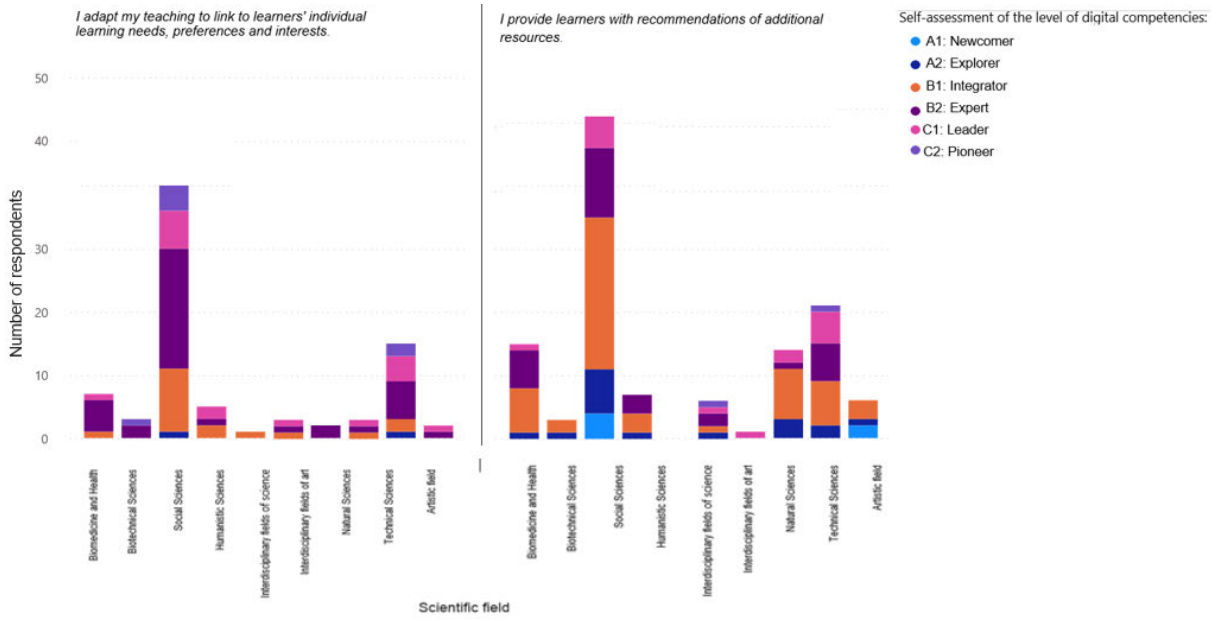

Figure 4. Use of digital technologies.

3.1.3 I use digital technologies for students to actively participate in classes

Fig. 5 shows that respondents who teach in the social field of science to a greater extent opt for the answers offered *"When teaching, I use motivating stimuli, e.g. videos, animations"* and *"My learners use digital technologies to investigate, discuss and create knowledge"* compared to their colleagues in other fields of science.

