

The integration of technology in basic and secondary education in Portugal from the 70s of the 20th century to the present day

A integração da tecnologia na educação básica e secundária em Portugal desde os anos 70 do século XX à contemporaneidade

Integración tecnológica en la educación secundaria en Portugal desde la década de 1970 hasta la actualidad

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ARTICLE



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Abstract

This systematic literature review aims to analyze the pedagogical experiences with the use of technologies in Portugal between the seventies of the twentieth century and today. It sought to understand how they were introduced into school over fifty years. A total of 47 articles were selected and analyzed from the SCOPUS, SCIELO and Web of Science indexing databases. It was found that, despite a certain conservatism very focused on the instrumental use of technology, more practices with pedagogical intent and more focused on the active participation of students have been implemented in recent years, highlighting 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 tools.

KEYWORDS

Portugal, Technology, Digital, Education, Basic and secondary education.

Resumo

Este trabalho de revisão sistemática da literatura visa analisar as experiências pedagógicas com recurso a tecnologias em Portugal, entre os anos setenta do século XX e a atualidade, procurando compreender como foram sendo introduzidas na escola ao longo de cerca de cinquenta anos. Foram selecionados e analisados 47 artigos das bases de indexação SCOPUS, SCIELO e Web of Science. Verificou-se que, apesar de algum conservadorismo ainda na utilização da tecnologia, muito centrada no seu uso instrumental, nos anos mais recentes têm-se concretizado mais práticas com intencionalidade pedagógica e mais focadas na participação ativa dos

estudantes. Constatou-se também a importância crescente da formação docente neste domínio das tecnologias digitais, com o objetivo de tornar os professores mais competentes e fluentes no uso pedagógico do digital.

PALAVRAS-CHAVE

Portugal, Tecnologia, Digital, Educação, Ensino básico e secundário.

Resumen

Este trabajo de revisión sistemática de la literatura, tiene como objetivo analizar las experiencias pedagógicas con el uso de tecnologías en Portugal, entre los años setenta del siglo XX y la actualidad, tratando de comprender cómo se introdujeron en la escuela a lo largo de unos cincuenta años. Se seleccionaron y analizaron 47 artículos de las bases de datos de indexación SCOPUS, SCIELO y Web of Science, y se encontró que, a pesar de cierto conservadurismo en el uso de la tecnología, muy centrado en su uso instrumental, en los últimos años se ha convertido en prácticas más materiales con vocación pedagógica y más enfocadas a la participación activa de los estudiantes, destacando la importancia creciente de la formación docente en este campo de las tecnologías digitales, con el objetivo de hacer que los docentes sean más competentes y fluidos en el uso pedagógico de lo digital.

PALABRAS CLAVE

Portugal, Tecnología, Digital, Educación, Educación básica y secundaria.

1. INTRODUCTION

Technology has influenced the school institution in a socially complex and non-linear relationship, which from an early age has been welcoming and transforming its own culture based on the new possibilities offered by the different technological artifacts that have contributed, above all, to improve the communication process. On the one hand, given the growth in the number of students, schools needed to create conditions to adapt; on the other hand, the increase in education turns out to be intrinsically linked to technological development.

However, when analyzing in particular the Portuguese case and how the introduction of technological innovations in education occurred at the beginning of the 20th century, it seems that these novelties (cinema, radio, various audio equipment and, in the second half of the century, television) ended up having a slow diffusion, sporadic, playful and almost exotic use. It was seldom integrated into pedagogical practices with the aim of improving teaching and learning processes.

This situation came from the scarcity of resources in most educational institutions, but it was also the result of almost zero concern for the training of teachers for the pedagogical use of technology.

