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Diagnostic assessment of the digital skills of future teachers in the early years of elementary school

Felipe Jailson Souza Oliveira Florêncio
Federal University of Pará (UFPA), Belém, Pará, Brazil
fjailsonn@gmail.com

Ana Cristina Pimentel Carneiro de Almeida
Federal University of Pará (UFPA), Belém, Pará, Brazil
anacpca@ufpa.br

Marianne Kogut Eliasquevici
Federal University of Pará (UFPA), Belém, Pará, Brazil
mariane@ufpa.br

Abstract: The study aims to carry out a diagnostic assessment of the digital literacy of students in a Licenciatura degree course. It is a qualitative and quantitative study, of pedagogical intervention type, with the application of an online questionnaire and interpretative analysis of the results. The results indicate the importance of considering the socioeconomic context of students, the use of digital technologies for entertainment as a teaching opportunity, and the need for concrete interventions in the classroom for the development of digital skills, essential in the training of future teachers in the early years of elementary school.

Keywords: Teacher training; Digital Skills; Diagnostic assessment.

Avaliação diagnóstica das competências digitais de futuros professores dos anos iniciais

Resumo: O estudo objetiva realizar uma avaliação diagnóstica de competências digitais de discentes de um curso de licenciatura. Trata-se de estudo de abordagem quali-quantitativa, do tipo intervenção

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pedagógica, com aplicação de questionário on-line e análise interpretativa dos resultados. Os resultados indicam a importância de se considerar o contexto socioeconômico dos discentes, a utilização de tecnologias digitais para entretenimento como oportunidade de ensino, e a necessidade de intervenções concretas em sala de aula para o desenvolvimento de competências digitais, essenciais na formação de futuros professores dos anos iniciais.
Palavras-chave: Formação de professores; Competências digitais; Avaliação diagnóstica.

Evaluación diagnóstica de las competencias digitales de los futuros profesores de primaria

Resumen: El estudio pretende realizar una evaluación diagnóstica de las competencias digitales de los estudiantes de una titulación. Se trata de un estudio cualitativo-cuantitativo, de tipo intervención pedagógica, utilizando un cuestionario online y un análisis interpretativo de los resultados. Los resultados indican la importancia de considerar el contexto socioeconómico de los estudiantes, el uso de las tecnologías digitales para el entretenimiento como una oportunidad de enseñanza, y la necesidad de intervenciones concretas en el aula para desarrollar las competencias digitales, que son esenciales en la formación de los futuros maestros en los primeros años.
Palabras clave: Formación de profesores; Competencias digitales; Evaluación diagnóstica.

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1 INTRODUCTION

The inseparability between educational processes and the use of digital technologies has required teachers not only to develop digital skills (Silva; Machado; Behar, 2022), but also to promote them in their students. Digital literacy, therefore, has been shown to be fundamental to meeting the challenges of the contemporary world, including the responsible and critical use of digital technologies.

The objective of the research reported in this article was to carry out a diagnostic assessment [1]of the digital skills of students in two classes of a Licenciatura degree course in the area of Science and Mathematics Education, offered by a public higher education institution (HEI)[2]: one during the Emergency Remote Teaching (ERE) period, in 2021, and the other presentially, in 2023. Our research question is to understand the relationship of students in the course with digital technologies, considering the in-person and emergency remote teaching contexts.

We also hope to identify differences and similarities between the profiles of these subjects, taking into account the role of the pandemic in education. We believe that by carrying out a diagnostic assessment of students' digital literacy, we are shedding light on a reality that is often neglected, on a peripheral region in terms of economic flows, and on a public that is caught between what is most often addressed in reference instruments: not yet trained educators, but students in training to become educators.

The methodology used in this study, which is part of a broader assessment of the classes, is that of pedagogical intervention (Damiani *et al.*, 2013)[3]. The diagnostic assessment, obtained by applying an online questionnaire, constitutes the first stage of the pedagogical interventions carried out with the classes, carried out on different occasions : the first in 2021, during a teaching internship on the theme “Relationships between Science, Society and Citizenship I”, taught during emergency

[1]Conceptualized in topic 2.2 of this article.
[2]The course works on “training, at undergraduate level, teachers to teach Science and Mathematics in the early years of Elementary School, *alongside* the teaching of Mother Tongue and Human Sciences” (UFPA, 2012, p. 3, translated by us). For the purposes of this work, we refer to these students as “future teachers”, as they are individuals undergoing initial training so that they can work, once graduated, as teachers in the early years.
[3]Planning and implementation of pedagogical innovations, with the aim of promoting improvements in the teaching and learning process of participating students.

