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Digital Competence for Pedagogical Integration: A Study with Elementary School Teachers in the Azores

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Abstract: This study builds on previous research carried out in 2021 on the self-perception of elementary school teachers in Portugal regarding their digital competences for the pedagogical integration of technologies in educational contexts. In order to verify this perception throughout the country, we extended the research to include teachers from the Autonomous Region of the Azores (ARA), considering the following objectives: (i) to verify teachers' digital competences; (ii) to identify their levels of digital competence; and (iii) to identify the level of influence of training on the categorization of teachers' level of digital competence. This is an exploratory study that used an online questionnaire based on the digital competences in Area 2 of the DigCompEdu framework. Two hundred seven teachers took part in this study. The results revealed that teachers seem to feel capable of using technology but need to improve their ability to adapt digital resources for student learning. The global mapping of digital competences will make it possible to verify these competences, these attitudes and abilities, and the integration of ICT into teaching practices as well as helping to outline future projects and guidelines in the area of teacher training in the ARA in particular.

Keywords: digital competences; teaching and learning; digital technologies; pedagogical innovation; teacher training

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1. Introduction

The rapid technological advances in today's digital society are altering the educational landscape and impacting the skills and knowledge needed to live and succeed in this new society, calling into question the processes of initial and ongoing teacher training. Traditional education systems are now under great pressure to change. Teachers' activities transcend the traditional boundaries of the classroom and increasingly require mastery of digital competences appropriate to the new socio-cultural and technological context. There is a need to prepare teacher training models that promote the development of competences and skills that are more in line with the new educational requirements in order to ensure that schools evolve so that they can adapt to more challenging educational contexts that promote meaningful learning that reveals opportunities for collaborative work, problem-solving, communication, safety, and digital citizenship, enabling students to face the challenges of a constantly changing world [1–3]. In this context, teacher digital competence frameworks can play an important role, as they are documents resulting from studies and research that provide a structure and guidelines for the development of digital competences for

the effective integration of technology into teaching and learning, for networked teacher professional development, and for the promotion of students' digital competences, and they can thus be fundamental elements for educational transformation [4–7].

The innovative potential of digital technologies can play an important role in the evolutionary process of school education, promoting the transformation and enrichment of pedagogy, which has led to a considerable effort in teacher training centered on the development of digital competences, with the aim of ensuring innovation in pedagogical practices. This is one of the key aspects common to all the digital competence references for the teaching profession [3,8]. For this to happen, it is essential to analyze the competences that teachers have already developed to direct training towards aspects that are considered necessary and relevant.

In this sense, this study aims to follow on from previous research by Loureiro et al. [9] into the digital competences of elementary school teachers (1st to 3rd cycles) in mainland Portugal and seeks to draw a picture of some of these competences, particularly those related to Area 2—Digital Resources of DigCompEdu [4], among teachers in the ARA, a Portuguese autonomous region, considered to be outermost, where there are no known studies of this nature.

It is important to point out that the previous research [9] was carried out prior to the training in digital competence, while this one took place after the training for the development of teachers' digital competence within the framework of the Action Plan for the Digital Transition of Schools [10].

The study by Loureiro et al. [9] shows that teachers' level of digital competence varied considerably between the Leader (C1) and Pioneer (C2) levels, according to the DigCompEdu [4] benchmark, in terms of identifying, selecting, and evaluating the most appropriate resources for their learning objectives. Still, this same level of competence is not identified in terms of the effective application of these competences in educational practice.

These results coincide with similar studies that point to the need for teacher training as a way of contributing to the construction of good practices or innovative practices that integrate the digital [11–13] and the importance of including these competences in the initial training of future teachers [14,15], as McGarr points out [16].

As teacher educators and student teachers now operate in a digitally rich environment, it is important that the educational merits of the technology are embraced; however, it should be approached by taking a critically reflective stance. As part of this, student teachers should be encouraged to critically reflect on the digital competence frameworks and explore the ideological underpinnings and hidden values that they can present (p. 14).

In general, these studies highlight specific competences that are identified by the teachers themselves as needing further development, reflecting the need to continue investing in training teachers and increasing their proficiency levels in specific aspects of the DigCompEdu framework [4,17–21]. These studies, which cut across all levels of education, are clear about the relationship between training and boosting teachers' digital competences [22].

Aware of the importance of teacher training for the effective integration of digital technologies in the context of learning, we have now extended the initial research to elementary school teachers in the Autonomous Region of Azores to assess their perception of digital competences according to Area 2 (Digital Resources) of DigCompEdu: (i) selection; (ii) creation and modification; and (iii) the management, protection, and sharing of ICT [4]. Similarly to the previous research carried out by Loureiro et al. [9], our objectives were (i) to verify teachers' digital competences; (ii) to categorize levels of digital competence; and (iii) to identify the level of influence of training on the categorization of teachers' level of digital competence, now explicitly focused on the Azorean teaching population. The research involved 207 elementary school teachers from the Azores, who answered the online questionnaire created and validated for the previous study, duly adapted to the specific contexts of the ARA, which will be presented in the methodology section.

In this study, we present the data collected in this study and share the analysis carried out, bearing in mind the need to analyze the Azorean reality. We ultimately seek to define better training and professional updating strategies in this field. In this way, we believe we can contribute to the development and monitoring of teachers' digital competences for the pedagogical integration of ICT in elementary education for future researchers and projects in the area of teacher training in the region.

2. Theoretical Framework

2.1. Digital Competence Benchmarks for Teachers

Although it is not a concept that can be defined in a consensual way, due to the proximity between the terms digital competence and digital literacy, teacher digital competence can be understood as a set of skills, attitudes, and abilities that teachers must develop so that they can effectively and critically integrate information and communication technologies into their teaching practice, seeking to make a positive contribution to leveraging the processes of teaching, learning, and assessing students [23,24].

Its relevance lies in creating conditions that lead teachers to design and use pedagogical contexts that are more meaningful, dynamic, and interactive for students, with positive results for their learning, preparing them for an increasingly technological and digital world [23,25].