The main objective of this work was to provide a contemporary vision of the use and the way in which education has appropriated technology since the introduction of computerized teaching in Portugal. In this sense, we sought to analyze the pedagogical experiences in the use of technologies in Portugal between the seventies of the 20th century and today, trying to understand how they were introduced in the Portuguese educational context, what type of pedagogical experiences were being carried

out and what concerns have existed in the sense of preparing teachers for the pedagogical use of these technologies. An attempt was made to understand how or in what way they have become “educational technologies”, in the sense attributed by Silva (1989), by underlining that “talking about educational technology essentially means making the educational process more effective and talking about efficiency means improving the learning” (p. 39), or Sarra-mona (1986) presenting the idea that educating oneself meant “becoming a man” and technology gave its contribution to make it even better.

2. THE EVOLUTION OF TECHNOLOGY IN SCHOOLS: FROM “SPELLING MACHINES” TO DIGITAL TECHNOLOGIES

It was in the 1960s that the first computers and the first generation of “Computer Aided Instruction” (CAI) emerged, taking inspiration from the Pressey machine. However, they were too expensive and did not achieve the expected objectives, that is, they did not demonstrate their usefulness in an educational context.

In the early days, the difference between CAIs and their predecessors, teaching machines, was in the type of technology to present the materials. Saettler (2004) explains that the student responded to the questions (filling in the spaces or marking the correct answer), immediately obtaining an answer. In case the system made a mistake, it immediately generated a new question and if the answer was correct, more material was presented. In other words, a technological upgrade to the Pressey machine.

Despite having a very high value, the introduction of these first computers opened the door to new experiences (Russel, 2006). Therefore, when in the 70s their value fell enough to make

its introduction into the school environment viable, there was a certain trend in its implementation in North American schools for fear that the United States would be left behind in terms of technological advances (Russel, 2006).

Teaching students to use computers seemed to be the solution to this problem, as well as ensuring that they were adequately prepared for the new demands of an increasingly technological society (Russel, 2006). Finally, what would be more important: computers could contribute to making the educational process more efficient.

In reality, what has been proven is that little by little and between the 60s and 80s, more and more schools began to have computers but still with a very precarious educational use.

In 1960, PLATO (Programmed Logic Automated Teaching Operations) began to be developed at the University of Illinois, which allowed individualized learning based on content previously prepared by the teacher (Unwin & McAleese, 1978).

This was the first successful computer, followed later by those produced by IBM and Apple. Based on the ideas of Pressey and especially Skinner (1958), IBM developed the IBM650 computer in 1953 and the first time it was used as a teaching support equipment was in 1959 for the training of American military pilots. (Thamishetty, 2015). It didn't take long for them to get to the schools.

The first IBM computer produced for a school was installed in 1966 at Brentwood Elementary School in East Palo Alto. In 1976, Apple also launched its first computer and in 1978 won a contest promoted by the Minnesota Educational Computing Consortium to equip the state's schools with 500 computers.

In the post-World War I period, technologies began to be used as "teaching aids", beginning in the 1960s to be called "learning aids" with the introduction of a teaching program that eventually modified the teaching and learning process in general, changed the teacher/student relationship and optimized the processes in the classroom (Silva, 1993).

Silva (1993) indicates that the way to talk about "educational technology" was opened with educational research carried out in the 70s, the development of cybernetics, and hypermedia in the 80s.

In Portugal, this period of systemic approach does not move away chronologically from its development at the international level, with a starting point in the 1960s and its affirmation in the 1970s and, above all, during the 1980s. This was characterized by the introduction of educational technology as a component in teacher training, whether initial or continuous, and was accompanied by projects focused precisely on the affirmation of educational technology as a strategic area of the educational system itself (Silva, 1993).

Concern for teacher training for the use of educational technologies grew especially from the end of the 1980s, after the Portuguese educational reform, and became part of the teacher training component as a curricular unit of different degree courses, postgraduate and courses. Silva (2001) states that "the Global Reform Proposal presented in 1989 included, within the scope of the curricular and pedagogical reorganization plan, three execution programs that especially value the implementation of Educational Technology in the educational system" (p. 245).

The first program involved the development of a first technological project in the field of education. It emerged in 1985 and was entitled MI-

NERVA (Computer media in teaching: rationalization / empowerment / updating) and had the objective of bringing technologies closer to the educational process. At the beginning of the 1990s, state programs co-financed by the European Community - Educational Development Program for Portugal (PRODEP) appeared, which provided schools with various technological resources such as overhead projectors, tape recorders, photocopiers, televisions, and computers.

