

## **Technologies and Digital Competences in Portuguese Education: History of its Integration in Pedagogical Practices since the Beginning of the 20<sup>th</sup> Century**

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This study aims to analyse the evolutionary context of the introduction of technology in Portuguese schools, from the beginning of the 20th century to the present day, and to identify the digital competences of Portuguese teachers at different educational levels. The analysis, qualitative and quantitative in nature, allowed us to conclude that technologies had a slow diffusion in Portuguese schools, because of the scarcity of resources and residual investment in teacher training, giving the use of technology in school a more irregular and playful character rather than truly integrated in pedagogical practices to promote the quality of learning. Although in recent years there has been still some conservatism in the use of technology, very focused on its instrumental use, there have been more practices with pedagogical intent and more focused on the active participation of students, also noting the growing importance of teacher training in this field of digital technologies, with the aim of making teachers more competent and fluent in the pedagogical use of digital. Furthermore, the study focused on the teachers' perception of their digital competences in three dimensions: the teachers' professional and pedagogical competences and the students' competences from the *DigCompEdu* framework and the self-assessment questionnaire of digital competences built from the same framework - *DigCompEdu Check-In*. The analysis of the answers obtained in this questionnaire (collected from the participation of 434 teachers of Basic and Secondary Education and 118 of Higher Education) showed that teachers need to increase their levels of digital proficiency through specific training, since they present, globally, a moderate level of digital proficiency - level B1 -Integrators- being the areas 4 - Evaluation - and 6 - Digital empowerment of students, the ones that present the greatest weaknesses.

*Keywords:* history of education, educational technologies, Portugal, teachers' digital competences, teachers' training

### **Introduction**

The relationship between technologies and education has always been very close, with each one always benefiting from the development of the other. On the one hand, technology has greatly contributed to improving the educational process (Araújo et al., 2017) and to changing the teaching and learning processes and, on

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the other hand, the improvement in the quality of education systems contributes to the evolution of technology itself.

Naturally, technology alone does not promote school success. However, when accompanied by pedagogical changes, it has been found to be helpful in students' performance and in the development of their complex thinking (Graça, Quadro-Flores, & Ramos, 2021).

Throughout the 20th century, analogue, audiovisual, digital and, with the spread of the internet, networked technologies have been transforming education. The technological evolution that has been happening has naturally been accompanied and used to evolve, also, the pedagogical practices, trying to provide students the possibility to analyse, criticise, "learn by doing", experiencing and experimenting to proceed to their own knowledge construction.

Considering a coetaneous thought and simultaneously equating a problematisation that would take into consideration the possibilities of complementary approaches, we intended to study not only the technological evolution in school environments, but, above all, how this technology has been used in education. In fact, from previous analysis carried out, it was found that there were few works that dedicated their attention to the history of technology in education, focusing mainly on a more recent period and more specifically dedicated to the potentialities of the use of digital technologies. Thus, the need was justified to create a space in the study of recent contemporary history that would include a rigorous analysis of the relationship between technology and education, through an interpretation of the influence that one and the other have had on each other and on societies in general, and how this was articulated with competences requirements (Shanks & Hodder, 1995; Dias-Trindade, Ferreira, & Moreira, 2021).

In addition, it was considered urgent to understand the level of fluency in the use of technologies in general and their relationship with digital technologies, in an attempt to understand how much the use of technologies relates or not to cognitive-cultural heritage in order to contribute to improvements in educational processes because, as already recognized by Dias-Trindade and Moreira (2019), "identifying the nature of the knowledge required for the integration of technology in the learning process may allow for a very effective response to bridge the gaps identified in this study at the level of digital proficiency" (p. 75). However, this needs to be analysed in relation to material, social, cultural, and educational contexts because this is the only way to obtain a systemic and dense vision capable of envisaging a consistent action strategy in the face of such rapid changes as those currently taking place. Therefore, the main objectives of this study<sup>1</sup> were defined as follows: to characterise the evolution of the technologies used in educational contexts over the 20th and 21st centuries; and to assess the perception of Portuguese teachers of Secondary and Higher Education on their digital competences and the resulting training needs.

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To achieve these objectives, the study combined two types of research in methodological terms, in a perspective of complementarity: qualitative and quantitative.