In order to gain a better understanding of the skills that teachers need to develop and to encourage educational organizations and government officials to invest in their training, various organizations have developed digital competence benchmarks for teachers, which seek to serve as reference documents to guide them [23,26]. Thus, international organizations such as the European Union, UNESCO, ISTE, and INTEF are trying to influence educational policies by drawing up these references, with a growing concern about initial and ongoing training for the development of digital competences, in order to make teachers more capable of integrating ICT into the curriculum, with the aim of expanding learning opportunities and developing digital competences in students [4–7].

In a systematization of existing proposals since 2016, Benali and Mak [23] identify a set of focus areas for the development of teachers' digital and transversal competences, comparing these references with DigCompEdu and identifying competences that teachers need to develop to improve their teaching practice, in the logic of continuous professional development. These competences, which will deepen and enrich over time, as the authors point out [23], will help to prepare teachers better personally and professionally. From the work of Benali and Mak [23] and Loureiro et al. [26], we can see the need and relevance of this type of tool, which, on the one hand, makes it possible to identify the competences that teachers should develop as a "part of what teachers need to develop to improve their teaching practice and for their continuous professional development" [23] (p. 135), both in their initial training and in their ongoing training, and, on the other hand, to serve as a tool for self-reflection on and the monitoring of their own practices, evaluating their evolution and impact.

Criticism of initial training programs and their current limitations in preparing teachers for a lifelong profession as well as the importance of continuous training as a fundamental stage in teacher education has led many countries to develop teacher training policies to enable them to use digital technologies in learning and training contexts [8,9]. In this study, as in the previous study [9], we have taken DigiCompEdu [4] as the guiding reference for our research. We will now describe this reference and its origin and objectives.

2.2. Teachers' Digital Competences According to DigCompEdu

In 2013 DigComp 1.0 [27] was published as a reference for the development and understanding of digital competence in Europe, aimed at empowering all citizens to face the challenges of the future. Digital competence is recognized as one of the eight key competences for lifelong learning, a transversal competence necessary for the confident, critical and creative use of ICT to achieve goals related to work, employability, learning,

leisure, inclusion, or participation in society. In 2017, as a result of research carried out by the European Commission's Joint Research Centre on Learning and Skills for the Digital Era, the European Digital Competence Framework for Educators—DigCompEdu [4] was launched to provide evidence-based policy support to the European Commission and member states to harness the potential of digital technologies to innovate education and training practices, improve access to lifelong learning, and deal with the emergence of new digital competences needed for employment, personal development, and social inclusion. With studies starting in 2005, DigCompEdu is the result of more than 20 major studies on these issues, with more than 120 different publications [4].

DigCompEdu proposes a model for the assessment and development of pedagogical digital competences, offering a common basis for these competences for EU countries, promoting the development, comparison, and discussion of different instruments for the development of digital competence for education professionals. The document has been organized into six areas, with a total of 22 digital competences focusing on different aspects of educators' professional activities: Area 1—Professional involvement; Area 2—Digital resources; Area 3—Teaching and learning; Area 4—Assessment; Area 5—Empowering learners; and Area 6—Promoting learners' digital competence (Figure 1).

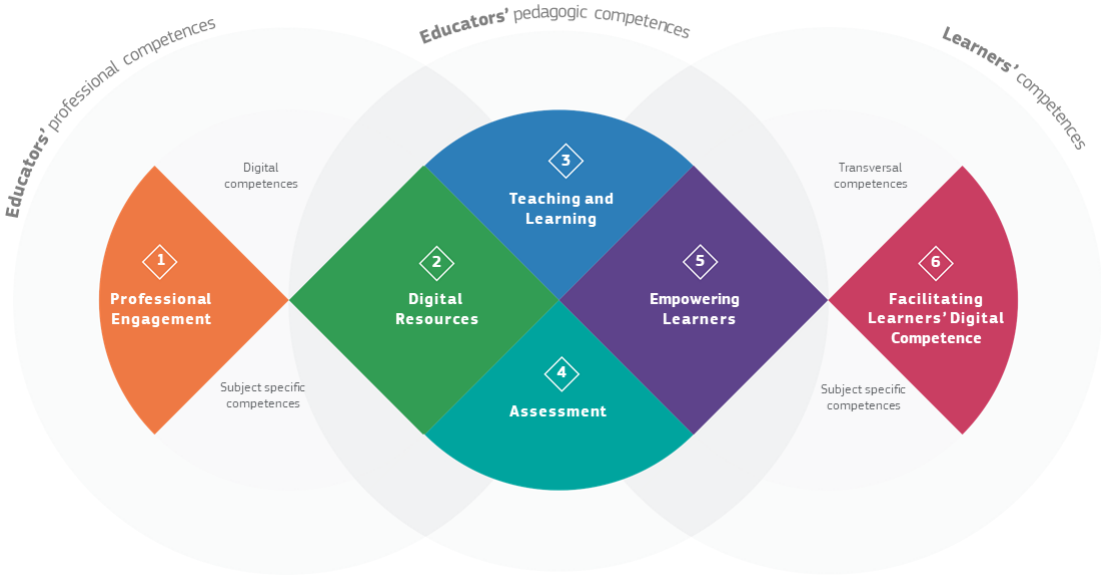

Figure 1. Areas and scope of DigCompEdu [1], p. 15.

These competences proposed in DigCompEdu are not developed in isolation (Figure 2). They are interrelated, so developing one area implies the parallel development of another or others. Areas 2 to 5 are the core of the DigCompEdu Framework and explain the educator's digital pedagogical competence, which is necessary for them to promote innovative, inclusive, and efficient teaching/learning strategies.

Areas 1 and 3 are anchored in the teaching process, whether supported by technologies or not. Area 5 focuses on learning, recognizing the potential of digital technologies for learner-centered educational processes, and Area 6 presents the pedagogical competences needed to promote learners' digital competence.