From then to the present, the education digitization programs have been varied, always following the different projects that the European Union has been developing and culminating in the current Action Plan for the Digital Transition, with an area dedicated to education that has been in force since 2020.

Until the mid-80s, the introduction of technologies in education was done without a real concern for their incorporation into pedagogical practices and their use as a resource to enhance educational processes. From the mid-80s onwards, and as Figueiredo says:

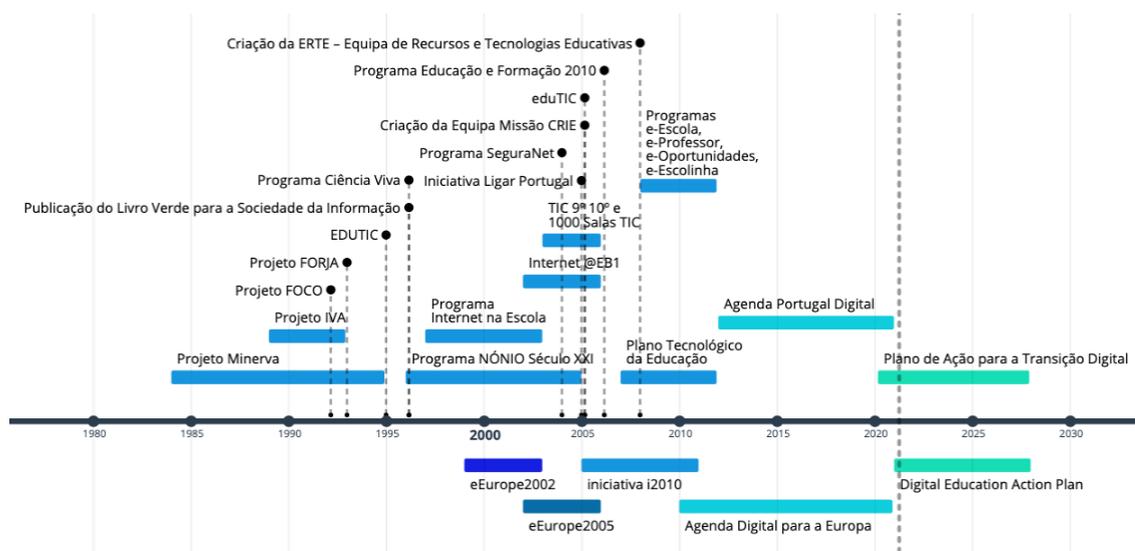
The educational use of computers is now beginning to enter a maturity phase clearly supported by pedagogical reasons, both in terms of the design of educational software and in terms of strategies for the use of computers in formal and informal school learning environments (1989, p. 80.)

The 1990s saw the Internet arrive in Portugal with different programs that spread the computers in different Portuguese schools. In the 2000s, educational environments were reconfigured due to the growth of virtual environments that allowed new interactions within the school with other schools, creating collaborative networks and even the “deterritorialization” of the school and educational processes.

There was support for the acquisition of different equipment, either by teachers or students, equipping schools with computers, Internet connections, projectors, interactive whiteboards, teacher training and also the development of programs to promote students’ digital competence. (Figure 1).

Figure 1

Timeline of Portuguese and European programs on digital technologies in education



The rapid evolution of computers, especially in the last 20 years, and the possibilities they provide, particularly with the development of the Internet, has changed practices. In fact, “the learning approach and the teaching of methodological solutions begin to integrate other pedagogical paradigms, in addition to those with a behavioral and cognitive base, thanks to the circularity that allows communication between actors in real time” (Rosenberg, 2001, p. 25-29). However, Rosenberg affirms that “the history of the use of electronic technology for learning in the school environment is full of promise and failure” (2001, p. 26), wondering if the Internet could change this situation.

