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ORIGINAL RESEARCH

Digital Teacher Training in the Portuguese National Plan for Digital Development at Schools: A Case Study

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Abstract
Schools have been responding to the ongoing digital transformation, which requires continuous self-reflection and decision-making skills from teachers in the inclusion of new digital technologies in the teaching and learning process. In the present study, descriptive measures were used to understand how 140 teachers, in a school group, perceived their digital competences through the Check-in Questionnaire (Study 1). A school group is a Portuguese organisational unit, constituted by different schools, catering to different age groups, managed by a single director. Study 2 addressed how this specific school group organised teacher training courses, considering the results of Check-in Questionnaire, and the scope of the National Digital Transition Plan. Interviews, in which data content analysis was applied, were undertaken with seven teacher instructors, selected to implement digital training. The results of Study 1 revealed that most teachers are positioned at level 2, an intermediate level, with no differences in age or years of service. In Study 2, instructors revealed that the proficiency level assigned in the Check-in Questionnaire did not always correspond to a teacher's real digital skills, identifying this as one of the obstacles to achieving the initial training aims. The goal of the training was for these professionals to feel committed to their educational context and understand what is intended in the inclusion of digital skills in the classroom. The relevance of this study relates to the current context, which places education and teachers at the centre of a digital agenda focused on the development of digital skills, thus generating new pedagogical practices, while accompanying the process from the initial assessment to the implementation of training in the National Digital Transition Plan.

Keywords Digital transition · Technology · Teachers · Training · DigCompEdu

1 Introduction

One of the many challenges in the educational system and in teacher training is the use of digital technology in an era of digital learners (see Creighton, 2018). Digital competence, among other foundational competences (e.g., environmental; health; cultural and

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civic; economic; scientific; analytical and communication (Figueiredo, 2016)), is one of the multiple skills to be promoted in and by educational systems not only throughout childhood and earlier academic years (Buckingham, 2013; Carvalhais et al., 2020; Pöntinen & Räty-Záborszky, 2020), but also in higher education (Janschitz & Penker, 2022). However, recent studies have shown that teachers in the European Union often do not incorporate digital technologies in teaching, as this is considered a complex process. According to the 2018 OECD Report, less than 40% of educators reported using digital technologies. A major contributing factor has been the infrequent implementation of these technologies in pedagogical settings, especially in the initial school years (Pöntinen & Räty-Záborszky, 2020). Teaching and learning practices need new models (Halász & Michel, 2011; Ilomäki et al., 2016). For this, teachers are required to innovate training methods which promote and/or improve the use of digital technologies (DGE, 2021; Kampylis et al., 2015; Loureiro et al., 2020; Lucas & Moreira, 2018; Palacios-Rodriguez, 2022). This includes daily routine habits (e.g., to communicate with students or parents), learning through digital technology (e.g., integrating digital technology in different subjects) and the support of students' development of digital competence (e.g., promote robotics and programming skills). Digital technologies include digital resources and devices, software, hardware, and digital data/content.

Taking these findings into consideration, we aimed to study how a group of teachers perceived their digital competences, using the Check-in Questionnaire, translated previously to Portuguese (Study 1); and how the training courses for teachers in a specific school setting were organised by instructors in the context of the new Portuguese National Plan for Digital Transition (2021–2027) (Study 2), through a case study.

To analyse the teachers' digital competences, tools such as Check-in were designed and implemented (for more information on design and implementation see Sect. 3.1.2) in schools in European countries. However, not much is known about the results of these tools in Portuguese schools, having in mind the specific setting and the cultural and contextual differences. Furthermore, the results could be an expression of teachers' perceptions but not necessarily reflect the true state of the reality in schools (Costa et al., 2021).

In this sense, a case study could give a more detailed view of how the process of assessment and training of digital competences of teachers was being undertaken in a Portuguese context, and how instructors were trained to tutor teachers in this specific competence, following European directives.

2 Literature Review

The Portuguese Ministry of Education, in line with the European institutions for Education, recognises the relevance of digital technologies in schools. In 1985, the MINERVA Project was implemented (Ministry of Education, 1985). This ten-year project led not only to a real school culture shock, but also to the stimulation of the development of new pedagogical scenarios, and highlighted teacher training needs in this specific area (Ponte, 1994). From 1995 to 2011, a set of actions (e.g., Internet at School Program (1997–2002); Technological Plan of Education (2007–2011)) were undertaken to promote the technological modernisation of schools and to broaden student access to computers and to the Internet (Pereira & Pereira, 2011). Some of these initiatives continued to implement several activities, but most had a very short duration (DGE, 2021). Since 2015, the European Commission's Joint Research Centre has been defining digital guidelines for educational

settings, manifested into programmes such as the European Framework for Digitally Competent Educational Organisations—DigCompOrg (2015); the European Digital Competence Framework for Educators—DigCompEdu (2017); and the European Digital Competence Framework for Citizens—DigComp 2.1 (2017).