Finaly, it is important to point out that there are already complementary contributions to the framework, such as the proposal to define the skills and competences of educators, teachers, and trainers in terms of AI [28] or the additional competences identified by Benali and Mak [23], such as Computational Thinking, Gamification, Micro-Credentialisation, Distance and blended learning, among others.

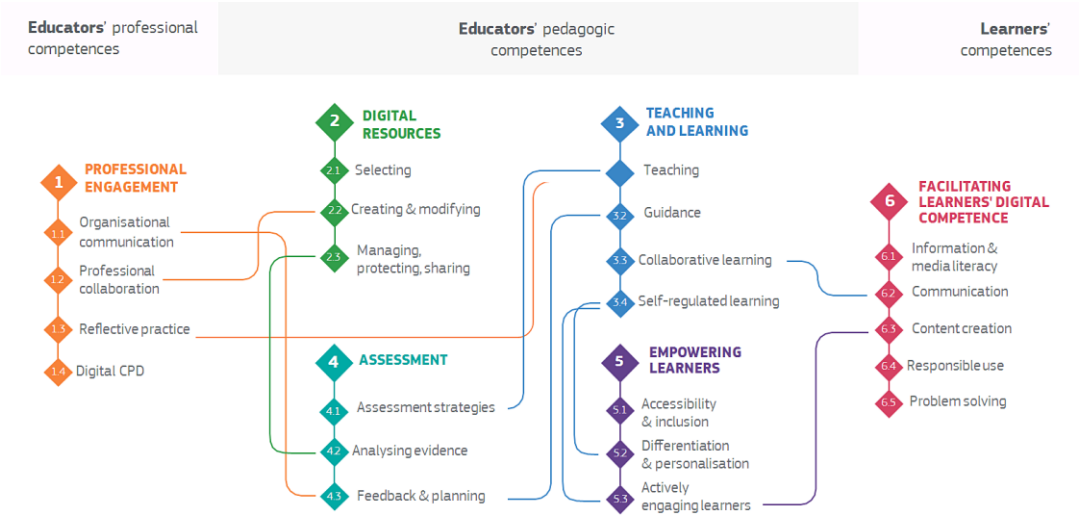

Figure 2. DigCompEdu competences and their connections [1], p. 16.

3. Materials and Methods

The perception of elementary school teachers in the ARA about their digital competences was verified based on the competences established in Area 2 (Digital Resources): (i) selection; (ii) creation and modification; and (iii) management, protection, and sharing of ICT of DigCompEdu [4] (Appendix A). We took this framework as a guide for our research because it offers a common reference framework for the member states of the European Union and because it has a common scientific language and logic, which is expressed in a set of specific digital competences for the teaching profession, with a structure that allows educators to understand what it means to be digitally competent and to assess and further develop their own digital competence [9].

For the study, we adopted a descriptive exploratory approach using a quantitative methodology that allowed us to obtain information from a large number of respondents. As a data collection tool, we used an online questionnaire survey created in the Google®® Foms application, the same one used in the research by Loureiro et al. [9], as this was an extension of that research to a new sample that had not previously been included (teachers from the 1st to 3rd cycles of basic education in the ARA, an outermost region located in the middle of the Atlantic Ocean and belonging to Portugal). Organized according to the objectives of this study, the questionnaire has four sections: (1) Identification of the Respondent; (2) Selection of Digital Resources; (3) Creation and Modification of Digital Resources; and (4) Management, Protection, and Sharing of Digital Resources. For sections 2 to 4, questions were organized with information and variables related to digital competence according to DigCompEdu [1]. The aims and objectives of the study were explained on the first page of the questionnaire, followed by the "Informed Consent" form.

The participants were asked to be as honest and objective as possible about how they consider themselves regarding digital competence and the ability to handle various digital resources for teaching and learning. It was explicitly stated that "Questions will be presented for which there are no right or wrong answers, so we ask that you read the questions carefully and tick, in a reliable, conscious and rigorous way, the alternative that best corresponds to your experience or mastery of the competences listed".

The "Informed Consent" form, as well as the objectives of the study, were given in the first section of the questionnaire so that it would only be possible to move on to the other blocks of questions if the consent form was ticked "I agree" by the participant.

3.1. Participants

The online questionnaire was sent via the Regional Directorate for Education and Cultural Affairs to elementary school teachers in all schools in the ARA, Portugal. A

total of 207 responses were collected, making up the participants in this study (N = 207). Demographic, personal, and professional information was collected from the answers to the first block of questions "Respondent Identification", producing the data shown in Figures 3 and 4 and Tables 1–3.

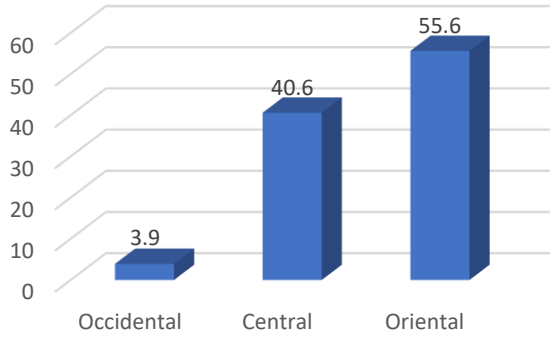

Figure 3. Residence group.

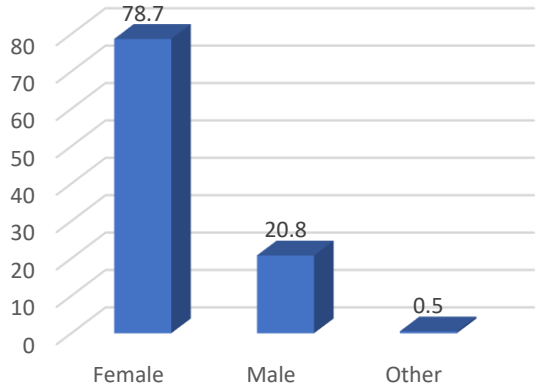

Figure 4. Gender.

Table 1. Age.

Age	N = 207	%
less than 31 years	6	2.9
31–40 years	12	5.8
41–50 years	104	50.2
51–60 years	80	38.6
over 60 years	5	2.4

Table 2. Years of active teaching.