On the one hand, information and communication technologies were born from the Portuguese curricular reforms of the early 2000s to integrate pedagogical practices and contribute so that school culture plays its role in the computerization of society (Pineiro & Correia, 2014). On the other hand, we come to the year 2020 with the obligation of teaching completely online during the periods of confinement generated by the COVID19 pandemic, both in Portuguese and international schools, with visible weaknesses in the teaching and learning process in relation to the pedagogical use of digital technologies and existing resources (Dias-Trindade et al., 2020).

In spite of everything, it is considered that the spread of the Internet has allowed a new stage in terms of the incorporation of technology in schools, especially with the development of the web 2.0 and the development of a set of resources that not only allowed the development of collaborative and networked work (Bassani & Barbosa, 2018; Selwyn, 2010), mentioned abo-

ve, but also a change in school culture towards an era of “prod’users”, that is, a culture in which students actively participate, create content that then also use, build, co-build and expand their knowledge from the information they collect in their educational activities.

In the framework of the COVID-19 pandemic, the Council of Ministers of Portugal approved the Action Plan for the Digital Transition, which is assumed as “the engine of transformation of the country” (Council of Ministers, 2020, p. 8), and which aims to implement a varied set of measures to allow its digitization. These measures are organized into three main pillars, the first dedicated to digital training and inclusion, incorporating digital education, requalification, and vocational training.

In the context of digital education, one of the objectives for the training of young people is the “transversal integration of technologies in the different curricular areas of primary and secondary education” (Council of Ministers, 2020, p. 12), having that transversal training is appropriate for the skills of the 21st century where the role of technology, as mentioned in 2015 by the World Economic Forum, will be fundamental to guarantee social and professional equity for everyone in the world. Among the measures to be adopted, teacher training is the sub-pillar that refers to requalification and specific professional training. Naturally, it will be essential for an effective integration of technologies in educational practices.

In fact, teacher qualification is essential for effective integration of digital technologies in schools (Alves et al., 2019; Aşık, et al., 2020; Gutiérrez-Fallar & Henriques, 2020; Ricoy & Couto,

2011; Rodrigues, 2020) throughout the educational process in order to create an integrated culture aware of the potential that the digital technologies have in the present and future of young students, with the Portuguese government committed to monitoring the European reality and aware that digital skills are essential to increase the country's capacity and the degree of competitiveness (Council of Ministers, 2020; Government of Portugal, 2017; Ministry of Economy and Digital Transition, 2020).

However, it is important to understand how this path has been built in Portugal, how the entry of computers into schools and, more recently, the spread of the digital signal has contributed to changing practices.

3. THE STUDY

The work presented here is based on the methodology of systematic literature review, following the methodological procedures recommended by Petticrew and Roberts (2006).

3.1. DELIMITATION OF RESEARCH QUESTIONS

The study carried out has the following research question: What pedagogical experiences with technologies have been carried out in Portugal between 1975 and 2021 in Basic and Secondary Education?

In this sense, some questions were outlined that served to define the corpus of articles to be selected:

Q1 - What technologies have been introduced into schools since 1975?

Q2 - What kinds of pedagogical experiences were the teachers developing?

Q3 - What is the teachers' opinion on the use of technologies in an educational context?

Q4 - What is the relationship between the diffusion of these technologies and the training of teachers for their use?

3.2. CHOOSING THE SOURCES OF ACCESS TO THE DATA

For data collection, the SCOPUS and Web of Science databases were selected, considering that they are spaces for scientific and academic dissemination of excellence. After the first data collection, these sources referred us only to more recent texts, which is why the SCIELO database was added as it could add relevant data in the period referred to the initial decades of the study.

3.3. KEYWORDS DEFINITION

The defined keywords (in Portuguese and English) sought to encompass the different aspects that were intended to respond, that is, the introduction of technologies and different digital resources, either from the perspective of education in general or related to the process teaching and learning, and also on the digital competences of teachers. Table 1 presents the number of results found.