Thus, at first, and within the framework of a constructivist paradigm, the research was based on a qualitative methodology through the systematic analysis of the journals of the main Portuguese *Lycea* (namely *Labor*, *Palestra*, *Arquivo Pedagógico* and *Boletim do Liceu Normal de Lisboa*), from a historical perspective, as well as articles published in the *SCOPUS*, *Web of Science* and *SCIELO* databases, covering a period between the early twentieth century and the present day. The aim of this analysis was to verify how technology has been used in education, trying to understand not only how the equipment was introduced in the school environment, but also how this equipment was used and how teachers were prepared to integrate it in the classroom.

In a second moment, a quantitative analysis of the results of the application of the *DigCompEdu Check-In* questionnaire, in its version validated for the Portuguese population by Dias-Trindade, Moreira, and Nunes (2019), was conducted with Secondary School teachers and, also, with Higher Education teachers.

### **Technology and Education in Portuguese Schools: A Past and Present Perspective**

The literature review carried out showed that most of the innovations that are disseminated in other countries came from the United States, and that Portugal has remained close to these innovations. However, particularly during the first half of the 20<sup>th</sup> century, there were very few references to the use of technological resources in Portuguese schools, denoting some ignorance about their pedagogical use and implying that teaching through technology was mostly a novelty, almost unheard of, reduced, above all, to the main Portuguese high schools located mostly in a few urban centres (Dias-Trindade, Ferreira, & Moreira, 2021).

This situation remains over time, and several authors continue to recognize that the use that has been made of the technologies that later entered the schools (computers, projectors, interactive whiteboards, tablets, among others) was usually conservative and little associated with truly innovative practices. However, they point out that, for renewal to happen, it would be necessary to invest in training to empower and equip teachers with digital competences that enable them to use technologies with pedagogical intent (Lobo & Sánchez, 2016; Ricoy & Couto, 2011; Silva, 2001).

This issue assumes greater urgency with technological development and, above all, with the pedagogical possibilities generated by digital technologies. It becomes ever more important to train teachers so that digital resources are integrated into quality pedagogical practices (Meisner & McKenzie, 2022; Aşık, et al., 2020; Gutiérrez-Fallar & Henriques, 2020; Rodrigues, 2020; Alves, Torres, Neves, & Fraga, 2019) not forgetting that, as Lobo and Sánchez (2016) stated, this fruitful integration of technology in school will " have a significant impact on the

students' community and therefore on the general community for the generation and creation of knowledge" (p. 49).

However, as Ducros and Finkelstein (1986) point out, innovation is not something simple to achieve. It requires a change in attitudes and the ability to adapt. The school has kept the door open to innovation, even if with certain asymmetries, because of internal or external factors. The big question is how this innovation is used to enhance the educational process. In fact, analysing the Portuguese journals published by the *Liceus Normais* (schools that usually had initial teacher training in Portugal), one finds several texts, over the years, calling for the need for teacher training, but not specifying the need for teacher training for a pedagogical use of these technological resources (Dias-Trindade, Ferreira, & Moreira, 2021a). Tomaz (1964) indicated that, in the 1960s, one began to live the euphoria of technical-didactic aids (audiovisual aids, music, radio, television and, in the 1960s, the "teaching machine"). However, this teacher states that it is fundamental that all these resources be used after prior preparation and due integration into the learning objectives for the students. As Moderno (1984) also noted, "too often these [audiovisual] media are introduced into educational establishments without the question of teachers' needs, interests and preparation being raised" (p. 181).

Despite a slow pedagogical introduction of technology in education, initially very little associated with innovative practices, much the result of an incipient pedagogical preparation for the use of technology in the classroom, there was a continuous development of projects, especially from the 80s onward, seeking to encourage teaching and learning processes enriched by technologies in general and, more recently, also by digital ones (Dias-Trindade, Moreira, & Ferreira, 2021b).

In recent decades, and despite some conservatism still in the use of technology, very focused on its instrumental use, we found a greater number of practices with pedagogical intent, also concerned with an active participation of students in their learning process, also noting the growing importance of teacher training in this area, with the aim of making teachers more fluent in the pedagogical use of digital (Dias-Trindade, Moreira, & Ferreira, 2021b).

This analysis allowed us to reach some very important conclusions about the relationship of the school with technology and that, on the one hand, justify the training needs that still exist today and, on the other hand, reveal how, despite being old, this relationship has often taken on a more exotic side than effectively pedagogical.