The DigCompEdu Framework for teachers designed international, national, and regional policy guides to provide tools, and training programmes to be directly applied in both public and private schools, from early childhood to higher and adult education (Redecker, 2017). This framework which proposes 22 digital competences, and is organised in six areas, is directed towards educators (see Supplementary Material). The DigCompEdu Check-in (Joint Research Centre, 2017) is a self-reflection tool which identifies an educator's personal strengths and weaknesses in digital technologies. It sets three different levels of proficiency (and three sub-levels) and defines what it means to be digitally competent while offering a set of useful descriptors for (self) assessment and professional development. Considering how teachers perceived their preparation to use technology, studies reported variations across different variables such as age, years of service and/or school levels/grades.

In a survey distributed to 356 newly qualified teachers in Norway, Gudmundsdottir and Hatlevik (2017) found that more than 80% of teachers believed in the usefulness of technology. Data from a Portuguese study, using the Check-in Questionnaire involving 99,760 teachers, showed that self-reported levels of proficiency are significantly associated with a teacher's age, and that older teachers and teachers with more years of service presented lower levels of proficiency (Lucas & Bem-Haja, 2021). Additionally, 127 Portuguese secondary school teachers self-reported their digital competences through the Check-in Questionnaire, with results placing them at levels B1 and B2 (level 2 of proficiency). This level indicates that teachers have already experimented with different digital technologies, but still need to work on understanding which tools work best in diverse contexts, suggesting the need for more time for experimentation and reflection to reach level 3 (C1 and C2, as the maximum levels) (Dias-Trindade & Moreira, 2020).

Aligned with these European frameworks, educational policies in Portugal developed an Action Plan in 2020 for Digital Transition (2021–2027) (Council of Ministers Resolution no. 30/2020, April 2020). This national plan includes three main measures: Action I—Training and digital inclusion of people; Action II—Digital transformation of business; Action III—Digitalisation in the Government, with the aim of accelerating digitalisation throughout the country. In 2021, Plan 21|23 School + (Council of Ministers Resolution no. 90/2021, 2021) targeted human resources in schools, with a special focus on training and qualification of teaching and non-teaching staff, assisted by the promotion of digital resources and the availability of equipment and infrastructures. To support these plans, schools and teachers had different tools at their disposal, namely Check-in. With the use of this tool, each school's training centre could develop a plan of action for digital development (PADDE), in order for teachers to participate in in-service training courses connected with digital abilities. Previous studies had already demonstrated the need to support teachers in the use of technology in pedagogical contexts, and in the training of competences through practical and experimental activities (Instefjord & Munthe, 2017; Ramírez-Montoya et al., 2017).

Digital training for teachers includes webinars, online courses, conferences, or training sessions promoted by expert teachers on the theme. It supports teachers' professional development and keeps them updated on the latest best practices in education (Baser et al., 2021). However, some in-service training activities present several issues, such as the lack of follow-up support, and a focus on theoretical information instead of on practical activities (Aslan &

Zhu, 2016). This is particularly concerning as previous research shows that if teachers train their technological knowledge, they are more likely to transfer it to their teaching practice (Tweed, 2013). Furthermore, research also indicates that, even when training in digital competences is promoted, teachers do not have the professional support to keep making use of their skills in school contexts (Duran et al., 2012). These results lead to questions on how teachers are trained to implement and integrate their digital competences in daily activities (Escudero et al., 2018; Tejada Fernández & Pozos Pérez, 2018). In order to incorporate specific contents in a pedagogical context, using technology, several different training models were developed. One of the most well-known models is the TPACK model (technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK)) developed by Koehler and Mishra (2008), which considers that competent teachers are those who can effectively activate disciplinary, pedagogical, and technological knowledge. In 2020, Fernández-Batanero et al. (2020) presented a systematic review on studies conducted on digital competences for teacher professional development. According to this literature review, teacher training on these competences is still lacking, and is still viewed as a challenge in initial and in-service training. The Krumsvik study (2009) defends a model in successive phases, starting with the training of basic IT skills; followed by didactic IT competence; thirdly, learning strategies; and lastly, when the previous phases are well integrated, digital teaching competence. George and Sanders (2017) developed a training model after identifying that many technology-based tasks fail in leading to meaningful learning for students due to the lack of teacher training. Based on the evidence found, they developed a training model organised around the following areas: technological competence knowledge, the beliefs about the use of technology, teachers' attitude towards IT, intention to use IT, and knowledge about TPACK.