Table 1*Keywords for search*

String	SCOPUS	Web of Science	SCIELO	Total
Technology AND Education	520	99	204	823
Tecnologia AND Educação	3	1	55	59
Technology AND Teaching	244	21	149	414
Tecnologia AND Ensino	1	0	70	71
Technology AND Learning	270	74	175	519
Tecnologia AND Aprendizagem	1	0	53	54
Digital AND Education	158	54	181	393
Digital AND Educação	0	0	66	66
Digital AND Teaching	111	13	113	237
Digital AND Teaching	1	1	71	73
Digital AND Learning	147	62	149	358
Digital AND Aprendizagem	3	0	58	61
Audiovisual AND Education	54	3	11	68
Audiovisual AND Educação	1	0	2	3
Audiovisual AND Teaching	21	0	11	32
Audiovisual AND Teaching	0	1	4	5
Audiovisual AND Learning	5	2	9	16
Audiovisual AND Aprendizagem	0	0	4	4
Digital environment AND Education	14	1	31	46
Ambiente Digital AND Educação	0	0	4	4
Digital environment AND Teaching	12	0	14	26
Ambiente Digital AND Teaching	0	0	4	4
Digital environment AND Learning	18	1	20	39
Ambiente Digital AND Aprendizagem	0	0	4	4
Game AND Education	113	32	26	171
Jogo AND Educação	1	0	19	20
Game AND Teaching	84	7	14	105
Jogo AND Teaching	5	0	17	22
Game AND Learning	113	66	23	202

Jogo AND Aprendizagem	3	0	17	20
Digital competence	7	6	27	40
Competência digital	0	2	28	30
Digital literacy	55	13	32	100
Literacia digital	0	0	3	3
TOTAL	1965	459	1668	4092

3.4. STUDY SELECTION

The studies were selected according to a set of previously defined inclusion and exclusion criteria, which served as the basis for the analysis of the titles, abstracts and keywords of the collected articles. An initial search criterion referred to the exclusive collection of articles from peer-reviewed journals related to activities carried out in Portugal or by Portuguese authors in the period between 1975 and 2021.

Inclusion criteria:

Inc1- The study reports experiences of the use of educational technologies in an educational context

Inc2- The study presents a theoretical reflection on the use of educational technologies

Inc3- The study discusses the digital competences necessary for the use of technologies in educational contexts

Exclusion criteria:

Exc1- The study does not concern research carried out in Portugal

Exc2- Repeated study

Exc3- The study is not about non-higher education

Exc4- Studies not available for access

Exc5- Studies with irrelevant content for the research context of this work

After applying these criteria, 66 papers were selected from the set of 4092 results found, as shown in Table 2.

Table 2*Selected and excluded results (1st. Stage)*

Data Base	Total Publications	Excluded					Total of selected studies
		Exc1	Exc2	Exc3	Exc4	Exc5	
SCOPUS	1965	1680	148	35	1	91	10
Web of Science	459	10	155	71	5	172	46
SCIELO	1668	1586	58	3	1	10	10
TOTAL	4092	3276	361	109	7	273	66

In a second phase, a more detailed study was carried out and the articles were analyzed in their entirety. This resulted in the exclusion of ten texts from the Web of Science, one from SCOPUS and one from SCIELO, as it was determined that they were not in the research context (Exc5). Four studies were excluded from the Web of Science list for referring to repeated content related to the same projects

(Exc2). One text was excluded from the Web of Science list because it was not related to non-higher education (Exc3). Two texts were excluded from the Web of Science because they did not contain information related to Portugal (Exc1) (Table 3). By excluding the aforementioned texts, the corpus to be analyzed resulted in a total of 47 articles.

Table 3*Final table with selected and excluded results*

Data base	Total Publications	Excluded					Total of selected studies
		Exc1	Exc2	Exc3	Exc4	Exc5	
SCOPUS	1965	1680	148	35	1	92	9
Web of Science	459	12	159	72	5	182	29
SCIELO	1668	1586	58	3	1	11	9
TOTAL	4092	3272	365	110	7	285	47

4. RESULTS

The selected texts were rigorously analyzed in order to understand which were more focused on the teacher and which were more focused on the student. It was concluded that this distribution was almost equivalent (Table 6) with 24 studies focused on the teacher (51.1%), 18 studies focused on the student (38.3%) and 5 studies (10.6%) that articulate the teacher-student relationship in the experiences presented.