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remote teaching; and the second during a teaching internship on the theme "Pedagogical Technological Resources I", in presential modality [4]. When applying the online questionnaire in 2021, we obtained responses from 35 students, while in 2023, from 30 students.

We are therefore aware of the limitations of the extract presented here since the assessment of competencies involves the combination of different strategies, including those of a formative nature (Bernardi; Guizzo; Silva, 2022). For this reason, we focus on habits of use and skills with digital technologies, as they provide us with the necessary elements to begin a more accurate diagnosis to understand this reality. Considering that, to develop digital literacy among university students, it is first necessary to carry out a diagnostic assessment of the uses and levels of digital literacy of this audience so that appropriate strategies and interventions can be designed, the results presented here provide indications of essential elements that cannot be overlooked in such a process.

Therefore, in the following, we will detail the theoretical bases that allowed us to analyze the impact of emergency remote teaching and the traces it left, even after the return to face-to-face teaching; the main guidelines for an assessment of digital skills; the context in which the research was carried out; the preparation and application of the online questionnaire; and, finally, the comparison of the results.

2 THEORETICAL FRAMEWORK

2.1 From Emergency Remote Education to the Return to Presential Learning

If we look at the time when the data for this article began to be compiled, we see that in the present day, humanity has just completed four years of an epidemiological situation caused by the spread of a new variant of the coronavirus that causes Covid-19. On March 11, 2020, this situation was classified by the World Health Organization (WHO) as a "pandemic", so called because of the wide geographical range affected by the virus[5].

[4]Mandatory components of the course curriculum, 45 hours each, offered to classes in the initial periods.
[5] Available at: https://www.paho.org/pt/covid19/historico-da-pandemia-covid-19 . Accessed on: Jan. 19, 2024.

The paradigmatic nature of such an event becomes even more important as the impact of the pandemic goes beyond the field of public health, affecting the way society is organized in its most diverse social, economic, cultural and also educational aspects. As Behar and Silva (2022) state, one of the milestones in Brazilian education, in view of the social transformations of the pandemic, was the adoption of Emergency Remote Teaching (ERE) to continue activities from basic to higher education, even without the physical presence of people, due to social isolation measures[6].

It is important to highlight two aspects: the first is that the adoption of remote teaching was not a transposition of presential teaching to distance education, since this is a specific modality, already consolidated and implemented for decades by Brazilian public education policies, based on a specific pedagogical model, with prior planning, instructional design, teaching materials and human resources prepared for this environment (Luz; Miranda, 2023). The second aspect is that this measure required speed of adoption and achievement of results, thus configuring itself as an emergency measure, precisely to maintain access to education in a time of health crisis (Hodges et al., 2020)[7].

However, adoption has not been smooth. In the context of Brazilian higher education, universities had to review their academic calendars, prepare guidelines and train students and teachers, establish biosafety protocols, review processes, and approve new work formats (Carvalho et al., 2022). The pedagogical change required a dive into the potential of digital technologies, with teachers seeking new ways of teaching (even if derived from traditional practices) and students of learning, through computers or mobile devices such as notebooks, tablets and smartphones.This revealed the urgent need to train teachers and students for a reality already deeply linked to the digital. (Oliveira; Corrêa; Morés, 2020), but the pandemic made everyone move in the same direction.

Therefore, the return to presential classes after the emergency period did not fail to bring traces of these changes. While we believe that teachers and students would not be the same after what happened, opening a path for innovation in education (Rondini; Pedro; Duarte, 2020), we cannot fail

[6]Remote teaching is defined as such due to the geographical distance between teachers and students. The term "emergency" is adopted due to the abrupt need for its adoption, causing changes in the pedagogical planning of educational institutions (Behar, 2020).
[7]The ERE was adopted in the country after authorization by the Ministry of Education (MEC), through ordinance no. 343, of March 17, 2020, which established the replacement of face-to-face classes with activities in digital media while the pandemic lasted (Moraes *et al.* , 2020).

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to take into account that the pandemic favored conditions of impoverishment and learning deficits, especially among the economically less privileged (Gomes et al., 2021).