In addition, it was also possible to see that the dissemination of technology was not homogeneous, especially in the most recent years of the 20th century, and that it was only within the reach of some secondary schools with funds that allowed them not only to buy and maintain the equipment, but also to adapt spaces for its placement and use.

However, in the face of the overwhelming evolution of technology, which is currently undergoing constant innovations and provides the development of pedagogical scenarios that make use of that technology and of digital environments that are now increasingly available to all, in a close interaction

between human and non-human actors for the construction of knowledge, it was still important to understand effectively how that interaction can be put into practice.

To this end, it was necessary to understand the articulation between pedagogy and technology, so that the teacher could make a pedagogical use of technological resources, which will thus contribute to enhance the teaching and learning processes.

In our view, for technology to be correctly integrated into educational environments, it is necessary, above all, to understand which competences need to be mobilised. In what concerns teacher digital competences, we consider that it is important to define and make explicit the construct "digital competence", in articulation with the concepts "digital literacy" and "digital fluency".

It was this awareness that guided the second part of this study towards the analysis of teachers' digital competences, seeking, as mentioned above, to assess the perception of Portuguese teachers of Secondary and Higher Education on their digital competences and the resulting training needs.

## Methodology

Aware of the complexity of the operationalization of "digital competences", different international organizations have, in recent years, sought to list all the competences that should be developed in educational settings to overcome the stage of digital literacy and reach digital fluency, and several benchmarks and models have already been produced with a view to improving the teaching and learning processes using digital technologies (Dias-Trindade & Moreira, 2021).

In 2017, the *DigCompEdu* emerged because of the awareness that it is essential for teachers to master a set of specific digital competences to take advantage of the potential of digital technologies and, thus, enhance and innovate education (Redecker, 2017).

The organisation of the *DigCompEdu* framework takes on particular importance for defining these concrete areas, in particular this concern with the empowerment of students, whose integration in 21st century education seems fundamental.

Redecker (2017) recognises the importance of teachers as key role models to demonstrate how to make creative and critical use of digital technologies, but more than that, to assist their students in the learning process and to build with them quality digital environments.

It is therefore essential that teachers are aware of the validity of digital competences in their profession, both in the field of pedagogy and as "facilitators" of the development of these same competences in their students, making them able to meet the demands of this millennium, especially (but not only) when they are able to enter the labour market (Dias-Trindade & Moreira, 2021). In line with this idea, Hatos, Cosma, and Clipa (2022) consider that it is important for the teacher to be digitally competent as it facilitates knowledge transfer.

Therefore, we sought to understand the level of digital competence of Portuguese teachers, as already mentioned, through the application of the self-assessment questionnaire of digital competences *DigCompEdu Check-In*.

It is understood that, although a study based on the teachers' perception of their own digital competence is only an estimate, as mentioned by Bandura (1994), the individual's perception determines how he/she feels, thinks, behaves and is motivated. In this case, for example, Wang, Meyers, and Sundaram (2013) have already pointed out that motivation is considered one of the factors that influence the willingness to, for example, progress in terms of digital competence.

The instrument was applied during 2019 and early 2020 to 434 teachers of Secondary Education (Dias-Trindade, Moreira, & Ferreira, 2021b) and to 118 teachers of Higher Education (Dias-Trindade & Ferreira, 2020), with similar mean ages, with a greater preponderance of females in Primary and Secondary Education (representing 82% of the sample) (Table 1).

Table 1. Participants' Age and Gender

Age					
Mean [minimum – maximum]			Interquartile interval		
Secondary Education Teachers	50.5 [32-65]		Secondary Education Teachers [45-56]		
Higher Education Teachers	49.9 [31-69]		Higher Education Teachers [44-56]		
Gender					
Female			Male		
	N	%		N	%
Secondary Education Teachers	356	82.0		78	18.0
Higher Education Teachers	60	50.9		58	49.1

Source: The Authors.

## Results and Discussion

The results obtained in both studies, systematized in Table 2, show some similarities, particularly regarding the mean scores obtained, with teachers of Basic and Secondary Education obtaining 43 points and those of Higher Education 39 points, placing them at level B1, *Integrator*, i.e., corresponding to teachers who already use digital technologies in the educational context, but without major methodological changes, without the necessary adjustments in the design of learning activities.