Years of Active Teaching	N = 207	%
less than 11 years	28	13.5
11–20 years	47	22.7
21–30 years	88	42.5
31–40 years	42	20.3
over 40 years	2	1

As the ARA is organized into three geographical groups, the majority of respondents live in the Eastern group (55.6%), which is the largest group, followed by those living in the Central group (40.6%) and, finally, those living in the Western group (3.9%).

Figure 4 shows that most of the participating teachers are women (78.7%). Taking age into account, Table 1 shows that the majority are between 41 and 50 years old (50.2%), followed by the 51 to 60 age group (38.6%).

Table 3. Educational stage.

Educational Stage	*N* = 207	%
1st Cycle	72	34.8
2nd Cycle	40	19.3
3rd Cycle	87	42.0
1st and 2nd Cycles	2	1.0
2nd and 3rd Cycles	6	2.9

Most respondents have been teaching for more than 21 years, with the highest percentage of time in service being between 21 and 30 years, with 42.5% of respondents (Table 2).

Most respondents are teachers of the 3rd Cycle of Basic Education (42%), followed by teachers who teach in the 1st Cycle of Basic Education (34.8%). Less significant was the participation of teachers who teach in the 2nd Cycle of Basic Education (19.3%) and teachers who teach simultaneously in the 1st and 2nd Cycles of Basic Education and the 2nd and 3rd Cycles of Basic Education (Table 3).

Also in this block, the participants were asked about their academic background and level of specialization in the field of digital technologies, answering 3 questions, expressed in the data presented in Figure 5 and Tables 4 and 5.

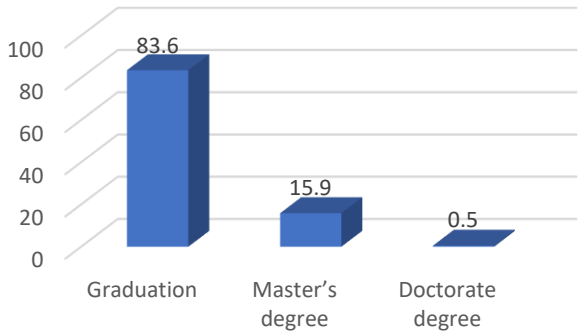

Figure 5. Academic qualifications.

Table 4. Specialization in digital technologies and education.

Specialization in Digital Technologies and Education (Level)	*N* = 207	%
specialization/graduate	13	6.2
master's degree	1	0.5
doctorate	0	0
continuous training	105	50.7
none	88	42.5

Table 5. Hours of training in the last 10 years.

Hours of Training in the Last 10 Years	*N* = 207	%
0	33	15.9
less than 51	96	46.4
from 51 to 100	44	21.3
from 101 to 150	14	6.8
from 151 to 200	8	3.8
from 201 to 250	6	2.9
over 250	6	2.9

As for their academic qualifications, the highest number of teachers had a degree (83.6%) and only one (0.5%) had a doctorate (Figure 5).

Bearing in mind that more than 50.7% of the survey participants showed a high level of awareness of the importance of continuous training (Table 4), it emerged that despite this awareness, the majority of them (46.6%) replied that they had completed less than 51 h of training in the field of digital competence in the last 10 years, followed by 21.3% who had completed between 51 and 100 h (Table 5). Participants with training from 101 h to over 250 h totaled 16.4%, and a considerable percentage of participants (15.9%) said they had not taken part in any training during that period. These figures lead us to believe that the survey participants are generally looking for training to enable them to use ICT and are placing greater emphasis on continuing training courses (83.6%) and self-taught courses (41.1%). In the training area, a high percentage of respondents (42.5%) revealed that it had no connection to digital technologies and education.

3.2. Instrument

The online questionnaire used was updated compared to the original one used in the study by Loureiro et al. [9], and some questions were included in the section (1) Identification of the Respondent to adapt it to the specific context of the population to be surveyed. Since the questionnaire had already been validated by PhD professors and higher education researchers in the field of teacher training for digital technologies and by a sample of teachers with the profile of the recipients, this study was only submitted to the Ethics Committee of the University of the Azores, and after its validation (Opinion no. 61/2023), it was distributed to schools via the Regional Directorate for Education and Cultural Affairs, which oversees the Region's schools.

Organized according to the objectives of this study, the online questionnaire has four sections: (1) Respondent Identification; (2) Selection of Digital Resources; (3) Creation and Modification of Digital Resources; and (4) Management, Protection, and Sharing of Digital Resources. For sections 2 to 4, questions were organized with information and variables related to digital competence according to DigCompEdu [4] (pp. 44–49).

3.3. Data Collection and Analysis Procedures

The data collection questions in this survey were self-assessment questions, and the participants answered according to their experiences with common ICT use processes and areas [9]. Digital competence was measured and operationalized in a total of 3 competences, (i) selecting, (ii) creating and modifying, and (iii) sharing digital resources [4] (p. 24), organized by 29 competence descriptors addressed in the 2—Digital Resources area [4] (pp. 44–49), according to the objectives of this study, and the questions were created based on these descriptors (Table 6).

Table 6. Number and purpose of descriptors/questions for competences.

Competence	(i) Select	(ii) Create and Modify	(iii) Share Digital Resources
Number of descriptors (questions)	14	8	7
Objectives	(i) identify, select, and effectively evaluate the resources best suited to their learning objectives and methodological approach	(ii) modify, add, and develop digital resources to support their practice	(iii) be aware of how to use and manage digital content responsibly

The descriptors were organized according to DigCompEdu's competence progression model (A1 to C2) [4] (pp. 28–31), and the answers were analyzed following a statistical description for each of the questions in the three competence blocks (Figure 6).

