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Teachers' digital competences: Concepts, models and challenges for the educational integration of technologies

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ABSTRACT
Digital technologies have caused numerous transformations in educational contexts, revolutionizing pedagogical practices, inviting new organizations of school spaces, redesigning curricula and reinventing models of communication between teachers and students.

1 INTRODUCTION

Digital technologies have caused numerous transformations in educational contexts, revolutionizing pedagogical practices, inviting new organizations of school spaces, redesigning curricula and reinventing models of communication between teachers and students.

Classrooms have come to welcome digital devices, interactive applications and instant access to a vast world of online knowledge. In this broad and unpredictable stage of change, teachers find themselves. By their central role as transforming agents of education, teachers reinforce their role, now more mediator than transmitter, where digital skills are fundamental to know, understand, select, evaluate and integrate the numerous digital resources that are available in the teaching and learning processes.

The preparation of teachers goes beyond the acquisition of digital skills to the simple mastery of the use of equipment and applications. It's about knowing how to incorporate digital tools into the curriculum in a meaningful and innovative way, creating interactive and engaging learning experiences, fostering creativity and collaboration through digital resources, preparing students to become critical, responsible and ethical digital citizens.

In this text, we will analyze the concept and relevance of teachers' digital competencies so that they can impact on teaching and learning processes, contributing to the formation of a new generation of students.

2 TEACHERS' SKILLS

The presence of digital technologies in the educational context impacts on the ways of knowing, learning, organizing, informing and relating to knowledge (MELLO; NETO; PETRILLO, 2021), becoming an increasingly necessary and challenging reality. Necessary because technological transformations determine and characterize the ways we live, relate, produce, access knowledge and develop. This social impact caused by successive technological advances significantly reaches the school, however the exploration of the potential of these resources in education still needs to be developed and demonstrated (ESTEVE; ADELL; LINDA CASTAÑEDA, 2018). On the other hand, this is a challenging reality, "since technological complexity has led to the emergence of different needs." (SILVA; BEHAR, 2019, p. 1), to demand new knowledge, new skills and a new way of doing for the educational system, especially for teachers.

It is the teachers who perform the essential task in the mediation of the teaching and learning process (PERRENOUD, 2002), considering that they are responsible for planning, putting into practice and evaluating this whole process. The use of digital technologies in pedagogical practices places teachers with new tasks and functions (CAMARGO; DAROS, 2021), requiring specific competencies (MOURA, 2017), a crucial aspect to ensure the integration of new methodologies and strategies of teaching and learning mediated by technologies (OTA; DIAS, TRINDADE 2021) that meet the social demands of the new generation (FIGUEIREDO, 2019).

For teachers to converge their practices with the possibilities that digital technologies offer to teaching it is necessary not only the technical mastery of the resource, but the development of digital skills that allow the critical integration of these resources, recognizing benefits and limitations that their use offers to the educational process (RABELLO; Tavares, 2022), underpinning a teaching that builds in students a critical and innovative reflective posture capable of solving problems to generate knowledge that responds to global challenges (UNESCO, 2019, 2022).

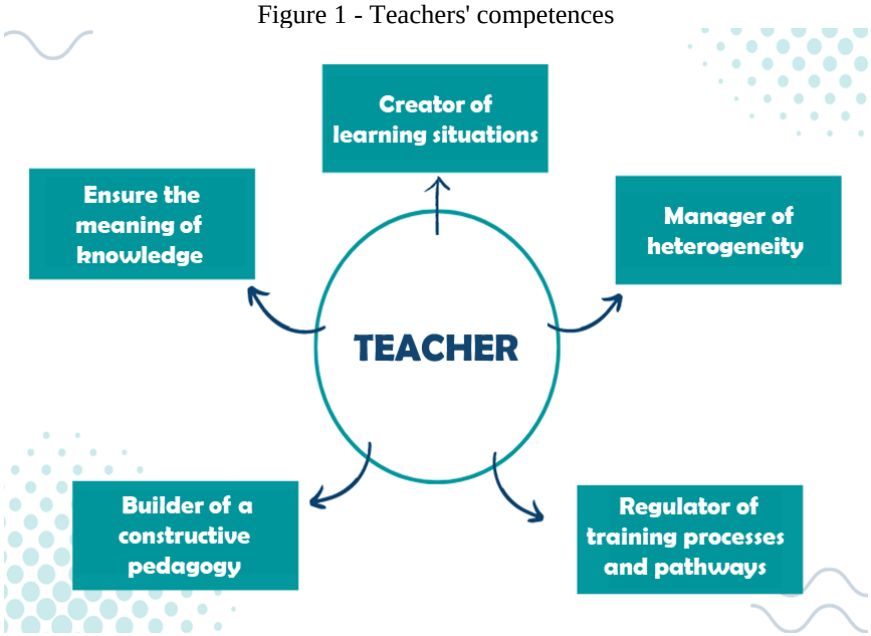
But after all, what are digital skills? To point out this conceptualization, it is first necessary to understand that its definition is marked by a diversity of concepts (FIGUEIREDO, 2019); second, the term digital skills can carry a diversity of nomenclatures (SILVA; BEHAR, 2019).