In connection with teachers' training in digital competences, little is known on how the information provided by the Check-in Questionnaire in Europe and in Portugal was integrated in the training plans for teachers in specific school contexts and on how teacher instructors developed and implemented their digital plans for teacher digital competences in the in-service training provided to teachers.

The work reported here deals with exploratory research using descriptive measures and data content analysis designed to understand how a group of teachers from a specific school group perceive their digital competences based on a Check-in Questionnaire (Study 1) and how this specific school group organised the training courses for teachers in the context of the new Portuguese National Plan for Digital Transition (2021–2027) (Study 2). Research on this issue has led us to conclude that not much is known concerning how this process is carried out in Portuguese schools and implemented by in-service teacher instructors and by the centres in which they operate. Based on previous studies, we expected for teachers' perception of their digital competences to differ according to the school level of instruction, as secondary school teachers tend to engage more in the use of technology than teachers at lower levels of schooling. We also expected younger teachers to be more used to digital contexts than older teachers (Lucas & Bem-Haja, 2021). Furthermore, as how the information from the Check-in Questionnaire was used and how these training plans were developed (2021/2022 academic year), is still unknown, semi-structured interviews were undertaken with instructors and the data obtained was analysed.

3 Method

3.1 Study 1

3.1.1 Participants

140 adult participants aged 37 to 64 (M = 50.15, SD = 6.35), of whom 21 were male (15%) and 119 (85%) were female, in line with the Portuguese context, in which female teachers are the majority (see DGEEC, 2023 Report). The teachers taught at a school in the North of Portugal. Most were full-time teachers employed at the school (n = 124, 88.6%). Time of service varied from 6 to 41 years (M = 24.90, SD = 7.31). 22 of the participants were 1st Cycle teachers (15.7%) (1st–4th grades), 17 (12.1%) were 2nd Cycle teachers (5th–6th grades) and 101 (72.1%) were 3rd Cycle and secondary school teachers (7th–12th grades).

3.1.2 Tools

3.1.2.1 DigCompEdu Check-In The Portuguese version of DigCompEdu Check-in Questionnaire was developed by the European Commission's Joint Research Centre (2017), and translated by Margarida Lucas, from CIDTFF (University of Aveiro). Dias-Trindade et al. (2019) analysed the construction procedures of the scale used and its psychometric qualities, concluding that it is a satisfactory and reliable instrument, and, therefore, a scale capable of contributing to the assessment of the digital competences of teachers in Portugal.

This self-report tool conceptualised for six different school settings includes 22 items, in which teachers report their perceptions regarding personal digital competences (see Supplementary Material).

Teachers were instructed to answer this questionnaire, assuming that the school had the adequate conditions to use digital technologies (e.g., enough equipment and good quality internet access). The data assessed teacher proficiency from level A (lowest level, A1 and A2) to levels C1 and C2 (highest level) (level order: A1 and A2 (level 1); B1 and B2 (level 2); C1 and C2 (level 3)). The teachers were then placed in courses in accordance to the level obtained in the Check-in Questionnaire, with learning contents adapted to each competence level. The school coordinated the placement of the teachers with the Teacher Training Centre, taking into consideration the results that were sent to the school, concerning its teachers.

The Portuguese version used a 5-point scale. International studies using the same material reported very good psychometric properties, and high levels of reliability (McDonald's coefficient omega superior to 0.784, see Cabero-Almenara et al., 2020).

3.1.3 Procedures

This study was conducted with the approval of the authors of the translated versions, who gave their permission to use the questionnaires. The ethical procedures adhered to the Helsinki Declaration and to the most recent national General Data Protection Regulation (GDPR).

One school in the north of Portugal was selected, based on convenience procedures, from all the schools participating in this national project (January 2020). The teacher sample, which was collected in schools, contained the teachers' replies to the Check-in

Questionnaire, comprising 22 questions and representing the 22 competences proposed in the DigCompEdu. Raw data was collected nationally and then computed into the specific levels of proficiency for each teacher by the research team responsible for this task (University of Aveiro). This data related to levels of proficiency was sent to each school and used in the present study, upon the approval of the director. Preliminary analysis was carried out concerning the variables referring to years of service, age, teaching level and levels of proficiency, using the descriptive statistics package of the IBM SPSS Statistic 27.

3.2 Study 2

3.2.1 Participants

The study sample regarding the instructors that developed the training provided was composed of 7 participants (6 males; 1 female), belonging to the same school group of Study 1, in line with the Portuguese context in which the areas connected with technology and technology teaching are more selected by men (for example, 2023 Council of Ministers Resolution concerning gender equality in STEM, 2023). These 7 participants were selected (convenience sample) from a pool of 15 instructors (approx.: 50% of the possible sample), responsible for developing and teaching the digital competence training courses to the teachers selected in Study 1. These 7 participants were selected because they were the ones that provided training to the teachers in the school group analysed in Study 1 and they also taught the most classes. It was believed, therefore, that they could provide more thorough information on the training process. The sample had an average of 25 years of experience as teachers (M = 25.75, SD = 2.89; min: 21 years; max: 30 years) and 16 years as instructors (M = 15.86; SD = 5.46; min.: 8; max.: 22).