Furthermore, it was found that 35 texts (74.5%) present empirical studies, while only 12 texts (25.5%) follow a literature review or theoretical essay methodology.

Regarding the connection of these works with the research questions, the studies focused on student learning reflect the experiences and their effects on these learnings and on the modification of practices, increasingly associated with the production of knowledge, that is, increasingly articulated with an idea of “prod’use” of resources at the service of learning.

In the case of teachers, the fact that there are several texts related to their training in the use of technology stands out (34%), to then divide them between studies that present different technologies or present practices carried out with different digital technologies (Table 4).

It should be noted that there are two studies included in the second quarter that already refer to experiences during the period of the pandemic.

Table 4

Approach of the studies selected by research question

(N=47)	Student		Teacher		Student and Teacher	
	F	%	F	%	F	%
O1	10	21.3	7	14.9	3	6.4
O2	14	29.8	5	10.6	3	6.4
O3	16	34.0	8	17.0	4	8.5
O4	0	0.0	16	34.0%	0	0.0

5. DISCUSSION

5.1. INTRODUCING TECHNOLOGIES IN SCHOOLS SINCE THE DEVELOPMENT OF COMPUTERS

In Portugal, starting in the 1980s, technological innovations associated with computer science and programmed teaching expanded, partly as a result of the development of government programs such as those mentioned in point 2.

There are several studies from the 80s and 90s that show the introduction of a diverse set of equipment:

- Linked to audiovisual, with technological innovations of audio and video such as cassette recorders and players and later on CD and DVD.
- Linked to the introduction of computers themselves in schools, in coordination with government programs to support the acquisition of this equipment, both for schools and for teachers and students.
- Linked to multimedia and, as Silva (1993) refers, focused on the construction of the multidimensional scenario

and the cognitive representation of knowledge.

The Internet and the speed of technological innovations of the 21st century quickly reached the Portuguese classrooms. First, computers, video cameras, cameras, projectors and printers have become devices that exist in many schools, mainly in instrumental use, “as a specific study objective in certain subjects [...], as an aid or tool for the study of other disciplines [...] as support for management and administration activities, not specifically for teaching” (Henriques et al., 2012, p. 11).

More recently, interactive whiteboards, laptops (highlighting the example of the Magalhães computer) and mobile technologies, such as smartphones and tablets, and even the use of robots have been introduced.

However, it is necessary to understand how these items have been integrated into teaching practices.

5.2. PEDAGOGICAL EXPERIENCES DEVELOPED BY TEACHERS

With the development of technologies, their use becomes more complex, with an emphasis on what students can do with these different resources. Among the selected texts and as mentioned in point 3, the studies presented have their focus on the development of learning and the improvement of transversal skills. These also reveal some concerns for the development of digital competences of students (Martins and Fernandes, 2015; Pinto and Osório, 2019) and their media literacy (Costa et al., 2018).

Although some of the studies are carried out with specific educational levels, the skills worked and the objectives set can easily be adap-

ted to other study cycles, since they focus on the use of technology as a means for the development of both disciplinary activities.

The resources presented in these studies are, in fact, quite varied. For example, the use of digital books to develop reading and interpretation skills (Gonçalves & Almeida, 2016), digital manipulatives (Sylla et al. 2015), podcasts (Coutinho & Mota, 2011) or social networks that enhance the development of informal learning (Moreira et al., 2019).

It is true that gamification is the most presented strategy (it represents 41% of the approach of studies that present pedagogical experiences), with or without the use of mobile technologies and even including a new form of interaction: augmented reality. As Student and Dietrich (2020) refer, it has increasingly become a reality, mainly as a result of the democratization of mobile technologies.