One of the characteristics of this level, *Integrator*, refers to teachers' motivation to learn more and to develop their digital competences to be able to move to subsequent levels in the different areas of this framework, which is in line with what Wang, Meyers, and Sundaram (2013) refer to.

Furthermore, it can be seen that among Higher Education teachers there are more initial levels (A1 and A2, corresponding to 34.8%) than among Secondary Education teachers (Table 2), which can also be associated with the fact that the vast majority of higher education teachers have not had any pedagogical preparation, simply because it is considered that teaching is an activity additional to the investigative dimension and eminently practical for which very specific knowledge will not be required (Pretto & Riccio, 2010; Zabalza, 2004).

Table 2. Results by DigCompEdu Check-in Level

Teaching level	Secondary Education Teachers		Higher Education Teachers	
	N	%	N	%
A1	9	2.1	12	10.2
A2	80	18.4	29	24.6
B1	187	43.1	42	35.6
B2	119	27.4	26	22.0
C1	39	9.0	8	6.8
C2	0	0.0	1	0.9
<i>Total</i>	<i>434</i>	<i>100</i>	<i>118</i>	<i>100</i>

Source: The Authors.

In fact, as Vieira recognises, "although lecturers and institutional managers value teaching and research as structuring activities of the university, the relationship between them tends to be conflictual and research is overvalued to the detriment of teaching" (2014, p. 24). Also, Zabalza (2004; 2012) refers to the importance of paying attention to the training of higher education teachers and to the importance of disseminating good practices as a way of providing this teaching staff with solid knowledge in didactics and pedagogy, we add the need to integrate, in this preparation, the integration of digital technologies into quality pedagogical and didactic practices. For that to happen, it is necessary, therefore, to invest in proper training.

In line with the above, on the importance of the interaction between content, pedagogy and technology, the need for greater investment in teacher training is justified, particularly regarding Higher Education. It is, therefore, necessary to address this lack of teacher training in technologies and provide these professionals with the competences to integrate quality digital resources into their teaching practices, adapting them, naturally, to the objectives to be achieved (Lima & Loureiro, 2015).

The results also showed that there are similarities in the results by area, particularly in terms of the area with the greatest weaknesses, which, in both cases, was area 4 - *Assessment* (Table 3). This shows the difficulty that teachers in general have in using digital technologies to monitor and assess the performance of their students and, consequently, to provide them with the necessary feedback.

As Amante, Bastos, and Oliveira (2021) point out, training in digital assessment is essential. In their study, these authors found that many participants had difficulties in defining assessment criteria, objectives, or competences to be assessed. This reflects a need, once again, to invest in training that integrates the digital in pedagogical practices, since digital resources today allow a panoply of types of assessment (in this specific case, but also related to the other dimensions presented in the *DigCompEdu* framework), and it is therefore necessary to integrate all these resources in different pedagogies, different objectives and different assessment models, fully integrated in the training needs for the society of the 21st century.

Table 3. Results by Area

Digital competence areas		Secondary Education Teachers		Higher Education Teachers	
		Mean values	Level	Mean values	Level
Teachers' professional competences	Professional engagement	9.5	B1+	8.1	B1
Teachers' pedagogical competences	Digital Technologies and resources	4.1	B1	4.2	B1
	Teaching and learning	10.2	B1	9.7	B1
	Assessment	5.2	A2+	4.9	A2+
	Empowering learners	4.8	B1	3.1	A2+
Learners' competences	Facilitating learners' digital competence	9.6	B1	8.7	A2+

Source: The Authors.

The results presented in Table 3 also reflect the intermediate levels of the *DigCompEdu Check-In* digital competence levels mentioned above - 43 points for secondary school teachers and 39 points for higher education teachers and, as stated, corresponding to Level B1 - *Integrator*. Specifically, this result reflects that professionals who use digital technologies, are willing to use and reflect on this (and which concerns the competences related to Area 1 - *professional engagement*), but still need to understand how to adapt the different digital tools to their objectives, their strategies and methodologies and, above all, to a more practical work with their students (very much associated with the areas that involve an adaptation to the reality and context of their own students - especially areas 4, 5 and 6). These competence areas are those where there is a need for an articulation between teaching and learning, creation of digital content and preparation of activities and strategies that help students control their learning processes and their own empowerment for transversal areas, particularly responsible digital citizenship. Samuelsson and Lindström (2021) also recognise that teachers lack the competences to help their students prepare for living in an increasingly digital society.