In what concerns the academic training of the sample, indicating the highest credential obtained, one participant possessed a PhD, three participants possessed a Master's degree and three obtained a Bachelor's degree. The area of training of the academic credentials was connected with the fields of technology and multimedia.

3.2.2 Data Collection

An interview protocol was used for the data collection in Study 2. The interviews were conducted by one researcher, one-on-one and online (e.g., Zoom Colibri). The interviewer did not know the interviewees. The interview protocol was composed of 21 questions (see Supplementary Material) organised in 3 main topics: instructor's academic credentials and experience (4 questions); the initial training given to instructors to enable them to provide training at schools/ school groups (6 questions); the planning and execution of the training provided to teachers (11 questions). An initial invitation to participate in the present study was made via e-mail and/or phone. Upon acceptance, participants were sent the interview protocol before the interview took place.

Interviewees provided written informed consent before the interviews. Before the audio recording, all ethical issues were repeated, that is, participants were duly informed about the aims of the study, the voluntary character of the research, and of the anonymity of the process. The interviews lasted an average of 47 min (min: 36 min, max: 60 min). Data collection was undertaken between mid-May and mid-June 2022, at the end of the 2021/2022 academic year, when most of the training courses had already finished or were in their

last sessions. Interviews were transcribed verbatim, using specific software, and an external professional, who remained anonymous.

3.2.3 Data Analysis

Qualitative content analysis (Bardin, 2011) was carried out by the two researchers. Categories and subcategories were extracted from content, based on the interview protocol, through an inductive approach. After an initial reading, each researcher created a coding frame based on interview 1. Disagreements on category and subcategory coding were solved by discussing each proposal. After this initial procedure, one of the researchers conducted the analysis of all the interviews. The final version of the content analysis is presented in the Results section, with a short definition and textual fragments of participant narratives to demonstrate the main results obtained. The textual fragments were translated into English.

4 Results

4.1 Study 1

A descriptive data analysis regarding teachers' age and years of service was computed and grouped in blocks. The frequency and percentage analysis showed teachers self-assessed their digital proficiency mainly at level 2, with a reduced percentage of teachers placing themselves at level 3. Teachers between 41 and 50 years of age and with 21–30 years of service, and in 3rd Cycle and secondary education were the largest group positioned at level 3. No teachers in 1st Cycle considered their level of digital proficiency to be at level 3. Moreover, 2nd Cycle teachers positioned themselves more at level 2 than at any other level. This tendency is also observed in relation to age, with teachers at extremes (younger and older) not reaching level 3. At level 1, we found a greater number of teachers aged between 51 and 60 and having 21–30 years of service distributed across the different teaching cycles, as mentioned below in Table 1.

4.2 Study 2

The interviews were analysed, and results were structured into three main categories: A. Characterisation of the training provided to instructors; B. Characterisation of teacher training; and C. Reflection about DigCompEdu training. Each category and subcategory were identified to facilitate a better clarification and in-depth analysis of the results.

4.2.1 Characterisation of the Training Provided to the Instructors

When analysing the characteristics of the training provided to instructors regarding digital competence, several subcategories emerged, namely: training aims; subjects; pedagogical methodologies; and the teacher's perception of the training.

4.2.1.1 Aims of Training This subcategory refers to the aims of the training developed for instructors in digital competence. The interviewees were unanimous in mentioning that the training was wide-ranging, very generic and had the main purpose of promoting

Table 1 Teacher characterisation

	Proficiency level 1 N (% at proficiency level)	Proficiency level 2 N (%)	Proficiency level 3 N (%)
Years of Service			
0–10	2 (6.5%)	3 (3.1%)	1 (8.3%)
11–20	3 (9.7%)	23 (23.7%)	3 (25%)
21–30	17 (54.8%)	51 (52.6%)	8 (66.7%)
31–41	9 (29%)	20 (20.6%)	0 (0%)
Age			
30–40	0 (0%)	8 (8.2%)	0 (0%)
41–50	13 (41.9%)	45 (46.4%)	8 (66.7%)
51–60	17 (54.8%)	38 (39.2%)	4 (33.3%)
61–70	1 (3.2%)	6 (6.2%)	0 (0%)
Teaching cycle			
1st cycle	6 (19.4%)	16 (16.5%)	0 (0%)
2nd cycle	3 (9.7%)	13 (13.4%)	1 (8.3%)
3rd cycle/Secondary school	22 (71%)	68 (70.1%)	11 (91.7%)