Faced with such contradictions, Luz and Miranda (2023) draw attention to the fact that, in higher education, the ERE has provoked needs such as: reconfiguration of pedagogical practices for teaching and promoting learning; reflection on the use of digital technologies beyond the purely tool-based character; and, above all, the need to face head-on the socioeconomic conditions of students who, even before any pandemic, already placed them in conditions of digital exclusion (Sonego; Silva; Behar, 2021).

Silva, Machado, and Behar (2022) show that the adoption of ERE required students and teachers to develop digital literacy, understood as "a set of knowledge, skills, and attitudes that, with the safe and critical use of digital technology, allow the subject to solve certain basic problems in all spheres of life" (Silva; Machado; Behar, 2022, p. 11, translated by us). Research, such as that of Spante et al. (2018), shows that digital literacy is essential for life in today's world, as it contributes to the acquisition of other skills, such as language, mathematics, learning to learn, and cultural awareness. It is also essential for teachers, enabling them to manage both the content to be taught and the pedagogical tools that help in the classroom.

The interrelationship between the assessment of these digital skills and the socioeconomic context of university students in initial teacher training is therefore essential for a deeper understanding of the impact that ERE has had in a given educational context, and what it may have in the future, given that these students will soon be responsible for training others.

2.2 Diagnostic Assessment of Digital Skills

The conceptualization of digital skills is based on several international reference studies, including the different versions of the DigComp (European Digital Competence Framework for Citizens) project of the Joint Research Center (JRC) of the European Commission, from 2013, from which DigCompEdu (European Digital Competence Framework for Educators) was derived, the latest version of which is from 2017. Although Brazil has its own initiative for mapping digital competences,

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namely the Digital Competence Matrix of the Innovation Center for Brazilian Education (CIEB) (Marroni; Miranda; Carvalho, 2022), it cannot yet be considered a national reference framework, as it is not directly linked to national public policies.

It is noteworthy that its understanding must vary according to the economic, social, and cultural context since the most widely used reference frameworks are mostly European, which provide a general understanding of digital literacy but do not cover the specificities and characteristics of each reality (Silva; Machado; Behar, 2022). Therefore, assessments derived from these frameworks must establish their bases according to each need and area of life of the people to be assessed to obtain pertinent data to support public policies that can consider the citizens of each country (Silva; Machado; Behar, 2022).

In the definition adopted by Silva, Machado, and Behar (2022), based on these reference studies, it is important to consider that although there is a main concept focused on the relationship between people and technology, this concept changes and unfolds according to the profile of the subjects and the context studied. Mapping digital competences therefore involves clearly defining a scenario and the elements to be assessed.

According to Bernardi, Guizzo and Silva (2022), the assessment of digital literacy should include not only knowledge but also the skills and attitudes of individuals towards the digital environment. It is an ongoing process, of a formative nature, carried out through different strategies and tools. Based on international and national instruments for the assessment of competences, the authors Bernardi, Guizzo, and Silva (2022) consider the self-perception or self-assessment as one of the valid steps for this type of assessment, which can be carried out in three ways: diagnostic, formative and summative. For this article, we will focus only on diagnostic assessment.

Diagnostic assessment, therefore, identifies the subjects' prior knowledge, strengths, and difficulties to facilitate decision-making based on these results. In the case of education, such assessment provides data on learning needs that support the development of pedagogical strategies by the teacher to intervene in a given situation or context (Bernardi; Guizzo; Silva, 2022). In the following topic, we understand a little better the profile of the respondents of the online questionnaire participating in this evaluation, based on the understanding of the degree they are studying, so that we can later evaluate the results.

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3 RESEARCH CONTEXT

Faced with data from the 2007 Educacenso, which attested to a deficit in the number of teachers working in elementary education in the state, the leadership of a public institution in the north of the country at the time was encouraged to create a degree program that would contribute to the reconfiguration of this reality, with a focus on training teachers to teach science and mathematics (Machado Júnior; Gonçalves, 2016). Subsequently, the political-pedagogical project for a degree in Science and Mathematics Education was developed, a higher education course that was previously unknown in Brazil, which began in 2009. In this course, the graduate must undergo a training experience that allows him/her to work in the maternal, scientific, mathematical and digital literacy of children and adolescents in an integrated manner (UFPA, 2012).