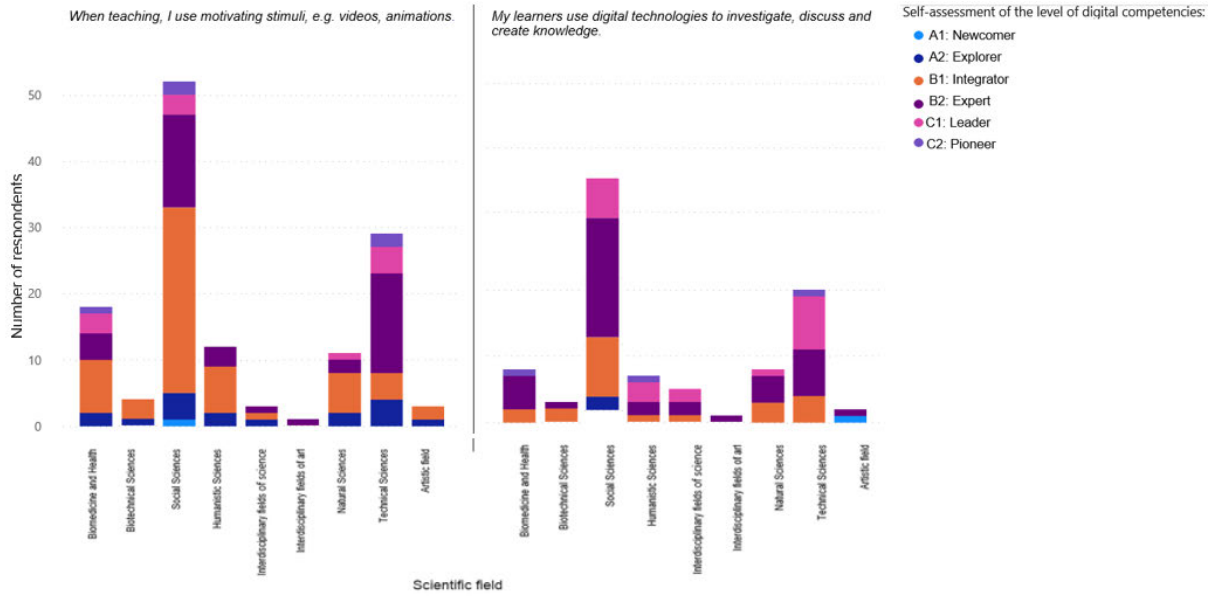

Figure 5. Using digital technologies for active student participation.

3.2 Area 6: Facilitating Learners' Digital Competence / Development of Digital Competencies of Students

The ability to facilitate students' digital competence is an integral part of academics' digital competence and at the heart of Area 6. [11]

3.2.1 I teach students how to assess the reliability of information

Fig. 6 shows that respondents who teach in the social field of science to a greater extent opt for the answers offered *"I discuss with learners how to verify the accuracy of information"* and *"I remind them that not all online information is reliable"* compared to their colleagues in other fields of science.

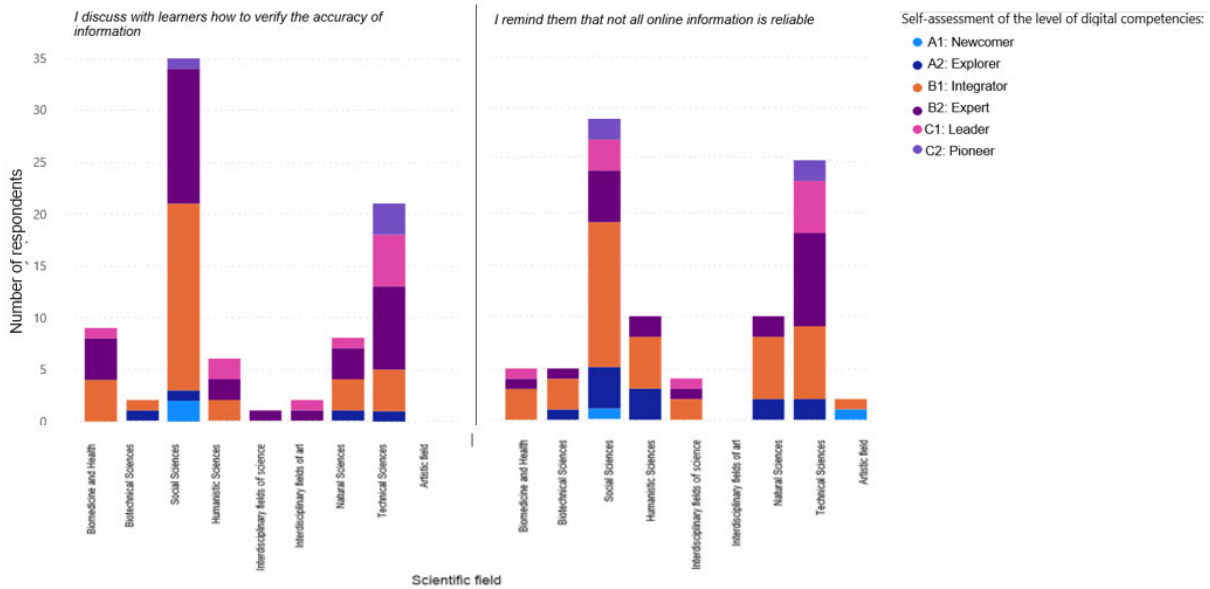

Figure 6. Teaching students how to assess the reliability of information.

3.2.2 I set up course tasks which require learners to use digital means to communicate and collaborate with each other or with an outside audience

Fig. 7 shows that respondents who teach in the social field of science to a greater extent opt for the answers offered "I encourage learners to use digital ways to communicate and to cooperate with each other and

with an external audience" and "I encourage learners to use digital communication and cooperation among each other" compared to their colleagues in other fields of science.