Teachers with different years of service (raw data) were similarly distributed concerning digital levels of proficiency [$\chi^2_{(62)}=61.29$, $p=0.50$] as were teachers of different ages (raw data) [$\chi^2_{(52)}=51.32$, $p=0.50$]. Teachers from 3rd Cycle were also distributed in the 3 levels of proficiency similarly [$\chi^2_{(4)}=3.31$, $p=0.51$]

one's self-reflection of digital competence and digital transition currently occurring in Portugal: "(…) wide-ranging training, which addressed the evolution of digital transitions that have occurred in the country (…) the idea is to promote reflection, naturally guided by the instructors, on the relevance of the change for the digital transition." (Instructor 1, p.3). The clear advantage of this training is the experience and the material shared among participants: "it also allowed us to share knowledge, tools for planning, workshops and how they were going to be developed." (Instructor 4, p.4). All the interviewees, except one, mentioned that, although the digital tools themselves were not the focus of the training, they were used during the training sessions, adding that it would have been more advantageous if the training had indicated which tools were more appropriate in each context. Nevertheless, the underlying idea is that this training should not focus on tools, "(…) during the training, it was conveyed to us that the focus here was not the tools." (Instructor 4, p.9), but on other skills such as digital and pedagogical so that at the end of the training, the participants could replicate the digital teacher training to colleagues: "(…) we would be able to replicate, (…) or develop as instructors the digital competence training." (Instructor 7, p.4).

4.2.1.2 Subjects In terms of the contents provided in the training, these concerned the analysis of the DigCompEd document and theoretical material concerning hybrid models of learning: "(…) at the level of theoretical reference, in addition to DigCompEdu, we were also provided with several documents on hybrid education, hybrid teaching, various models (…)." (Instructor 1, p.8). During training, different materials were provided as support for the assigned tasks and for later use in teacher training courses: "some materials were provided during the training, namely, work plans, best practices examples, some planning, (…) so we could develop the training courses." (Instructor 6, p.3).

4.2.1.3 Pedagogical Methodologies The instructors described how the training course was implemented, namely the different teaching methodologies used, mentioning active learning activities such as group tasks or planning discussions as the most common, after initial theoretical moments to introduce theoretical contents. The group tasks encouraged self-reflection and discussion and created resources to be shared with the participants: "(…) teamwork; many plans were made and discussed concerning the training courses we were going to give; (…) networks were created, in a certain way, national networks for sharing resources, but also for sharing information and opinions". (Instructor 1, p.4).

4.2.1.4 Instructors' Perception About Training The general opinion of the instructors regarding training differed in the sense that some focused on the aspects considered less positive (43%) while others focused on the added value of the training (57%). In general, the less positive aspect was that the training was considered to be very theoretical, with too much reflection on certain themes, without a common thread which would allow the standardisation of procedures: "(…) we had many reflection moments, (…) reflection moments after reflection moments, (…) everything was very theoretical, therefore, in practical terms, there was not exactly a common thread." (Instructor 3, p.4). On the other hand, the most positive aspect mentioned was the great advantage of creating work groups, which facilitated further work: "(…) this training allowed us to obtain information which will still be available in the forums for exchanging experiences and materials (…) we share all the plans of the instructors and, therefore, colleagues can easily find plans associated to a particular level or area." (Instructor 4, p.9).

4.2.2 Characterisation of Teacher Training

The teacher training in digital competence results were divided into six subcategories designed to clarify this characterisation.

4.2.2.1 Aims of Teacher Training The questions about the aims of this teacher training, and how they were expected to be achieved at levels 1–3, generated discussion, as these aims were not considered to be clearly specified. The aims were defined centrally, at a global perspective without linking a specific framework with each teacher's proficiency level, thus making it difficult to implement and execute them: "(…) they are already designed centrally". (Instructor 1, p.5). Instructor 1 indicated that "(…) the aims of level 1 are different from the aims of level 2 and, as of now, a reference to the fact that there is a sequence, and a link (…) in operational terms, is not so easy to achieve." (p.6). However, though there were some difficulties, the interviewees were able to differentiate the proficiency levels, considering the general proposed aims: "Level 1 concerns the tools domain. Level 2 concerns the domain of the classroom, in the pedagogical domain, and level 3 concerns the level of organisation." (Instructor 2, p.7). Also reinforced was the fact that there was a need for constant adjustments: "(…) needed to do theoretical adaptation work (…), then it was necessary to readapt according to the teachers, class by class." (Instructor 4, p.5).