This is a regular undergraduate course, with an annual offer, through a selection process, of 40 places per class, in the afternoon and evening shifts. The curricular components are divided into six Thematic Axes [8], through which the dimensions necessary for the professional training of future teachers are organized, in the format of Themes. The Themes are like “disciplines”, through which the different subjects to be worked on are organized, as provided for in the Course Pedagogical Project (PPC) (UFPA , 2012).

The research reported in this article is specifically situated in the training included in Thematic Axis 4 (Science, Technology, Society and the Environment), which includes the following themes: Historical and Epistemological Foundations of Sciences and Languages; Relationships between Science, Society and Citizenship; and Pedagogical Technological Resources. These three axes have a workload of 90 hours each, divided into two 45-hour offerings, distributed from the first to the fourth academic period and also in the seventh. The online questionnaire was applied in the offerings of the last two themes.

[8]The Thematic Axes are as follows: 1) Fundamental Thematic Axis of Reading and Writing Acquisition (480h); 2) Theory and Teaching Practice in Science and Mathematics (285h); 3) Teaching and Learning Processes in Science and Languages (255h); 4) Science, Technology, Society and Environment (270h); 5) Construction of Concepts and Use of Languages in Science and Mathematics; and 6) Teaching Internships.

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4 METHODOLOGY

The methodological approach of the study conducted here was pedagogical interventions, with the application of an online questionnaire. This questionnaire, designed to explore the digital skills of students, was structured in two sections: the first with six questions about the socioeconomic profile and the second with eight questions about the student's skills in using digital technologies. An informed consent form (ICF) was included at the beginning of the questionnaire so that participants could read about the nature of the research and indicate whether or not they agreed to participate. The question sections would only be available if they indicated their consent.

With the two sections of the questionnaire, we aimed to obtain data on the different realities of students' lives, both in terms of their socioeconomic profiles and their use of digital technologies, believing that the context in which the research subjects live is directly related to the way they develop their digital skills (Miranda, 2019). In the following, we will explain how the questionnaire was prepared, and then we will move to the presentation of the data obtained.

4.1. Preparation and Structure of the Questionnaire

The questionnaire was initially structured based on the adaptation of an existing instrument designed with the aim of understanding the profile of students enrolled in Calculus I and II subjects, in the Engineering and Exact and Natural Sciences courses at the University, during the period of emergency remote teaching (Canella et al., 2022). In the first section, on the socioeconomic profile of the student, in addition to the name of the student, the following fields had to be filled in: 1. How old are you; 2. What city are you from; 3. What city are you currently studying in; 4. What is your occupation; and 5. What is your family income (sum of salaries of all members/people)?

The second section, titled "Students' Skills in Using Digital Technologies," included the following fields 6. What device(s) do you have at home that are available for use (not just for studying)?; 7. Rate the ease of use (ability to turn on, operate, access content, etc.) of the listed devices;

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8. Rate the frequency with which you use the listed platforms; 9. What skills do you have?; 10. How do you learn?; 11. What digital resources and/or tools have you used to learn?; 12. How would you describe yourself and your personal use of digital technologies?; and 13. On a scale from "Strongly Disagree" to "Strongly Agree", indicate your level of agreement with the importance of the following skills for scientific literacy[9].

The questions of the first section, as well as questions 6 to 8 of the second section, were taken from the original instrument (Canella et al., 2022). The elaboration of the remaining questions was based on two reference documents: the white paper of the research "Transmedia Literacy in the New Media Ecology" (Scolari, 2018) and the DigCompEdu CheckIn , a self-assessment instrument of the European Digital Competence Framework for Educators (Lucas; Moreira, 2018). The former was the basis for the elaboration of questions 9 and 10, while the latter was the basis for questions 11 and 12. The adapted version of the questionnaire, to be used in the pedagogical intervention, was validated by two specialized teachers who participated in the construction of the original instrument.

The "White Paper" is a document that functions as an executive summary of the " *Transmedia Literacy* " research[10], bringing together its main findings (Scolari, 2018) [11]. This research identified a total of 44 main competencies of young people, subdivided into 190 specific competences. In terms of competencies, for our study we used those that make up the "production" dimension, focused on the practical ability to use different technologies, and one from the "risk prevention" dimension, related to the critical assessment of possible risks in the use of the Internet and digital content. According to Scolari (2018), these competencies can be used in both formal and informal learning contexts.