Therefore, these teachers will still have some difficulties in defining which technologies are most suitable for different situations and how they can improve the educational process.

Furthermore, the fact that higher education teachers show greater weaknesses, especially in areas 5 - *Empowering learners* - and 6 - *Facilitating learners' digital competence*-, reveals greater problems when it comes to digital competences, which imply the ability to use digital technologies to foster students' autonomous work and to assist them in digital communication among themselves and with an external audience.



**Table 4.** Results by Age Group (Mean Values)

Age	Teachers	Secondary Education Teachers	Higher Education Teachers
30-39		51.30	35.93
40-49		43.64	42.52
50-59		43.25	36.17
60-69		42.00	36.56

Source: The Authors.

Table 4 reflects what several authors already had stated: age is not a relevant variable when it comes to the assessment of digital competences (Wang, Meyers, & Sundaram, 2013; Drossel, Eickelmann, & Gerick, 2017; Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017). In fact, Wang, Meyers, and Sundaram (2013) suggest the existence of a continuum rather than a dichotomous rigidity between the so-called digital immigrants and digital natives, and that there are several factors other than age or accessibility to digital tools and content to explain the issue of digital fluency. In the present study it is found that although among secondary school teachers the average levels of digital competence decrease with increasing age group, they are minimal differences between the groups. As far as higher education teachers are concerned, there are even groups of teachers with higher ages that show slightly higher average values than teachers with lower ages.

Gu, Zhu, and Guo (2013) report that length of service can affect the level of digital competence more than the age of the teacher. In their study they conclude that teachers with less than 5 years of service used less digital technologies in class than those who had more years of teaching experience. This idea goes along with the PISA 2021 report (OECD, 2019), where it is indicated that there is evidence that younger teachers still have some inexperience regarding the pedagogical uses that can be given to different technologies, while older teachers sometimes lack the technical knowledge for a use of technology to enhance learning. A combination of pedagogical and technological competences is therefore needed, for which experience will also play a role.

Thus, the average results of digital competences were also analysed according to the length of teaching experience (Chart 1).

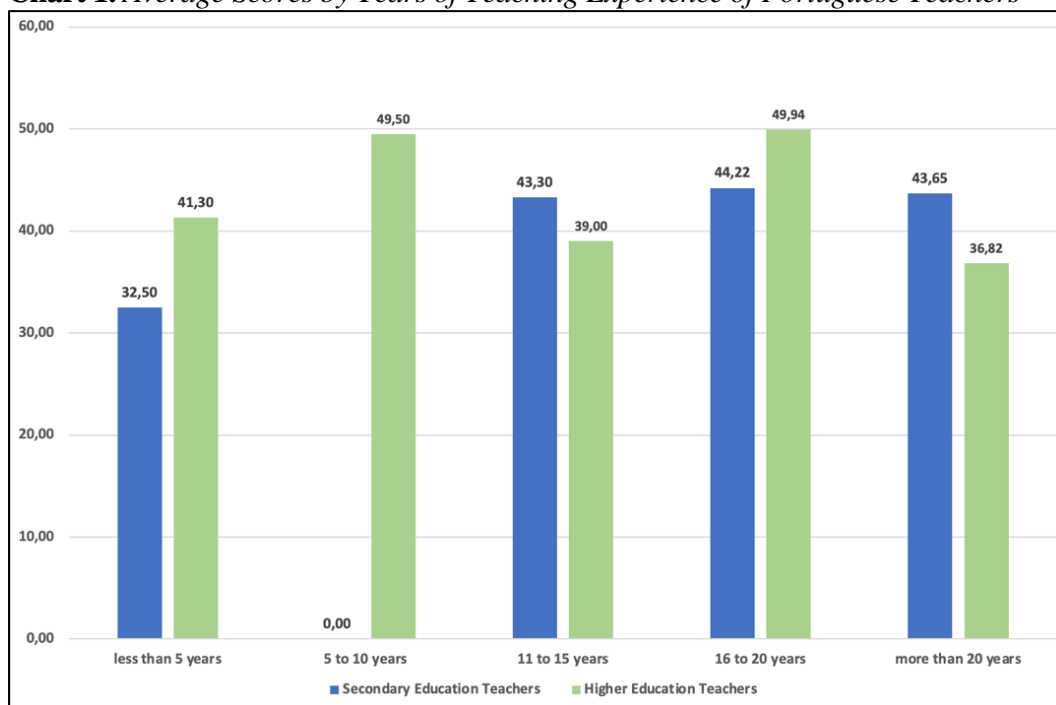
Once again, it is recognised that there is a difference in the average scores of teachers when analysing the age groups for both secondary and higher education teachers. However, the youngest secondary school teachers (with less than five years' experience) are the ones who present the lowest average scores in this study. In higher education, the teachers with 16 to 20 years of experience are those with the highest values.