Starting from a more general conceptualization, Perrenoud (2002) defends the idea that the purposes of the educational system cannot be dissociated from the competencies of teachers, conceptualizing them as the "aptitude to face a family of analogous situations, mobilizing in a correct, fast, pertinent and creative way, multiple cognitive resources: knowledge, capacities, microcompetences, information, values, attitudes, perception schemes, of evaluation and reasoning" (PERRENOUD, 2002, p. 19).

Perrenoud (2002) visualizes the figure of the "ideal teacher" as one who constructs knowledge and competencies, such as being able to create learning situations, knowing how to manage

heterogeneity, regulating training processes and paths, being a builder of constructivist pedagogy and ensuring the meaning of knowledge (Figure 1).

Figure 1 - Teachers' competences



Source: Adapted from Perrenoud (2002)

For the author, the recognition of these competencies is beyond the identification of situations to be managed, problems to be solved and decisions to be made, emphatically pervades the clarity of knowledge, capacities, thoughts and ethical posture, many of these characteristics being built through the course of practice and considered knowledge of experiences.

3 ELEMENTS FOR THE CONSTRUCTION OF DIGITAL COMPETENCE

With regard to digital competence in the educational context, there is a diversity of user terms to refer to it. A research conducted by Silva and Behar (2019), presents some of these different terms linked to digital competencies: Computer Literacy, Information Literacy, Media Literacy, Digital Literacy, Digital Fluency.

The authors traced a history of the variations of terms and concepts of Digital Competence treated so far, indicating that, in the 1980s, the term used was Computer Literacy (Computational Literacy) aggregating variations such as ICT Literacy (ICT Literacy), IT Literacy (IT Literacy) and Technology Literacy (Technology Literacy), and these variations are associated with the level of experience and mastery with the computer/computer applications. In the 1990s, the term Information Literacy emerged, with requirements beyond the use of the computer, covering the identification, location and evaluation of information.

In the same decade, 1997, there were discussions about the terms related to Media Education and Media Literacy. The concept of Media Education was seen as a subcategory of Information

Literacy, which focuses on how information is accessed, evaluated, defined, constructed, and interpreted. On the other hand, Media Literacy emphasizes the ability to deal with different formats of information, such as print and audiovisual media (radio and television). In the case of Brazil, the concept of Digital Literacy, presents different translations such as: Digital Literacy, Digital Literacy, Digital Fluency and even Digital Competence (SILVA; BEHAR, 2019). The understanding of digital competence is also permeated by various terminologies, being referred to as "audiovisual, media, literacy or digital literacy competence" (PAZ; PONTAROLO; PELOSO, 2022, p. 10).