DigCompEdu CheckIn is a tool for educators to self-reflect on their level of digital literacy. In it, the educator has access to statements that correspond to the digital literacies listed by DigCompEdu,

[9]Question 13 was added only in the second application of the questionnaire (in 2023), to measure the importance that students attribute to the scientific literacy indicators proposed by Pizarro and Lopes Júnior (2015), and to also identify the relationship between the use of digital technologies by students and their future field of professional activity. Since the other questions already present indicators relevant to science teaching, the results of this question will not yet be explored in this article.

[10] The full title of the project, in the original, is " *Exploiting transmedia skills and informal learning strategies to improve formal education* ", also known by the acronym "TRANSLITERACY" (Scolari, 2018).

[11]This is based on the concept of Transmedia Literacy, which "focuses mainly on what young people do with the media, considering them prosumers (producers + consumers), capable of sharing and generating media content of different types and levels of complexity" (Scolari, 2018, p. 4). A more complete version can be found, in Spanish, in the book " *Adolescentes, medios de comunicación y cultura collaboratives. Aprovechando las competencias transmedia de los jóvenes en el aula* ", edited by Scolari (2018).

and for each statement, there are six alternatives that position the respondent at a level of digital literacy. Based on the statements, the educator is prompted to reflect on what level they are at and receives feedback with guidelines on what to do in practice to move towards a significant level of improvement in a given competency (Mattar et al., 2020). The DigCompEdu CheckIn focuses more on formal learning and uses the concept of "digital literacy". Questions 11 and 12 of our questionnaire were taken from the last section of this tool, which aims to obtain more general information about its respondents, not necessarily related to one of the digital competences of the European Framework, but intertwined with them.

It is important to emphasize that, since this is aimed at educators and not at students, the commands and alternatives of the questions had to be adapted to include the student audience. Although we are mapping competences and not just skills, we have chosen to use the term "skill" for the command of the questions, because it is present in the National Common Curricular Base (BNCC), where it has a sense of more immediate action, carried out on the basis of some learning, that is, more focused on the effective dimension of "doing", thus facilitating the understanding of the students.

4.2 Application of the Questionnaire

The first application took place during a teaching practicum on "Relationships between Science, Society and Citizenship I", in the course under study, offered remotely to two incoming classes, in the afternoon and evening shifts. Synchronous activities were conducted through the Google Meet platform, and asynchronous activities were conducted with the support of Google Classroom, including readings, viewing recorded lectures, guided research, and assessment activities. The internship was offered intensively, which meant that students took the curricular components one after the other, without other concurrent components, with activities concentrated during the period in which they were completed. This was one of the adaptations adopted by some HEI courses during the ERE period. The practicum took place over two weeks, from March 29 to April 9, 2021, with synchronous activities on alternate days. The questionnaire was made available for completion after the first synchronous session.

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The second application took place during a teaching practicum on the topic "Pedagogical Technological Resources I", also a mandatory curricular component of the course. The topic was offered to a class entering in 2023, in the evening shift, taught mainly in person (there was only one synchronous remote activity through the Google Meet platform, due to a power outage that affected the IES campus on the day of the class). Even after the end of the ERE period, at that time, the topics were offered in a "blocked" manner, that is, one after the other, which already reflects one of the adaptations of the period that continued even after its end. The internship lasted eight weeks, from May 11 to June 29, 2023, with one class per week. The questionnaire was made available in the first class and remained open until the end of the topic to receive responses.

5 RESULTS

5.1. Student Profile

In the 2021 application, 35 students responded to the questionnaire, while 30 students responded in the 2023 application, for a total of 65 students enrolled in the course. There were a total of 52 students enrolled in the 2021 class and 49 students enrolled in the 2023 class. The former entered university during the pandemic period, in 2021. The others had the experience of entering university in 2023, after the return of the traditional education. That year, on May 5, the WHO declared the end of the international public health emergency related to Covid-19[12]. Below, we provide a general overview of the socioeconomic profile of these students, based on the responses to the first section of the questionnaire. This integration is important because it helps to understand the audience of students who access the aforementioned undergraduate course.