Although these results do not corroborate the results of Gu, Zhu, and Guo (2013), mentioned above, they do show that it is important to focus on training for the pedagogical use of technology, both in initial and continuing education.

In fact, we advocate training that helps teachers identify the nature of the knowledge required to integrate technology into teaching, without neglecting the complex, multifaceted and situated nature of teachers' knowledge. Understanding the scenario of these teachers in times of pandemic is fundamental to act

strategically within the institution and make profitable the formative paths that are being designed for this set of teachers.

**Chart 1.** Average Scores by Years of Teaching Experience of Portuguese Teachers



Source: The Authors.

Riel, Dewindt, Chase, and Askegreen (2005) point out that it can be an added value that training pays attention to what they consider to be three important dimensions of learning: student-led, socially constructed, and continuous, which when combined can become a powerful vision of teaching and learning with technology. In this sense, it is certainly possible to move from using technologies only as a way of transmitting knowledge to a model in which those same technologies are used daily, in various individual or group tasks, by both teachers and students.

Therefore, one understands the importance of initial and continuous preparation for a pedagogical use of technology, in particular digital technology, a training that helps the teacher to identify the nature of knowledge required for the integration of technology in teaching, without neglecting the complex, multifaceted and situated nature of teachers' knowledge. This training will contribute to a feeling of greater confidence and motivation for the integration of different technologies in educational practices.

Different authors refer that the speed of technological evolution makes it difficult to prepare teachers, especially, to use technology to contribute to change practices and make use of different resources and digital technologies to transform the school (Albion, Tondeur, Forkosh-Baruch, & Peeraer, 2015; Redecker, 2017; Felizardo, 2019). In this sense, it is important to remember that "while technology may just be a bunch of gadgets, good technology is really good opportunity - good

technology allows people to do things they literally could not do before" (Norris & Soloway, 2013, p. 110).

In fact, the pandemic started in 2020 has made the needs more visible and accelerated the process of digitalization of schools, a process that was already underway in Portugal under the Portugal INCoDe.2030 (National Initiative Digital Competences e.2030), which started in March 2017, and that in April 2020, in the path of digital empowerment of the country, comes to strengthen the focus on Digital Education through the Resolution of the Council of Ministers No. 30/2020. This resolution approves the *Action Plan for Digital Transition*, which includes a strategic area focused on "Empowerment and digital inclusion of people" through Digital Education, and provides a digitalisation programme for schools that includes, in addition to access to digital resources and equipment, a digital training plan for teachers (Dias-Trindade, Moreira, & Ferreira, 2021b).

This training plan also follows what Dias-Trindade and Ferreira (2020) had already mentioned, about the need to prepare appropriate training at three levels of complexity (initial, intermediate and advanced), since even teachers who are at lower levels in a given area, may be at intermediate or even advanced levels in other areas; this self-assessment allows designing a training path perfectly suited to their real needs, and that enables the evolution in the field of digital competences and the design of a path leading to the achievement of digital fluency (p. 183).

Currently, one cannot think about education without including training in the use of digital media and technologies, nor without thinking about the importance they can have in promoting quality educational environments. Indeed, as Fraile, Peñalva-Vélez, & Mendióroz Lacambra (2018) recognise, "there is a real need for wisely designed training programs (whether initial training for novice teachers or continuous training), which help to close this divide between the demands posed by a knowledge society and the end-of-course profile of newly formed secondary school teachers" (p. 10). Also, Schwab (2018) refers: "emerging technologies are changing the way we create, exchange and distribute not only values, but also how we extract meaning - which helps us imagine our possible futures, and what futures are worth living in" (p. 67).