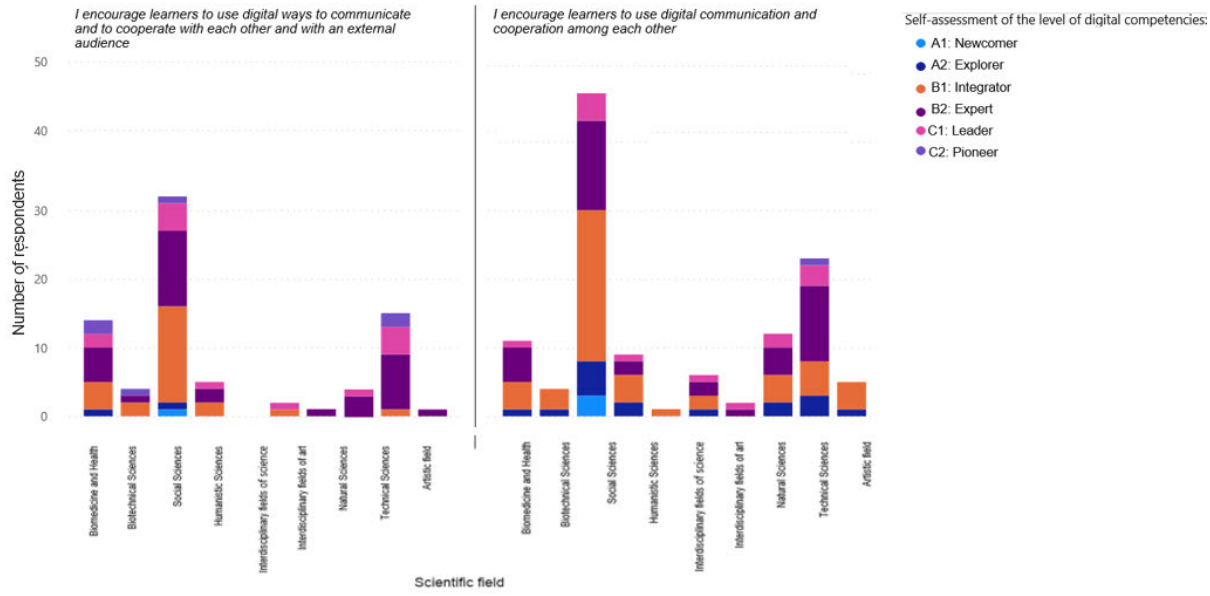

Figure 7. Setting tasks that require the student to use digital media and communicate.

3.2.3 I set up course tasks which require students to create digital content

Figure 8 shows that respondents who teach in the social field of science to a greater extent opt for the answers offered *"My learners create digital content as an integral part of their study"* and *"This is an integral part of their learning and I structure the course tasks and assignments in order to increase the level of difficulty to further develop their skills"* compared to their colleagues in other fields of science.

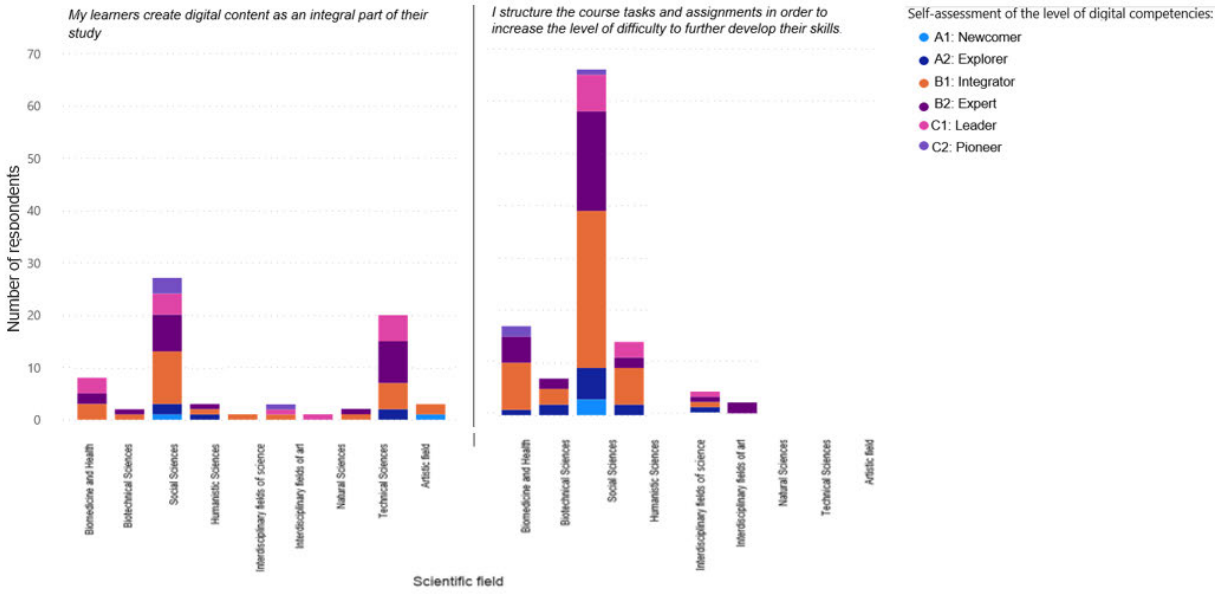

Figure 8. Tasks which require students to create digital content.