Contrary to the expectation that first-year students are those who have just finished high school (around 17 years old), the student profile is mostly people over 25 years old (only 38.5% are under this age). The classes include students aged 30 to 39 (20%), 40 to 49 (18.5%) and even 50-59 (3.1%), which demonstrates the diversity of the public that enrolls in this degree and indicates that it is sought

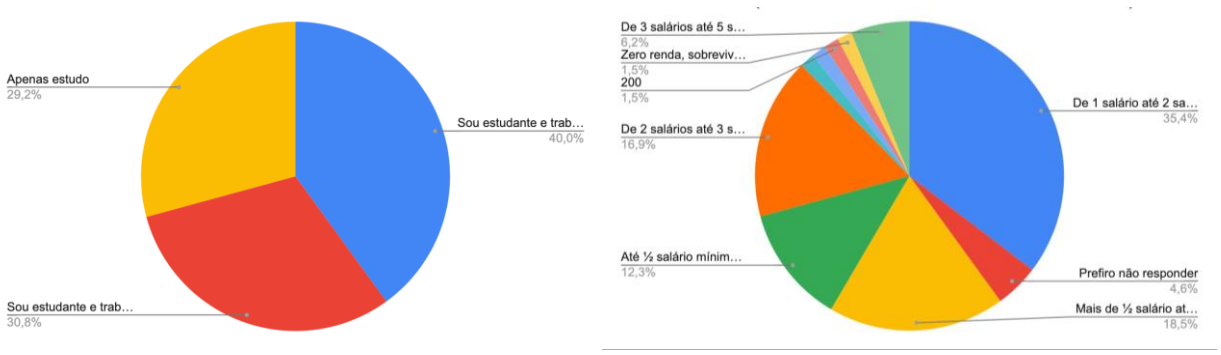
[12]Available at: https://www.paho.org/pt/noticias/5-5-2023-oms-declara-fim-da-emergencia-saude-publica-importancia-internacional-referente . Accessed on: Jan. 21, 2024.

by people in different stages of life, already more experienced, which may indicate the difficulties that many young people have in entering university, needing first to seek a certain stability in order to invest in studies.

The majority of the students who participated in the research were born (70.8%) and live (80%) in the city of Belém, capital of Pará and home to the largest number of courses at the IES. However, it is important to highlight the diversity of their places of birth, both in the neighboring municipalities of the capital, such as Ananindeua, Barcarena and Marituba, and in the interior of the state, such as Cametá, Magalhães Barata and Tucuruí, or even in the neighboring state of Amapá. The ERE period allowed some students to attend classes in their hometowns, in the interior of Pará, even if in a tentative way.

The return to presential education has reduced these opportunities, and students must live, at most, in communities near or within the Belém Metropolitan Region (RMB)[13]. It is no wonder that, among the participating students, the majority need to combine their studies with some kind of work, either part-time (40%) or even full-time (30.8%), as shown in graph 1.

Graphs 1 and 2 – Occupation and family income



Source: Research results.

[13]It is worth noting that even among students born and residing in the capital Belém, or in cities belonging to or close to the RMB, these were peripheral neighborhoods of the capital of Pará, that is, being in a city that is part of the administrative and/or financial center of a state does not necessarily mean access to better socioeconomic conditions.

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In the ERE class, during the synchronous sessions, these students shared that they work as building material store clerks, supermarket cashiers, sales clerks, teachers, tutors, and computer network technicians. In some cases, there were students who attended the class on the bus when they returned home, or when they were at home, they had to share the class with their families. In the face-to-face class, the classes always had to start with a long grace period because most of the students (night shift) were traveling from their workplaces to the university and ended up arriving at the class tired[14].

In graph 2, we highlight the family income that for most students did not exceed two minimum wages (the value considered was R$1,100, valid in 2021). Of these, 35.4% had an income of one to two minimum wages, 18.5% more than ½ minimum wage up to 1 minimum wage and 12.3% only up to ½ minimum wage (R$550). It is clear that the profile of students reflects some results of public policies, such as quotas for students from public schools or in situations of social vulnerability, for the admission of subjects historically excluded from higher education in Brazil[15].

5.2 Skills in the Use of Digital Technologies

Continuing the description of the data, now in the section on skills in the use of digital technologies, we will move on to information about the devices that students have access to, the most used platforms, skills and ways of learning (Scolari, 2018) and the relationship of these subjects to technologies (Lucas; Moreira, 2018). From Figure 3, we can see that almost all students, whether in ERE or presential classes, have a smartphone[16]. In the case of ERE, the *smartphone* played a leading role, as it was through it that most students followed the classes.