4.2.2.2 Subjects This section deals with the contents to be included in teacher training. In line with the goals, the contents also had to be adjusted in accordance with the group of teachers, with DigCompEdu as basis: "DigCompEdu is the reference document." (Instructor 2, p.6) and, in this document, "contents are vague, they have to be analysed in accordance

with the reality of the country, (…) they had to be adapted in accordance with the different levels (…) then I felt the need to undertake some changes in accordance with the group." (Instructor 4, p.5).

4.2.2.3 Pedagogical Methodologies In terms of the methodologies used, instructors organised the training for the sessions, and, in each session, they mainly used a theoretical introduction, followed by the presentation of some practical examples, with instructors showing how to use a specific tool, and then group tasks were carried out culminating with teachers presenting their work. The initial sessions were dedicated to getting to know the group, presenting a theoretical framework and the most common platforms/tools, then group tasks were carried out, and the training concluded with a presentation and with the sharing of documentation: "(…) the group of teachers I have in front of me are those I'm going to assess." (Instructor 7, p.6). Instructor 1 mentioned that the didactic sequence was composed of a "summary presentation (…); which is the pedagogical model (…); theoretical basis of that model, what are the assumptions, what are the underlying methodologies (…); I present 1 or 2 digital tools which may help to grasp that or other models (…); put forward an activity to a small group." (p.11). According to Instructor 4, "(…) the aim was for them to present those competences to the group. (…) a final document was drawn up with the result of the work of all the groups to be shared later." (p.16).

4.2.2.4 Class Organisation The criteria for class organisation were one of the items considered most relevant by the interviewees. In general terms, the criteria were based on the proficiency level of each teacher and, secondarily, on their initial subject areas/departments (mathematics, languages, natural sciences, arts): "teachers were divided according to their proficiency level." (Instructor 4, p.6), and "the training centre was careful to divide the teachers by departments." (Instructor 6, p.5). The instructors were selected from the same department or related area: "instructors who were also from those subject areas." (Instructor 4, p.7). The definition of these criteria generated some constraints, essentially due to the fact that classes were very heterogeneous, as instructors considered that the proficiency levels assigned by the Check-in Questionnaire, in most cases, were not adequate, since most teachers were below the level: "one of the great difficulties I had was to have a completely heterogeneous group of teachers (…) different functions (…) completely different realities (…) this distribution of the competence, of the digital skills of the teachers in the 3 levels, did not correspond, in most cases, to the true reality of each one." (Instructor 5, p.5). The instructors considered that most teachers "(…) had no idea concerning the aim of Check-in, which was filled out with socially acceptable answers instead of truthful replies based on their real practice." (Instructor 7, p.7).

4.2.2.5 Support Resources for Planning and Execution In terms of planning, there was a consensus in indicating that the training centre organised meetings for self-reflection and definition of the main lines of action: "we had a joint discussion initially and before the training began, among all the instructors, there was a kind of harmonisation of procedures, action strategies and assessment methodologies so that the difference would not be too great". (Instructor 1, p.7). However, these plans required constant adjustment and reformulation according to the composition of the classes: "to teaching 1st Cycle, I created more or less a set of tools I thought was suitable for teaching the cycle in question". (Instructor 3, p.13). There was a consensus in the planning especially concerning the importance of the dynamic of shared networks during training "there is even an area where the different plans

are shared, which, taking into account the reference tool, can be used to boost the training actions." (Instructor 2, p.4).

4.2.2.6 Teacher Assessment Regardless of the proficiency level, the focus of teacher assessment was based on the use of digital tools when planning lessons, its application in the classroom and the presentation of the results in the last sessions of training, and also the creation of a portfolio where experiences throughout the sessions were shared: "plan 2 or 3 lessons, according to a hybrid model, but to do the whole course. From planning, execution and evaluation." (Instructor 2, p.13); "basically show the tools which have been applied in the classroom, in a real context, that is, evidence to show proof of the facts." (Instructor 3, p.7); "in the training, there was always room for sharing experiences and exchanging ideas, as well as sharing the work they had done." (Instructor 5, p.13).

4.2.3 Reflection on the Training

This category refers to the instructors' and teachers' analysis regarding the quality and delivery of digital training.

4.2.3.1 Teacher Expectations It was clearly perceived that teachers were not expecting the methodologies applied in the sessions: "some colleagues were surprised when they saw what the training was going to be because it was totally different from what they were expecting (…) the shock is big." (Instructor 1, p.16). Teachers expected to work with digital applications/tools which they would apply in the classroom: "the fact that the training is about this, and we're going to work on this, but when we tell them the training is about something much more macro, (…) they get a bit lost." (Instructor 4, p.10). On the other hand, the interviewees mentioned some teachers had no expectations, as they were compelled to attend the training to obtain credits which would enable career progression: "most of the trainees were unmotivated, they were against it". (Instructor 7, p.5), "they didn't even know why they had come to the training and secondly because they needed to advance in their careers, they needed the credits." (Instructor 7, p.9), "we found many who were there because they were forced." (Instructor 3, p.9), "they were a bit reticent in coming to the training" (Instructor 6, p.7).