In fact, tablets and smartphones found their way to help the development of teaching and learning activities, appearing clearly in 27% of the experiences reported in these studies.

There are examples among the selected studies that clearly demonstrate the diversity of possibilities that the complexity of both the equipment and the software itself have allowed. For example, augmented reality and digital manipulatives (Sylla et al., 2015), the use of storytelling or activities such as those presented by Rodrigues and Bidarra (2014) that use different platforms.

As Almeida (2018) points out, there are still several teachers who use digital technologies as a teaching support and not so much as a practical learning support that have significantly changed the pedagogical approach. They do not provide a real innovation or reconfiguration of the educational process.

5.3. OPINION ON THE USE OF TECHNOLOGIES IN AN EDUCATIONAL CONTEXT

Among the studies analyzed, there is a tendency (28.6% of the texts) to associate technologies with either high levels of motivation and satisfaction (Barros et al., 2020; Gonçalves & Almeida, 2016; Faria et al., 2019), or with a more effective learning (22.5% of the texts) (Santos & Alves, 2017).

The positive aspects are varied, considering that the active participation of the students helps to increase the sense of self-esteem (Pinto & Osório, 2020), allows a better communication between the actors in the educational process (Fartura et al., 2014) and it also improves knowledge exchange (Moreira et al., 2019). As Gonçalves and Almeida (2016) point out, new ways of teaching are configured, but also new ways of learning.

Costa et al. (2020) highlight that, for example, the use of augmented reality contributes to a different experience, bringing students closer to a “real experience” and combining the playful side of these strategies with learning.

There are references from Fernandes et al. (2016) and Moniz et al. (2021) regarding the importance of the teacher as a mediator of all these activities, not only in their planning, but also in their implementation.

5.4. RELATIONSHIP BETWEEN THE DISSEMINATION OF THESE TECHNOLOGIES AND TEACHER TRAINING

The lack of teacher training has long been pointed out as a justification for an incipient, conservative or instrumental use of technologies in the classroom, which is why it is recognized as essential.

The fact that the Teaching Career Statute guarantees teachers regular access to continuous training to update and improve their knowledge and professional skills and, especially since 2007, the fact that continuous training in ICTs has been considered a priority (Ricoy & Couto, 2011), greatly increased the offer and, of course, the participation.

However, the initial training of teachers does not require the existence of curricular units related to educational technologies, although the legislation indicates that initial training must include an area of general educational training that encompasses “the knowledge, skills and attitudes common to all relevant teachers for their performance in the classroom” (Decree-Law No. 79/2014, of May 14, art. 9, p. 2891) Thus, despite the concern that initial training teaching is a reality (Aşık, et al., 2020; Gutiérrez-Fallar & Henriques, 2020; Ricoy & Couto, 2011; Rodrigues, 2020), it is observed that it is still insufficient (Ricoy and Couto, 2011).

Regarding training for the use of technologies, Gutiérrez-Fallas and Henriques (2020) and Sampaio (2016) highlight the need to organize training according to the TPACK model, “presenting both pedagogical and technological concerns, considering the context of each teacher and respective students” (Sampaio, 2016, p. 223).

In addition, there is also a frequent preference for training courses that have a relatively long duration, since it allows a better understanding of the effect it has on the teaching practice. Thus, the authors of these works manage to verify that the apprentices are beginning to modify their practices, promoting more active and dynamic classes and that they are beginning to make use of technologies as a means for the development of innovative, dynamic and active learning (Carlos et al. al. al., 2018; Montez & Ai-

res, 2013; Sampaio, 2016), although they consider that these changes do not occur overnight, but rather are slow processes that need “a certain maturation to generate transformation” (Sampaio, 2016, p. 222).