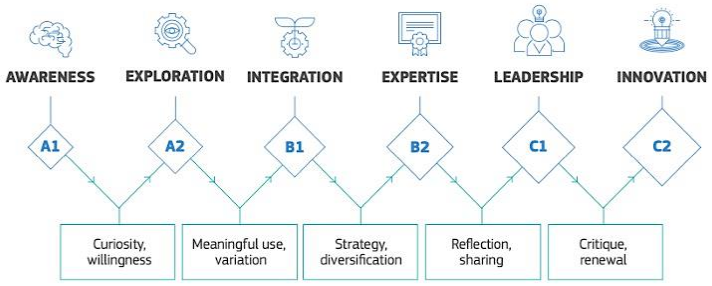

Figure 6. DigCompEdu's competence progression model [1], p. 29.

4. Presentation and Analysis of Results

The statistical description of the data obtained for each of the questions in the three competence blocks allowed us to obtain the total percentage of responses for each level of digital competence development and to gauge the levels of proficiency classified by the participants in the three categories assessed. After analyzing the demographics of the participants, we began to analyze the digital competences, the focus of this research. The findings indicated a significant variation in the level of digital competence among the teachers. The information shown in bold in Tables 7–10 represents the highest number of responses obtained for each descriptor.

Table 7. The competence level of the selecting category.

Descriptor/Question	Scale 1–6 (1 = Never Use/Do; 6 = Always Use/Do) Level A1 to C2 *N* = 207 (100%)					
	1 (A1)	**2 (A2)**	**3 (B1)**	**4 (B2)**	**5 (C1)**	**6 (C2)**
2.1. I rarely use the internet to find resources for teaching and learning	25 (12.1)	12 (5.8)	24 (11.6)	21 (10.1)	48 (23.2)	**77 (37.2)**
2.2. I use simple internet search strategies to identify digital content relevant to teaching and learning.	2 (1.0)	9 (4.3)	29 (14.0)	32 (15.5)	60 (29.0)	**75 (36.2)**
2.3. I use educational platforms that provide digital resources.	2 (1.0)	12 (5.8)	27 (13.0)	27 (13.0)	48 (23.2)	**91 (44.0)**
2.4. I adapt my research strategies based on the results I get.	1 (0.5)	9 (4.3)	28 (13.5)	46 (22.2)	55 (26.6)	**68 (32.9)**
2.5. Filter the results obtained to find resources appropriate to my goals.	0 (0.0)	11 (5.3)	21 (10.1)	31 (15.0)	61 (29.5)	**83 (40.1)**
2.6. I evaluate the quality of digital resources based on criteria such as place of publication, authorship, comments from other users.	4 (1.9)	17 (8.2)	24 (11.6)	34 (16.4)	50 (24.2)	**78 (37.7)**
2.7. I select resources that my students may find interesting, such as videos.	1 (0.5)	8 (3.9)	13 (6.3)	23 (11.1)	64 (30.9)	**98 (47.3)**
2.8. I combine my research strategies to identify resources that I can modify and adapt. Example: Search and filter by license, file type, date, user comments, etc.	10 (4.8)	26 (12.6)	32 (15.5)	34 (16.4)	**57 (27.5)**	48 (23.2)
2.9. I value the reliability of digital resources, their suitability for my group of students and the specific learning objective.	2 (1.0)	6 (2.9)	17 (8.2)	26 (12.6)	57 (27.5)	**99 (47.8)**
2.10. I evaluate and make recommendations on the resources I use.	13 (6.3)	30 (14.5)	29 14.0)	**50 (24.2)**	46 (22.2)	39 (18.8)
2.11. I use a variety of internet search sources. Example: collaborative platforms, digital resource repositories, etc.	8 (3.9)	22 (10.6)	21 (10.1)	40 (19.3)	**65 (31.4)**	51 (24.6)

Table 7. *Cont.*

Descriptor/Question	Scale 1–6 (1 = Never Use/Do; 6 = Always Use/Do) Level A1 to C2 *N* = 207 (100%)					
	1 (A1)	**2 (A2)**	**3 (B1)**	**4 (B2)**	**5 (C1)**	**6 (C2)**
2.12. When I use the resources in the classes, I explain their origin and refer to any biases.	18 (8.7)	36 (17.4)	36 (17.4)	34 (16.4)	41 (19.8)	**42 (20.3)**
2.13. I advise colleagues on internet research strategies, repositories, and resources appropriate to education.	28 (13.5)	37 (17.9)	**48 (23.2)**	44 (21.3)	38 (18.4)	12 (5.8)
2.14. I organize my own repository of links to resources, duly annotated and classified, and share it with other colleagues.	35 (16.9)	**44 (21.3)**	38 (18.4)	38 (18.4)	29 (14.0)	23 (11.1)
Percentage of the weighted average according to competence levels	13.2	5.2	11.1	10.2	23.1	**37.2**

Table 8. The competence level of the selecting category.

Descriptor/Question	Scale 1–6 (1 = Never Use/Do; 6 = Always Use/Do) Level A1 to C2 *N* = 207 (100%)					
	1 (A1)	**2 (A2)**	**3 (B1)**	**4 (B2)**	**5 (C1)**	**6 (C2)**
3.1. I use digital resources, but I do not modify them or create my own resources	35 (16.9)	50 (22.4)	**53 (25.6)**	36 (17.4)	25 (12.1)	8 (3.9)
3.2. I use a software editor to create and modify content. Example: worksheets, proofs, presentations, spreadsheets.	7 (3.4)	15 (7.2)	41 (19.8)	34 (16.4)	**62 (30.0)**	48 (23.2)
3.3. I create simple digital resources (e.g., presentations).	10 (4.8)	14 (6.8)	27 (13.0)	47 (22.7)	**62 (30.0)**	47 (22.7)
3.4. I create digital resources (example: presentations) and integrate animations, links, multimedia and interactive elements.	16 (7.7)	27 (13.0)	44 (21.3)	40 (19.3)	**46 (22.2)**	34 (16.4)
3.5. I make modifications to the digital learning resources I use to suit them to learning objectives.	6 (2.9)	12 (5.8)	34 (16.4)	48 (23.2)	53 (25.6)	**54 (26.1)**
3.6. I create digital, complex and interactive learning activities, for example: online assessments (quizzes, forms, etc.), online collaborative learning activities (wikis, blogs), games and applications.	43 (20.8)	**44 (21.3)**	36 (17.4)	34 (16.4)	30 (14.5)	20 (9.7)
Percentage of the weighted average according to competence levels	17.0	24.2	**25.6**	17.4	12.0	3.8

Table 9. The level of competence of the category managing, protecting, and sharing digital resources.