3.2.4 I teach students how to behave safely and responsibly online

Fig. 9 shows that respondents who teach in the social field of science to a greater extent opt for the answers offered "I inform them that they have to be careful with relaying personal information online" and *"I explain the basic rules for safely and responsibly acting in online environments"* compared to their colleagues in other fields of science.

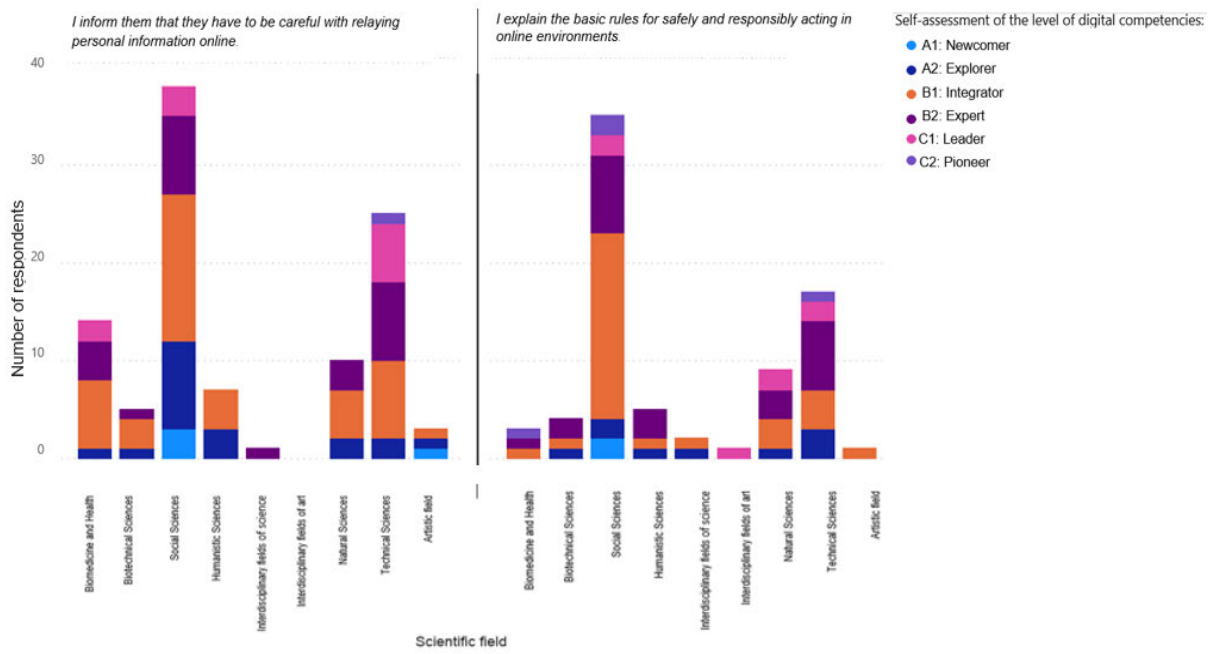

Figure 9. Teaching students to use digital technology in a safe way.

3.3 Self-assessment of digital competencies of teachers

Applying the self-assessment test technique and the Higher Education SELFIEforTEACHERS tool, 411 teachers from 75 higher education institutions participated in the research, assessing their level of digital competence as shown in Table 2, and their distribution according to scientific fields in Fig. 10.