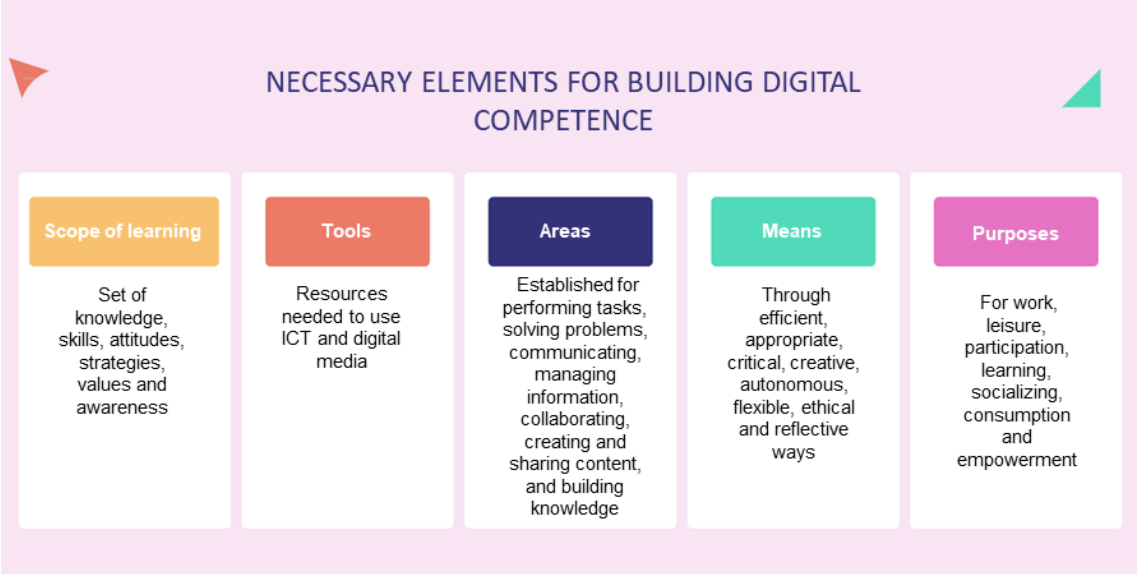
When we present the variables of the terms associated with digital competencies, it is evident that digital technologies have dictated a change in the processes of socialization and culture, impacting people's relationships with knowledge. Thus, the concept of digital competence comprises a breadth beyond digital literacy, being composed of a complex set of skills, knowledge and attitudes necessary to participate and act in digital culture. In this aspect, it is worth emphasizing: the concept of competence is marked by alternations due to the evolutionary and transitory profile of digital technology.

In 2006, the European Commission (2007) presented a report with a reference framework of key competences for lifelong learning, highlighting as one of the eight core competences digital competence, defining it as a junction of knowledge, skills and attitudes, for the safe and critical use of technology in the information society for work, leisure and communication, sustaining the use of the computer to "obtain, evaluate, store, produce, exchange information, communicate and to participate in cooperation networks via the Internet" (COMISIÓN EUROPEA, 2007, p. 7). Corroborating this definition, Gisbert and Esteve (2011) In addition, in addition to the combination of skills, knowledge and attitudes related to technological aspects, digital competence also involves informational, multimedia and communication aspects, giving rise to a complex of multiple literacy.

Pérez-Rodríguez and Ponce (2012) They define digital competence as the ability to seek, process, communicate, create and disseminate information through technologies, enabling an educational approach based on critical thinking, cooperation, dialogue, management and production of new knowledge, learning functionality, tolerance and appreciation of diversity. In line with this conceptualization, Adell et al. (2018) indicate that the most recent trends indicate that the digital competence of the teacher should be expanded beyond mere digital literacy, focusing on the development of competencies to explore specific pedagogical resources that can be transferred to the classroom, promoting authentic learning through an environment enriched by technology.

The European Commission (FERRARI, 2012) published in 2012 a study called "Digital Competence in Practice: An Analysis of Frameworks" that defines five elements necessary for the construction of digital competence (Figure 2).

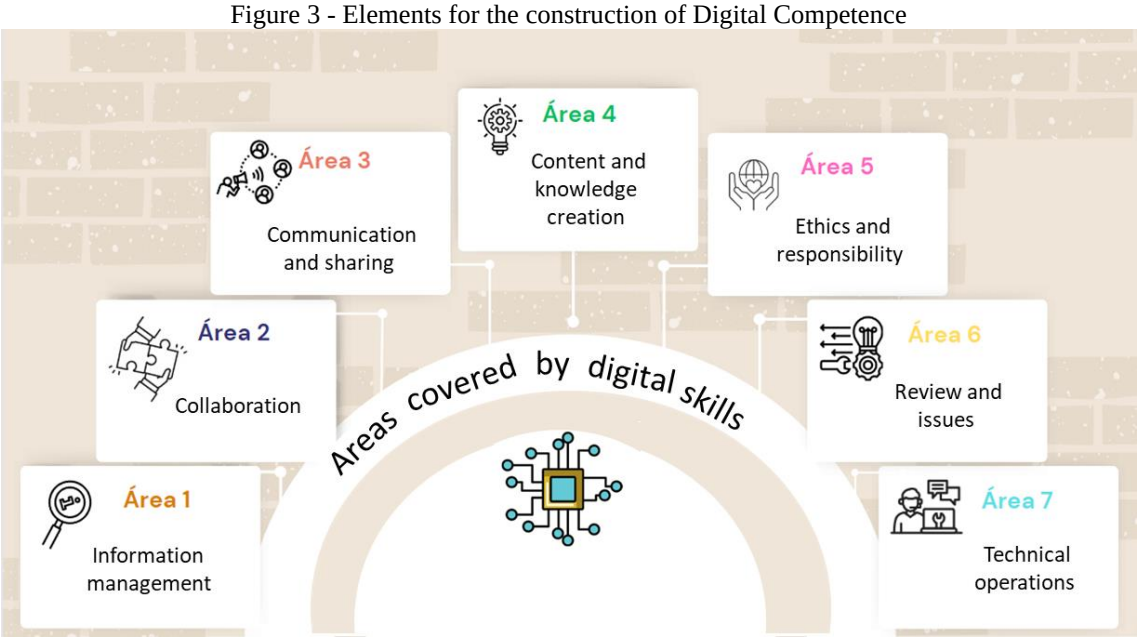
Figure 2 - Representation of the elements for the construction of Digital Competence