Descriptor/Question	Scale 1–6 (1 = Never Use/Do; 6 = Always Use/Do) Level A1 to C2 *N* = 207 (100%)					
	1 (A1)	**2 (A2)**	**3 (B1)**	**4 (B2)**	**5 (C1)**	**6 (C2)**
4.1. Store and organize digital resources for my future use.	2 (1.0)	16 (7.7)	32 (15.5)	24 (11.6)	56 (27.1)	**77 (37.2)**
4.2. I share educational content by sending attachments in an email or through links.	18 (8.7)	15 (7.2)	36 (17.4)	38 (18.4)	**55 (26.6)**	45 (21.7)
4.3. I share educational content by linking or incorporating it into virtual learning environments, e.g., on a website or blog, staff or educational institution.	**73 (35.3)**	39 (18.8)	25 (12.1)	29 (14.0)	27 (13.0)	14 (6.8)

Table 9. *Cont.*

Descriptor/Question	Scale 1–6 (1 = Never Use/Do; 6 = Always Use/Do) Level A1 to C2 *N* = 207 (100%)					
	1 (A1)	**2 (A2)**	**3 (B1)**	**4 (B2)**	**5 (C1)**	**6 (C2)**
4.4. I am aware that some resources distributed on the Internet are protected by copyright.	1 (0.5)	6 (2.9)	15 (7.2)	16 (7.7)	36 (17.4)	**133 (64.3)**
4.5. I protect access to private content, e.g., exams, student reports.	18 (8.7)	19 (9.2)	34 (16.4)	10 (4.8)	29 (14.0)	**97 (46.9)**
4.6. I compile comprehensive repositories of digital content and make them available to students or other educators by applying their licenses to resources.	**75 (36.2)**	40 (19.3)	32 (15.5)	18 (8.7)	27 (13.0)	15 (7.2)
4.7. I keep the resources that I share digitally and allow others to comment on, classify and modify them.	**73 (35.3)**	36 (17.4)	43 (20.8)	19 (9.2)	18 (8.7)	18 (8.7)
Percentage of the weighted average according to competence levels	1.1	7.7	15.4	11.6	27.0	**37.2**

Table 10. The total percentage of the three categories of competences assessed by the participants.

Competence	Teacher Self-Assessment %					
	1	**2**	**3**	**4**	**5**	**6**
(i) Select Have the competence to effectively identify, select, and evaluate the resources best suited to the learning objectives and methodological approach.	13.2	5.2	11.1	10.2	23.1	37.2
(ii) Create and modify Have the competence to modify, add, and develop digital resources to support teaching practice.	17.0	24.2	25.6	17.4	12.0	3.8
(iii) Managing, protecting, and sharing digital resources Be aware of how to use and manage digital content responsibly.	1.1	7.7	15.4	11.6	27.0	37.2
Total	31.3	37.1	52.1	39.2	62.1	78.2

4.1. Category (i) Selecting

As mentioned above, category (i) encompasses the "Selection" competence, which contains 14 questions created from the competence descriptors of this category according to DigCompEdu [4]. Participants were asked to respond on a Likert-style scale, with intensity ranging from (1) I never use/do to (6) I always use/do, to each of the descriptors in this category (14 in total), which were organized progressively in terms of competence levels, ranging from A1 to C2 (see Table 7).

It can be seen that in the context of the descriptors of competences for identifying, evaluating, and effectively selecting the most appropriate resources for the learning objectives and methodological approach they use in the classroom, 23.1% to 37.2% of teachers have a self-perception of competences at level C1 and C2. However, with regard to the ability to organize, annotate, and classify digital resources in their own repository and share them with teaching colleagues, 13.2% and 11.1% of teachers consider their competences to be at A1 and B1 level, respectively.

4.2. Category (ii) Creating and Modifying

As for category (ii) create and modify (Table 8), we found that 25.6% of the survey participants answered that they feel capable of integrating strategies for the meaningful use and reflection of digital resources (Integrator—level B1). According to DigCompEdu [4]

(p. 30), integrators use digital technologies in various contexts and for multiple purposes, creatively incorporating them into many of their professional practices. Although eager to expand their repertoire, they are still learning which tools are most effective in different situations and how to adapt them to pedagogical strategies and methods. It is worth noting that in this category, only 3.8% of participants consider themselves Pioneers (level C2), i.e., capable of adapting pedagogical and digital practices to contemporary, innovative, and complex contexts to promote the development of learners' digital competences.

4.3. Category (iii) Managing, Protecting, and Sharing Digital Resources

Within category (iii) manage, protect, and share digital resources (Table 9), most participants, 37.2%, have the self-perception of being Pioneers (level C2), followed by 27% who perceive themselves as Leaders (level C1). It is important to note that these results are due to the high number of responses to questions (i) 4.4, whose descriptor falls under the competence of knowing the copyright of resources distributed on the internet; (ii) 4.5, which concerns the competence of protecting access to private content; and (iii) 4.1, which encompasses the competence of storing and organizing the digital resources researched for future use.

In the context of the competences described in questions (i) 4.6, which encompasses having the ability to bring together a large collection of digital resources and make them available to students or other educators, ensuring that each resource has the appropriate license for its use; (ii) 4.3, being able to distribute educational content by integrating it into online learning platforms; and (iii) 4.7, which involves the ability to store shared resources in digital format and allow other people to comment on, evaluate, and edit these resources, it can be seen that the majority of participants, 36.2%, 35.3%, and 35.3%, respectively, consider themselves to be Newcomers (level A1). According to DigCompEdu [4] (p. 30), these teachers recognize the potential of digital technologies to improve pedagogical and professional practice. However, they have had little contact with these technologies and use them mainly for lesson preparation, administration, or organizational communication.