4.2.3.2 Teacher Assessment of the Training Assessment was positive at the end of the training; teachers considered they had learnt new tools and working methodologies and consequently intended to continue: "I had the final feedback that they had liked the training, that they would like to have more training on this issue, and that it was really worthwhile." (Instructor 3, p.9); "they had never had (…) the opportunity to experience training from this point of view, so structured, i.e., starting from the most conceptual part to the most theoretical part, which is important for us to understand and, naturally, to guide our practice." (Instructor 4, p.11).

4.2.3.3 Reflection by the Instructors The keyword throughout the interviews was "demystifying", that is, the challenge of making teachers understand the goal of including digital tools in the classroom, in the sense that they should recognise that it is a process, and that they should be more open to using the tools: "it is very important to demystify, especially, because there are people from some areas who fear working with computers." (Instructor 3,

p.12); "the training for now, demystified the idea that the teacher has to know everything, in all areas." (Instructor 4, p.21). Additionally, the fact that some teachers felt demotivated and resistant to sharing materials and experiences with their peers was also mentioned: "many teachers really feel very demotivated." (Instructor 7, p.5), "they don't want to share anything." (Instructor 2, p.9).

4.2.3.4 Constraints to the Digitalisation of Education The digital transition in education faces many pressures: obsolete or non-existent equipment, resistance to change on the part of teachers, the outlook of parents, the lack of knowledge of the reality on the part of the parents: "there is a problem of equipment and infrastructures in schools." (Instructor 4, p.18); "greater resistance from teachers, from older colleagues". (Instructor 4, p.26); "you have to be motivated (…) if the teacher is not motivated, he/she will not apply it, it's not worth it". (Instructor 6, p.18); "it is necessary to educate parents. And it's not easy to reach parents, to explain that the computer is for children to work with." (Instructor 5, p.10); "we have a reality at school, which sometimes doesn't seem to be the reality that the parents know about." (Instructor 7, p.6).

5 Discussion

The results obtained in Study 1 are partially in line with previous literature regarding teacher distribution at the 3 levels of digital proficiency. Teachers mainly assessed their performance at level 2, intermediate, as already reported by Dias-Trindade and Moreira (2020) in secondary school teachers and Lucas and Bem-Haja (2021) in 3rd Cycle and secondary school teachers. These results still reflect the fact that few teachers are positioned at level 3, the highest level, which denotes the need for further training and competence building in digital technology. However, the common teachers' perception of an intermediate position can also be the result of the choice for answers considered as socially acceptable, and these self-assessed levels may not always correspond to the teacher's current skills, as observed in Study 2, and found in the literature. According to Cabero-Almenara et al. (2020), although the tool DigCompEdu Check-in Questionnaire is sufficiently robust to discriminate subjects in terms of technology-related variables, it may be important to develop research to create new tools which enable the assessment of teacher performance in tasks or, alternatively, increase the number of questions used in diagnostic instruments.

Regarding the distribution of teachers at the three levels of proficiency according to their age, years of service and the schooling levels they teach, the results revealed that the participants were similarly distributed. Based on years of service, we cannot conclude, as Lucas and Bem-Haja (2021), that overall, the proportion of teachers at the lowest levels of proficiency, mediated by age, are teachers with more years of service. Concerning our results, we can argue, as Wang et al. (2012), that digital competence perceived by the teachers is not related to age, because the teachers who were older and had more years of service also engaged in digital technology as younger teachers do.

In terms of different levels (1st Cycle, 2nd Cycle and 3rd Cycle and secondary school), none of the 22 1st Cycle school teachers assessed their digital proficiency at level 3. This result can lead us to conclude that 1st Cycle teachers do not perceive themselves as leaders or pioneers in digital technology. However, this number is lower than in the other levels thus the interpretation of this observation should be undertaken

carefully. We had more teachers at level 3 in 3rd Cycle and secondary school which can be explained by the fact that teachers in the Technology and Sciences area are mainly working at 3rd Cycle and secondary schools where these contents are commonly addressed. In this sense, different levels, content/subjects, and student diversity influences the way training is organised so it is necessary to make teachers feel committed to their educational context.

Concerning the results obtained in Study 2, to answer the question about how digital training has been undertaken in a school group, in connection with the Portuguese National Plan for Digital Development at schools, several ideas were extracted from interviews, organised in three main topics: the characterisation of the training provided to the instructors, the characterisation of teacher training and a reflection about the training.