Source: Adapted from Ferrari (2012)

The study presents the need for digital competencies to encompass much more than technical skills, proposing seven prominent areas that need to be considered in a perspective more adapted to current needs, such as managing information, collaboration, communication and sharing, content and knowledge creation, ethics and responsibility, review and problem, technical operations (Figure 3).

Figure 3 - Elements for the construction of Digital Competence



Source: Adapted from Ferrari (2012)

For each of the areas of coverage of the digital competencies presented in the figure above, definitions considered essential for the development of the learning objectives are established: (1) Information management: refers to the knowledge, skills and attitudes necessary to identify, locate, access, retrieve, store and organize information; (2) Collaboration: refers to the competence to link

with other users, participate in online networks and communities, and interact constructively and with a sense of responsibility; (3) Communication and sharing: refers to communication through online tools, taking into account privacy, security and netiquette; (4) Content and knowledge creation: refers to the expression of creativity and the construction of new knowledge through technology and media, also to the integration and re-elaboration of previous knowledge and content and its dissemination through online means; (5) Ethics and Responsibility: refers to the knowledge, attitudes and skills necessary to behave in an ethical, responsible and aware of the legal frameworks; (6) Review and Problem: refers to identifying the right technology and/or media to solve the identified problem or to complete a task, as well as evaluating information; and (7) Technical operations: refers to the competence necessary for the effective, efficient, safe and correct use of the technology.

Based on the analysis of several studies and various understandings of Digital Competence, the European Commission's report proposes the following definition:

> Digital competence is the set of knowledge, skills, attitudes (including skills, strategies, values and awareness) that are required when using ICT and digital media to accomplish tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge in an effective, efficient, appropriate, critical, creative, autonomous, flexible, ethical, reflective way for work, leisure, participation, learning, socialization, consumption and empowerment (FERRARI, 2012, p. 43).

The author presents a balanced approach to digital competence, in which each area of competence is developed equally, without emphasizing only the "technical operations" of the tools, but also highlighting the importance of the didactic component. She argues that most of the frameworks analyzed do not present an organized structure to interconnect the competencies, limiting their development to a mere accessibility and technical domain. Thus, the author presents a broad definition of digital competence as a structured and interconnected concept.

4 DIGITAL COMPETENCE REFERENCE FRAMEWORKS

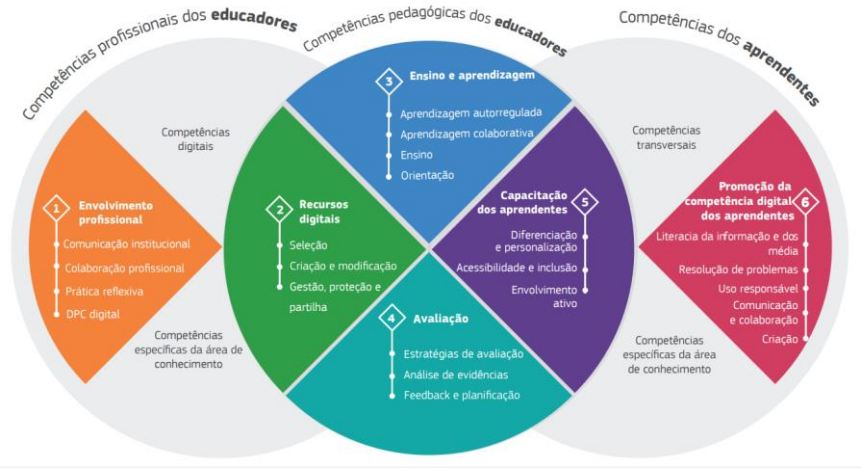
DigCompEdu: European Digital Competence Framework for Educators, was developed by the European Commission and presents a common frame of reference on the digital competences needed for educators[1] can effectively integrate digital technologies into their pedagogical practice. In the document, digital competence is defined generically as "the safe, critical and creative use of digital technologies to achieve objectives related to work, employability, learning, leisure, inclusion and/or participation in society" (LUCAS; Moreira, 2018, p. 91).