As recognised with this study, two key issues emerge in close relationship with the results obtained and with the notion of digital proficiency: the teachers' ability to take advantage of the different potentialities of the digital technologies available for teaching and learning; and the ability to know not only which technologies can be used more, but also which ones can best help achieve the objectives, thus approaching digital fluency.

This understanding of what defines teachers' digital competences is very important. How this construct encompasses an evolutionary process and requires reflection by the teacher to identify the areas where he/she is still in a digital literacy stage reflects this importance and clarifies the need for further training, and where he/she may already be close to a complex and critical use of digital resources and, thus, closer to digital fluency (Dias-Trindade & Ferreira, 2020). Furthermore, as Basilotta-Gómez-Pablos, Matarranz, Casado-Aranda, and Otto

(2022) have pointed out, to understand teachers' training needs it is necessary to start by identifying the starting point.

Indeed, this is an important point: to be able to understand teachers' real needs, to act according to those needs and to prepare training - in direct line with the recognised importance of both initial and continuous teacher training.

## Conclusions

The work presented here seeks to explain how different technologies have been introduced at school and how pedagogical practices have been changed or influenced either by the existence of these technologies or by the very needs of society in general. In fact, it is perceptible that this relationship between technologies and school is the result of a symbiotic interaction, in which each of these elements influences and is also influenced by the other. Furthermore, in an increasingly digital society, the school is required to prepare its students to know precisely how to move in spaces increasingly influenced by the digital.

It is clear from the analysis carried out that this technology assumes mainly a novelty character, with no pedagogical concerns about its use, which would be essentially sporadic, playful and without a strategy that truly integrates it in the educational process. This situation extends over time, and several authors continue to recognize that the use that has been made of technologies that have entered the schools (computers, projectors, interactive whiteboards, tablets, among others) has been conservative and little associated with truly innovative practices. However, they point out that for the renewal to happen, it is necessary to invest in training to train and equip teachers with digital competences that enable them to use technologies with pedagogical intent.

In fact, what was seen happening more recently, with the emergence and dissemination of the internet, was a major revolution in society and, once again, in school. Technology and the digital signal have made it possible to change educational processes and to think in networked environments, where teachers and students can build and develop knowledge and digital competences, in educational spaces that go beyond the physical classroom. However, the work here presented showed that, despite initiatives such as the Portuguese Technological Plan for Education (PTE), still at the beginning of the 21st century, the teachers' digital competence is still below the desired level.

If it was already reported the almost non-existent concern in preparing teachers, either in their initial or continuous training, throughout the twentieth century, in the early twenty-first century there began to be drawn, in the Portuguese school, examples of government projects that sought that the use of technology and digital signal were beyond the episodic and, above all, to enhance the educational processes. These projects, as the mentioned PTE, allowed some pedagogical experiences that incorporated different digital technologies, and where, little by little, and especially in more recent times, a digital and networked education begins to take shape (Dias-Trindade, Moreira, & Ferreira, 2021b).

Developing pedagogical environments where technology has a function, studying and understanding its organisation, requires the articulation between scientific and technical conditions and political, social, and economic conditions (just as the mentioned relationship between the reality of the last year and the public policies that emerged both nationally and internationally - albeit from a preparation that preceded the pandemic crisis) has been. It is from this articulation that a culture emerges where education and the school system are inserted.

Furthermore, thinking about education always implies an idea of the past and the future. It is therefore fundamental to understand the evolution of the integration of technologies in school, how they shape education and even how they are influenced by society and thus contribute to the development of school systems.

In 2015, the World Economic Forum pointed out the importance of technology for the development of some key factors for the development of countries (WEF, 2015). Two years later, in 2017, the same entity reinforced this role also as a facilitator of an extension of education through parents, educators or caregivers, in an educational development that goes beyond foundational competences, abilities or character qualities and includes social and emotional learning, as together they can equip students to succeed in a rapidly evolving digital economy (WEF, 2017). With the pandemic situation recently experienced, the 2020/2021 report points in a similar direction amplifying, however, the sense of urgency that on this issue the different societies need to place (WEF, 2021). For this to happen, there must be an integration of digital technologies in teacher training, and, above all, an understanding of the digital competences needed for these technologies to be used in a way that effectively enhances educational processes.

It is therefore recognised that digital competence in an educational context is not limited to the ability to use digital resources in teaching or learning, but should integrate the whole school context, from peer communication to the promotion of a digital pedagogical culture among students.

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