The results also show that there is still some work needed in developing teachers' digital competences, particularly those related to Area 2—Digital Resources, the target of this study. While the competences of selecting and managing, protecting, and sharing are mostly highly rated by the respondents, the same is not true of the competences related to creating and modifying digital resources, where most responses are at lower levels in the teachers' self-perception. Therefore and in agreement with what Costa states in his study [29] (p. 24), in addition to the competences of knowing and using technological and digital resources, it is important that teacher training also involves "developing the ability to manipulate new technologies as learning tools", adjusting them to the context and needs of the students.

4.4. Global Analysis

In the totality of the survey (Table 10), the results reveal that although 78.2% of teachers perceive themselves as Leaders (level C1) and 62.1% as Pioneers (level C2), these figures do not reflect mastery of digital competences that impact innovative teaching practices. As revealed in the Results section, many of the answers at these levels of competence refer to the ability to (i) use the internet to search for educational resources; (ii) use educational platforms with digital resource content; and (iii) filter, analyze, and evaluate the digital resources found in the search.

The awareness that having digital competences is necessary for the effective integration of ICT into teaching practices seems to be present among the participants in this study. When asked "What do you consider to be the most important way of developing your competences in the field of digital technologies and education?", teachers were highly aware of the importance of continuous training for their professional development and for promoting more innovative educational contexts. This question accounted for 173 responses (83.6%), as shown in Figure 7.

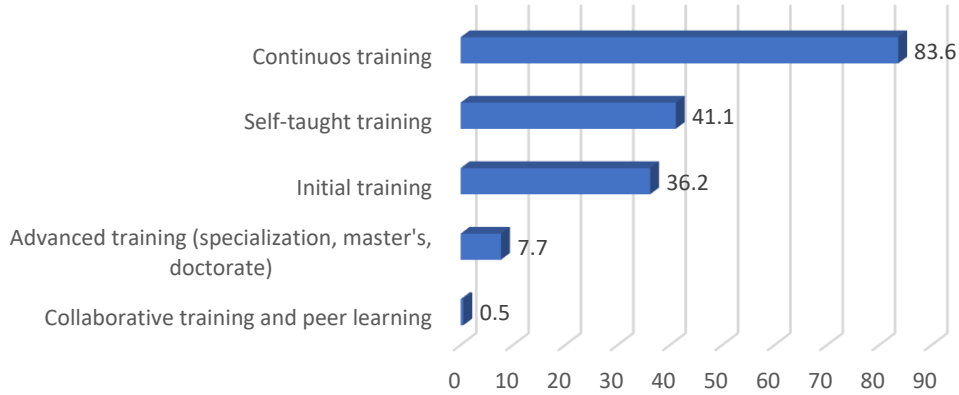

Figure 7. The most important training model in the field of digital competences evaluated by the participants.

These results may indicate the need for teachers to become more digitally competent given the pandemic period experienced in the years 2020 to 2022 and the training that has emerged and has been promoted within the scope of the Education Digital Transition Plan [10]. However, they corroborate the value attributed to continuous professional development (CPD) in DigCompEdu [4] (p. 89).

CPD is the means by which members of professions maintain, improve, and broaden their knowledge and skills and develop the personal qualities required in their professional lives, usually through a range of short and long training programs, some of which offer accreditation. This job-related continuing of education and training refers to all organized, systematic education and training activities in which people take part to obtain knowledge and/or learn new skills for a current or a future job.

5. Conclusions

This study sought to verify, analyze, and categorize the digital competences of elementary school teachers in the ARA to assess the level of influence of digital competence on innovative learning practices in educational contexts in accordance with the European DigCompEdu framework [4]. It was based on previous research by Loureiro et al. [9] on the perception of the digital competences of elementary school teachers (1st to 3rd cycles of basic education) in mainland Portugal.

We can see that being digitally competent is not just about making use of the fruitful potential of digital technologies and overcoming the challenges they impose on school environments but rather includes meaningful participation in the emerging digital society of the 21st century [9,10]. Being digitally proficient includes having an awareness of the resources available as well as an understanding of where to locate them and how to integrate them into classroom activities as tools to support students' learning [30]. Castañeda et al. [31] corroborate this idea when they point out that being digitally competent encompasses the dimension of knowing the potential of digital tools to promote students' abilities to navigate a digital environment and to develop communication and collaboration skills, content creation, and problem-solving. For their part, the studies by Lores Gómez et al. [32] show that in addition to basic digital literacy competences, teacher training, whether initial or ongoing, should include resources to prepare teachers in the management and interpretation of information, in didactic functionality, and in competences for autonomous learning.

From a comparative perspective between the results obtained in these two studies, we find in common the fact that the teachers surveyed are primarily over the age of 41, 91.2% in the ARA and 94.6% on the mainland, and indicate continuous training as the most important modality for developing digital competences, 83.6% in the ARA and 85.1% on the mainland. This means that on the one hand, these are teachers with more years of professional experience but who are less likely to have had training in the area of digital technologies in their initial training, a lack that seems to be made up for by short courses,

which are also a requirement for progression in the teaching career. However, as we shall see, this training is not always aimed at addressing difficulties or needs in the area under analysis.

Thus, one of the differences found in the results between the two studies relates precisely to training in educational digital technologies, where we found that in the ARA, 42.5% of teachers indicated that they had not had any training in this area, while 83.9% of teachers on the mainland indicated the same. First and as a positive aspect, we cannot help but highlight this sharp decrease in the number of teachers who have never had any training in this area, even considering the temporal and physical distance between the two contexts in question. However, we must take into account the fact that digital competence training has been promoted since 2022 [10,33].

However, second, we cannot fail to mention that there are still more than 40% of teachers who have no training in this area, a figure that should lead policymakers and educational institutions to consider a clear commitment to digital training for these professionals to improve their teaching practices, bringing them into line with the demands of Digital Education for the 21st century, as advocated in the European Commission's Digital Education Action Plan (2021–2027) [10]. This also ties in with the issue of training and the importance of bringing it closer to the training needs of the teachers themselves, as pointed out in studies such as those by Andaluz-Delgado et al. [17] or Palacios-Rodríguez et al. [21], also considering that these competences are not built in the same way in all areas, so it is necessary to respond to those that are identified by the teachers as most deficient.