The Digital Competence Framework for Educators has been developed to address the awareness in many European countries that teachers need specific digital skills to enable them to

[1] In the DigCompEdu document, the term "educator" is used to refer to anyone involved in the process of teaching or promoting access to knowledge.

harness the potential of digital technologies to improve education through innovation, presenting three dimensions of competences: (1) Professional competences of educators; (2) Pedagogical competencies of educators and (3) Competencies of learners, and their respective areas (Figure 4).

Figure 4 - DigCompEdu Competence Framework



Source: Lucas and Moreira (2018, p. 15)

The DigCompEdu Competency Framework is composed of 22 competencies organized into six areas: (1) Professional Involvement: refers to the use of digital technologies by educators in their professional interactions with colleagues, aiming at their own professional development and the collective benefit of the institution; (2) Digital Resources: refers to the fundamental skills to use, create and share digital resources that best suit the abjects of learning, in an effective and responsible manner; (3) Teaching and Learning: refers to the management and adaptation of the use of digital technologies in the different phases and configurations of the teaching and learning process; (4) Evaluation: refers to the use of digital strategies to improve evaluation; (5) Learner Empowering: refers to the potential of digital technologies to support student-centered pedagogical teaching and learning strategies and drive the active involvement of learners in this process; and (6) Promotion of learners' digital competences: refers to the specific pedagogical competences essential to promote pupils' digital competence. The goal of DigCompEdu is to provide guidance to educators, educational institutions and policy makers regarding the development of teachers' digital skills for the digital age.

In addition to this European experience, we highlight the result of a mapping of articles published in the CAPES Periodicals Portal carried out by Wheel and Morgado (2019) on international productions related to teachers' digital competencies. In this study, multiple interpretations were identified about the understanding of what digital competence is, as well as indications of the use of various terminologies to refer to these competencies. By compiling the analyzed texts, the authors propose a definition for teachers' digital competencies as a set of knowledge, skills and attitudes necessary for the efficient use of technologies during the teaching-learning process, emphasizing that

this definition evidences the complexity and comprehensiveness of the concept, suggesting that the digital competence of the teacher requires more than simple technical skills and proficiency in the use of tools specific, these being just some of the various aspects of digital teaching competence.

Another fact that the study reveals is the fact that research on teachers' digital competencies stands out in institutions in countries such as Norway, Spain, Mexico, the United States, Brazil and Chile, with universities in Norway (Norwegian University, Nordic Institute for Studies in Innovation and University of Bergen) at the forefront. This prominence of Norway is related to its global pioneering in the inclusion of technologies in the national curricula of compulsory education, established since 2006.

The study points out that the researchers focus mainly on the digital competencies of teachers, exploring topics such as the training of teachers for the development of these competencies, the challenges and opportunities related to the use of technology in the teaching and learning process and how the development of these competencies can improve methodological aspects of this process (RODA; MORGADO, 2019).

To compile what the studies and reports presented in this subchapter point out about the definition of digital competence, we present in Chart 1 the main concepts and their authors:

Frame 1 - Digital Competency Concepts

Reference	Concept
Comissão Europeia (2007)	Combination of knowledge, skills and attitudes for the safe and critical use of technology for work, leisure and communication to "obtain, evaluate, store, produce, exchange information, communicate and participate in cooperation networks via the Internet.
Gisbert e Esteve (2011)	Combination of skills, knowledge and attitudes related to technological aspects, as well as informational, multimedia and communication, originating a complex of multiple literacy.
Pérez-Rodríguez e Ponce (2012)	Skills to seek, process, communicate, create and disseminate information through technologies
Ferrari (2012)	Set of knowledge, attitudinal skills (including skills, strategies, values and awareness) to accomplish tasks, solve problems, communicate, manage information, collaborate, create and share content and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexible, ethical and reflexive for work, leisure, participation, learning, socialization, consumption and empowerment
Lucas e Moreira (2018)	Safe, critical and creative use of digital technologies to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society
Adell et al. (2018)	In addition to mere digital literacy, it focuses on developing skills to explore specific pedagogical resources that can be transferred to the classroom, promoting authentic learning through an environment enriched by technology.