More recently, the relevance of the topic of digital teaching competences has been more evident, the DigCompEdu framework developed by the European Union being one of the most prominent. Based on this framework, the European Union developed a self-assessment questionnaire on digital teaching competences (the DigCompEdu CheckIn), which was subsequently validated for the Portuguese population by Dias-Trindade et al. (2019). In the same way, Sampaio (2016) mentions the importance of a training more focused on specific scientific areas, or in an articulation between pedagogy, content, and technology. What this questionnaire allows, as mentioned by Dias-Trindade and Ferreira (2020), is that each teachers can “define which of the trainings they should take, even investing first in those in which they have encountered the greatest difficulties and advancing according to their interests to evolve at their own pace towards achieving digital fluency” (p. 181).

The study carried out in Portugal using this questionnaire (Dias-Trindade & Moreira, 2020) showed, for example, greater weaknesses in terms of more articulated competences with adaptation to the different needs of students. Greater difficulties arise to adapt to the digital context when referring to feedback, self-regulated learning and adaptation of learning, that is, practical work according to the needs of the students. On the other hand, the competences related to the individual work of a teacher, with a reflective and planning practice, are those that collect, on average, the highest results (Dias-Trindade & Moreira, 2020). The study by Ricoy and Couto (2011), also based on the Di-

gCompEdu framework, shows that there are some gaps in practices related to digital security among participants who are still in initial teacher training.

Having made this reflection, it is also important to highlight the two studies published in the context of a pandemic. Dias-Trindade et al. (2020) provide an overview of the transition from a face-to-face regime to remote emergency education in Portugal (compared to Brazil as well). In turn, Moreira et al. (2020) reinforce the need for teacher education and training for digital educational contexts.

6. CONCLUSIONS

With the technological advances of the last 60 years, computers have become increasingly powerful and portable. With the arrival of the Internet, they can be interconnected and have recently been associated with new mobile digital equipment that allows, as recognized in the studies analyzed, greater interactivity and participation based on methodologies that teachers can promote.

However, many authors acknowledge that the use given to the technologies that have entered schools (computers, projectors, interactive whiteboards, tablets, among others) has been conservative and little associated with innovative practices. But they also point out that for renewal to take place it is necessary to invest in training to provide teachers with digital competences that allow them to use technologies with pedagogical intentions.

Since the 1980s, there have been many projects that Portuguese governments have developed in association with European projects to digitally train teachers and even to equip schools and the school community. However, when analyzing the sample collected for this

study, it seems that there is still a long way to go, which, for several authors, should begin with initial teacher training.

In general terms, these works show the evolution that technology has had in an educational context, although it must be recognized that it is slower than desirable. However, in the last 20 years there has been a more effective use of technology by students, pointing to an increasingly active and participatory learning, which may lead us to consider that this more recent stage in the relationship between technologies with school is becoming an era of “prod’users”, where students interact with technologies and their teachers to learn and expand their knowledge, also contributing to the production of new content in a constant interaction between production and use. As Oliveira (2020) affirms, it is essential to think of a “School that makes learning, instead of teaching, where the student is the builder of his life project. [...] A School where digital skills are transversal and where the student is a user / producer of technology” (p. 497). Hence the importance, also, of developing digital competences not only for teachers, but also for students.

The pandemic that began in 2020 made the needs more visible and accelerated the process of digitizing schools, a process that was already underway in Portugal within the framework of Portugal INCoDe.2030 (National Initiative for Digital Competences e.2030), initiated in March 2017, and that in April 2020, on the path of digital training in the country, reinforces the commitment to Digital Education through Resolution of the Council of Ministers No. 30/2020. This resolution approves

the Action Plan for the Digital Transition, which includes a strategic area focused on “Capacity and digital inclusion of people” through Digital Education and provides a digitization program for schools that includes the commitment to a digital training plan for teachers, in addition to the access to digital resources and equipment.

This is in line with the idea of a digital school where teaching and learning processes are increasingly enriched with digital technologies and where humans and non-humans interact collaboratively with the objective of teaching, learning and building knowledge in an active and participatory manner. This is the objective of the Portuguese school, a school that makes use of technology and digital elements to bring “students closer to the productivity and collaboration tools that they can find in a professional work environment” (Resolution of the Council of Ministers noº 30/2020, p. 15), that is, a fully developed school in an era of “prod’users”.

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