In what concerns the characterisation of the training provided to the instructors, topics about the training aims, contents, and the perception about the training were mentioned. Overall, the instructors concluded that no specific theoretical model was used to organise and to structure the training provided to them. This idea is not in line with previous research as theoretical frameworks have already been developed (e.g., TPACK, George & Sanders, 2017) which could be used to organise trainings courses in the digital area. In terms of contents, instructors expected to learn more about new tools or new strategies to implement in classroom contexts and less about historical and theoretical development of DigCompEdu (Redecker, 2017). Previous literature already mentioned this in-service training issue, with a focus on theoretical information rather than on practical activities (Aslan & Zhu, 2016). The opinions of the interviewees have led us to conclude that teachers would consider it more helpful to a greater focus on more practical exercises and workshops. In order to further what was taught in the training classes, schools could also develop after training strategies, like a monitoring system to assess training impact, which can include periodic and annual assessment moments. However, despite these less positive results, the creation of collaborative and communicative networks between instructors was seen as crucial support in the development of teacher training. This collaborative network leads instructors to share material, examples of good practices and course plans. It is interesting to note that although the interviewees emphasised the theoretical characteristics of the training, it had one very practical outcome: the collaborative efforts of the participants in sharing materials and experiences. If this type of training can assist in the development of networks in which teachers cooperate and help each other in seeing the benefits of the use of ICT in the classroom, it can have a positive impact on ICT integration and on pedagogical changes.

In terms of the characterisation of teacher training, the class organisation and planning and execution required the instructors to constantly adapt to the different demands presented. Teaching digital competences to different teachers from 1st Cycle to secondary cycle, with different digital levels, according to the Check-in questionnaire, was presented as the main challenge. The training centres tried to manage the classes according to proficiency levels and their subject department, but due to logistical issues this was not always possible, which presented constraints to instructors. The diversity of teachers' backgrounds and their digital competences must be articulated with the objectives defined by the government for each level of proficiency, meaning that the objectives defined for teachers at level 1 differed from levels 2 and 3, in a progressive way. Although the specific objectives for each proficiency level were not always clear (for more information, in the Supplementary material we present the training aims according to the government, as a reference. This issue was not analysed in this study), the instructors managed to adapt the teachers'

knowledge and the levels at which they were placed to the objectives of the National Digital Training Plan.

Moreover, the implementation of digital tools in schools was presented as a process and instructors were concerned in transmitting this idea of process through time, which had begun with previous projects and now was connected with the recent European and National Plans for Digitalisation (DigCompEdu). These results obtained in our study are in line with Cabero-Almenara et al. (2022) who indicates that it is necessary to define teacher training itineraries, establish selection criteria and analyse the needs for professional teacher development.

Overall, and in line with previous research (Palacios-Rodriguez, 2022), teachers at the end of each course assessed it as relevant, reinforcing the idea that it is still essential to develop action plans to improve teachers' competences in the digital area.

As the results of this study indicate there is still a long way to go in what concerns ICT adoption by teachers. We believe that the schools where teachers work should have a broader role in this area. On the one hand, schools could assist in the development of communities of practice by providing spaces where teachers could meet to share experiences and to develop strategies of ICT use. On the other, schools should also provide a stress-free environment in what concerns hardware and software difficulties, so teachers can feel safer in their experimentation of ICT tools.

6 Limitations and Future Research

There are some limitations in this study. Firstly, only instructors were interviewed, and therefore, differences in perspective could not be analysed, namely those of school directors or teachers that had attended the training courses. Secondly, the convenience sampling procedure in the present study compromises data generalisation. Another limitation of our study is that the data could not completely demonstrate how the courses for instructors and teachers were designed and provided. Analysing documents such as session plans and course plans or the direct observation of the sessions could be an asset to the present conclusions. It would also be important to observe how teachers use the knowledge they acquired in these training courses in several daily school activities. Future research could investigate whether the Portuguese National Plan for Digital Development results in effective changes in teachers' digital competences from this specific school group or compare it with other school groups.

7 Conclusion

This study concluded that most teachers have an intermediate level of proficiency, but digital skills still have a long way to go. Digital competence training should start with a clear explanation of the objectives not only by exemplifying the importance of using digital resources in the classroom, but also by actively involving students in digital technologies. A network for sharing experiences and digital materials is undoubtedly the added value of these training courses, by promoting collaborative work and validation of teacher reflection. The efficacy of these training courses should be observed at a national and at an international level, and a specific training framework should be developed, with a final assessment at the end of the course, in order to assess if the teachers can advance to the next

level. Using different strategies, materials, methodologies, or even theoretical backgrounds concerning digital technology will result in a larger complexity in comparing results and in understanding if teacher training had an impact on student learning, on school organisation or even in the communication with the school community.

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Declarations

Conflict of interest The authors declare that the research was conducted in the absence of any commercial or financial relationship which can be construed as a potential conflict of interest.

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