Source: Prepared by the Author (2023)

The concepts of Digital Competence presented here are aligned primarily by the relationship of knowledge, skills and attitudes (COMISIÓN EUROPEA, 2007; GISBERT; ESTEVE, 201;

FERRARI, 2012), for safe and critical use of technology, going beyond the mere functional knowledge and domain of the resource obtaining the recognition and pedagogical exploration in the classroom (ADELL et al., 2018; LUKE; Moreira, 2018). Although there are some different emphases among the authors, there is a consensus that digital competence is a concept that has distinct dimensions and that requires the complex integration of technical, cognitive, socio-emotional and ethical skills.

There are some limitations in the digital competence reference frameworks with regard to the overemphasis on technical views when approaching the digital as an essentially instrumental reality, seconding the human and social dimensions (FIGUEIREDO, 2019). They are also limited to fulfilling descriptive functions, not giving clues or instruments that promote the development of these skills. In addition, a study conducted by Paz, Pontarolo and Peloso (2022) on the digital competencies of teachers highlights the lack of a pedagogical approach that can serve as a theoretical basis for the theme. The authors point out the need for specific training to promote the development of digital teaching skills, both in the initial phase of training and in continuing education programs. This highlights the importance of educational policies in relation to this subject.

Another parameter presented by Figueiredo (2019) It is the classification of five essential aspects of digital skills that do not receive due attention in the literature: (1) the importance of differentiating skills from digital knowledge, since both are necessary in different situations. The current emphasis of training in digital skills does not diminish the importance of training in digital knowledge, on the contrary, both complement each other; (2) digital competences cannot be separated from non-digital competences, on the contrary, they must be built on them, mutually reinforcing; (3) digital competencies are not reduced to instrumental skills to achieve specific goals, but encompass complex, multidimensional and transversal cultural competencies, indispensable to ensure mature, active, critical and emancipated participation in the digital age; (4) the acquisition of digital skills is not acquired through the frequency of disciplines, as in the case of knowledge development, but through involvement in complex social practices that make it possible to emerge and consolidate these competences; and (5) the identification and selection of practices for the development of digital competencies requires awareness of the dialectical relationship between pedagogies, learning models and social practices.

These aspects call attention mainly to the need to organize formative references for the development of digital competencies of teachers that privilege the use of technology not as a specific knowledge to be learned, but as a didactic approach applicable in various teaching and learning situations (ILOMÄKI et al., 2016).

Given the conceptual approaches presented, we can infer that the conception of digital competence is closely related to the ability to mobilize knowledge (technical and pedagogical) to

safely, critically and ethically explore, make decisions, collaborate, solve problems and build learning situations in the face of multiple circumstances with the use of technology.

5 FINAL CONSIDERATIONS

We understand that, in education, it is indispensable nowadays professionals prepared to explore technologies and their numerous pedagogical possibilities for teaching and learning. For this, the training of digital skills of teachers is crucial for success in this process. We could feel recently, during the remote emergency teaching established by the COVID-19 pandemic, how much the absence of these skills can lead to constraints and difficulties in adapting to new forms of teaching that demand pedagogical and methodological assumptions different from the usual, as well as in the effectiveness of the transmission of knowledge through digital means, highlighting the gaps in the digital skills of teachers, making urgent the need to overcome these limitations to ensure an education accessible to all.

The reality experienced by education and, especially by teachers, has accelerated the need for training for the development of digital skills that help them overcome the challenges of the contemporary world and education of the twenty-first century, allowing a pedagogical and methodological practice connected to the demands of the students of this time lived.

However, we still face some limitations in this regard, such as the lack of investment in initial and continuing education for the development of teachers' digital skills, the lack of resources and infrastructure in schools, as well as greater investment in policies and strategies that value teacher training in digital skills, recognizing its importance for the pedagogical exploitation of technological resources in the classroom, for the enrichment of the teaching and learning process and for the formation of critical and active students in an increasingly digitized world.

In this perspective, we consider it necessary to review and strengthen public policies for the initial training of teachers, reformulating the pedagogical projects of the courses through the insertion of more and distinct formative moments that prepare teachers for the acquisition of digital skills, based on innovative pedagogical practices and promoters of active learning. In addition, continuing education also plays an important role in preparing teachers for the challenge of educational technologies, requiring training plans that meet the demands of schools and teachers.

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