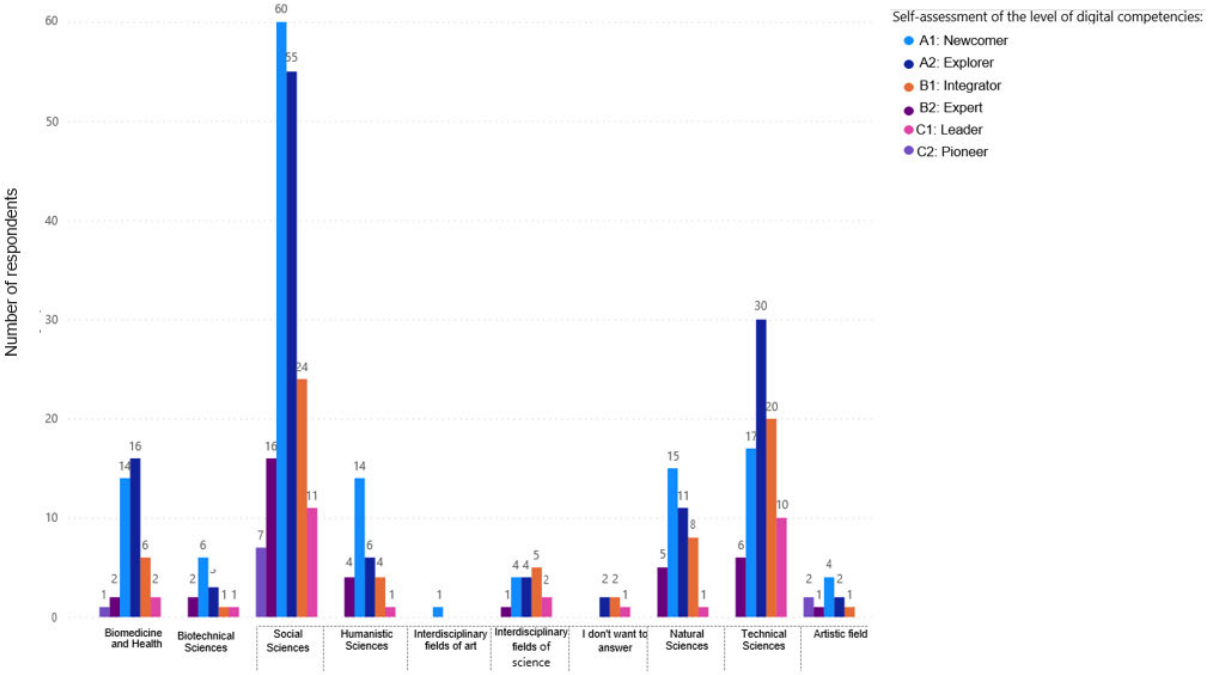

Figure 10. Self-assessment of the level of digital competencies according to the scientific field.

Table 2. Self-assessment of the level of digital competencies.

Colour	Level	Description	Number	Percentage
	A1	Newcomer	10	2,43%
	A2	Explorer	37	9,00%
	B1	Integrator	135	32,85%
	B2	Expert	129	31,39%
	C1	Leader	71	17,27%
	C2	Pioneer	29	7,06%
		Total	**411**	**100,00%**

The results of the research show that the respondents, teachers who teach in the field of social sciences are considered digitally more competent than their colleagues from other fields of science, and assess their level of competencies with B1 (n = 60) and B2 (n = 55). However, when the results are viewed from the perspective of the number of respondents, it is clear that the respondents, teachers who teach in the field of technical sciences assess the level of their digital competencies as C1 (n = 20) and C2 (n = 10). Also, the results of the research show that more than 60% of teachers rate their digital competencies with B1 and B2, and almost 25% with C1 and C2. From these results of self - assessment it is possible to conclude that higher education teachers in Croatia have an enviable level of digital competencies, but whether this is possible can be determined by testing, but also involving students in research to determine the impact of digital competencies of teachers on the development of students' digital competencies.

4 CONCLUSIONS

The research showed that most teachers consider themselves digitally competent enough to develop students' digital competencies, with social science teachers being considered more competent to develop students' digital competencies than teachers teaching technical, biomedical, and natural sciences. The results of the research analysed for the purposes of this paper will serve as an empirical starting point for the second phase of scientific research, which will include teachers and their students and the goal will be to design a causal model for validating the impact of digital competencies on learning outcomes. It is crucial to accept the importance of the suitability of instruments for the assessment of digital competencies based on concepts specific to the field of higher education, but also the specifics of teaching in certain scientific fields. Understanding the concepts of digital competencies of higher education teachers in the context of developing digital competencies of students is a challenge for researchers from different fields of science, whose goal can be directed to the development of innovative methods and tools for their evaluation, development of new algorithms and new methodologies for evaluation to which this paper in the field of information and communication sciences also contributes incrementally. Therefore, future research related to the evaluation of digital competencies of teachers in higher education should be based on the development of validation models and the assessment of digital competencies should include students through a participatory process in which research includes various focus groups and participants who actively participate in this process as co-creators of public policies. Based on the above, it is evident that the development of digital competencies of both teachers and students should be integrated into the higher education system, but also continuously developed through lifelong learning and formal and non-formal education programs, which should be an imperative for continuous training of teachers working in higher education.

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