In any case, because there is a close relationship between training and leveraging teachers' digital competences to use digital in their pedagogical practices [22,32], we hope that this study can make a further contribution to defining more relevant training paths and to defining future projects and guidelines around teacher training in the ARA. This training is even more important because we know that in some cases, the competences of teachers and students are not at the same level [29] and that boosting teachers' digital competences also means boosting students' digital competences. The EU recognizes this need and has made DigCompEdu [4] an important reference for education, training, and competence-oriented learning, making it a widely accepted tool for the assessment and certification of Digital Competence in Europe and beyond.

6. Limitations and Suggestions for Future Research

There are several limitations to the study that should be considered both when reading the results and in future research of this nature.

First, we should acknowledge the time gap between the research by Loureiro et al. [9] and the current study (30 months), a period during which digital was given a huge boost in educational contexts due to the pandemic and the need to use digital, leading many teachers to undertake accredited, scientifically recognized training, particularly aimed at developing digital competences under the Action Plan for the Digital Transition of Schools [10]. With this increase in training, it was expected that teachers would feel more digitally competent [22], which seems to be a real indicator of the relevance of training.

On the other hand, although the number of responses was high, the number of teachers teaching in elementary schools in the Azores at the time the questionnaire was carried out was much higher, so a greater number of responses could have led to a more accurate picture of the reality in the Azores, making it possible to generalize the results and look at the training and updating needs of teachers in a more targeted, focused, relevant, and coherent way. In this sense, our recommendation for future work of this nature is to use alternative ways of contacting teachers, making them realize the relevance of the work to their professional practice and future training. Simply sending an email to ask teachers to collaborate in a more impersonal way can contribute to a reduction in the number of responses. However, geographic dispersion is a limitation to more personal and comprehensive data collection. Furthermore, as a way of gaining a deeper understanding of teachers' digital competences in light of the European Digital Competence Framework

for Educators [4], it would be important to extend this analysis to other competences (professional, pedagogical, and learner) in the future in order to obtain more data that would allow us to see the reality in a more comprehensive and complete way, enabling a better and more targeted definition of educational strategies and policies aimed at leveraging the initial and ongoing training of teachers and, consequently, better monitoring of the development of students' digital competences.

This idea will serve as a basis for future studies, as a guide continuing training offers more centered on the development of digital competences identified as necessary by teachers.

Finally, in terms of its practical application, it would be important, on the one hand, for educational institutions as well as government entities to realize the importance of a survey of this nature as a starting point for defining training models that can meet the training needs of teachers in the region. On the other hand, greater dissemination among educational communities could represent new ways for teachers to look at their competences, particularly their digital competences, identifying strengths and weaknesses, and envisaging ways to leverage their competences.

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Institutional Review Board Statement: The study was approved by the Ethics Committee of the University of the Azores, Decision Nr. 61/2023, 29 November 2023.

Informed Consent Statement: Informed consent preceded the completion of the questionnaire and was presented in the following terms—By participating in this study, I understand that my participation is voluntary and confidential, as my answers will never be disclosed individually, and that they will be processed by experts and disclosed in terms of the total sample, solely for the purposes of teaching, communications at congresses, seminars or scientific articles, respecting the General Data Protection Regulation (Law no. 58/2019). I declare that I have read and understood the objectives and procedure of the study, giving consent for the processing of my data.

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Appendix A

Issues: Area 2—Digital Resources

Block 2. Selection

2.1. I rarely use the internet to find resources for teaching and learning.

2.2. I use simple internet search strategies to identify digital content relevant to teaching and learning.

2.3. I use educational platforms that provide digital resources.

2.4. I adapt my research strategies based on the results I get.

2.5. Filter the results obtained to find resources appropriate to my goals.

2.6. I evaluate the quality of digital resources based on criteria such as place of publication, authorship, comments from other users.

2.7. I select resources that my students may find interesting, such as videos.

2.8. I combine my research strategies to identify resources that I can modify and adapt. Example: Search and filter by license, file type, date, user comments, etc.

2.9. I value the reliability of digital resources, their suitability for my group of students and the specific learning objective.

2.10. I evaluate and make recommendations on the resources I use.

2.11. I use a variety of internet search sources. Example: collaborative platforms, digital resource repositories, etc.

2.12. When I use the resources in the classes, I explain their origin and refer to any biases.

2.13. I advise colleagues on internet research strategies, repositories, and resources appropriate to education.

2.14. I organize my own repository of links to resources, duly annotated and classified, and share it with other colleagues.

Block 3. Creation and modification

3.1. I use digital resources, but I do not modify them or create my own resources.

3.2. I use editor software to create and modify content. Example: worksheets, proofs, presentations, spreadsheet.

3.3. I create simple digital resources (e.g., presentations).

3.4. I create digital resources (example: presentations) and integrate animations, links, multimedia, and interactive elements.

3.5. I make modifications to the digital learning resources I use to suit them to learning objectives.

3.6. I create digital, complex, and interactive learning activities, for example, online assessments (quizzes, forms, etc.), online collaborative learning activities (wikis, blogs), games, and applications.

3.7. I create learning resources together with other colleagues.

3.8. I create applications or games to support my educational goals.

Block 4. Management, protection, and sharing

4.1. Store and organize digital resources for my future use.

4.2. I share educational content by sending attachments in an email or through links.

4.3. I share educational content by linking or incorporating it into virtual learning environments, e.g., on a website or blog, staff, or educational institution.

4.4. I am aware that some resources distributed on the internet are protected by copyright.

4.5. I protect access to private content, e.g., exams, student reports.

4.6. I compile comprehensive repositories of digital content and make them available to students or other educators by applying their licenses to resources.

4.7. I keep the resources that I share digitally and allow others to comment on, classify, and modify them.

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