Graph 3 – Devices you have at home and availability to use them

[14]In this sense, it is important to highlight that in both formats, remote and in-person, there are restrictions on the effective "presence" of students, which corroborates the inferences of Luz and Miranda (2023), demonstrating that this is still a difficulty that needs to be faced by educators.
[15]Entry, however, is not the only challenge that these students face, as their continued participation in the course is also hampered by unfavorable socioeconomic conditions, such as insufficient family income and/or the need to divide study time with work.
[16]It differs from a cell phone in that it has functions that go beyond calling and sending messages, for example, connecting to the internet and watching multimedia content, making it closer to a "small computer" than a traditional telephone.

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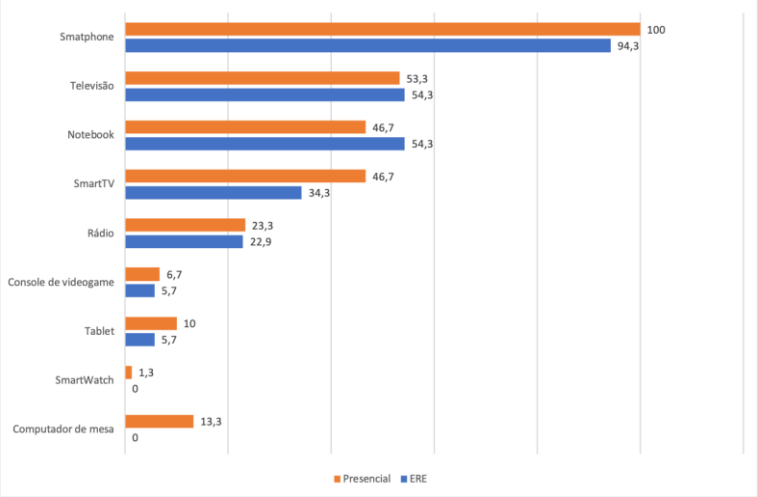

Source: research results.

The data shows that *smartphone ownership* exceeds, on average, 50% of both the second most mentioned device, the television, and the third, the *notebook* [17]. Smartphones are characterized by their portability, multimedia capabilities, and individual use (while families use the other devices, TV and notebook, together). They are widely used by students and/or other professionals who need to travel and maintain Internet access in places other than home. The results of question 7 on "ease of use of devices" confirm these data, since in both the ERE and the face-to-face survey, these three devices were the ones that students most often rated as "very easy" to use.

Smartphone use, along with other digital technologies, has been identified as potentially linked to negative outcomes in students' academic performance (UNESCO, 2023). However, the report also points to these technologies as alternatives to traditional education for hard-to-reach populations. It is up to this new generation of future early childhood educators to translate this ease of use and access to digital technologies into forms of use that go beyond recreation and the development of digital literacy (Schorn; Silva; Behar, 2022).

An important piece of information to look at is related to the command in question 8: "Assign a value to how often you use the platforms". It lists the platforms most often used for teaching and

[17]Among the factors that may contribute to this is that the *smartphone* is more financially accessible than others, being a product seen as a priority for acquisition, given the increasingly urgent needs for mobile communication and speed in accessing information.

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learning (Moodle, Integrated Academic Management System, Google Meet, Zoom, and Microsoft Teams), which are widely used during ERE for the continuity of classes; messaging applications and social networks (WhatsApp, Telegram, YouTube, Facebook, Instagram, Twitter, and TikTok); or audio and streaming platforms.

In ERE classes, WhatsApp (77.1%) and Google Meet (51.4%) were the platforms most used by students, which makes sense considering that messaging applications were not only used for personal communication but also as a tool for teaching and learning activities since content and information about classes were shared through groups (Gonçalves, TV; Gonçalves, TO, 2020); and that Google's GSuite for Education package was adopted by the HEI during the pandemic[18]. The social networks YouTube, Facebook and Instagram appear next. In presential class, the difference was significant. WhatsApp remains the most used platform with 83.3% of respondents. Google Meet, on the other hand, was used very frequently by 13.3% of the participants. The majority began to indicate low frequency of use (43.3%), medium frequency (40%), or even non-use (3.3%, which represents 1 student). In contrast, the percentage of respondents who indicated very frequent use of social networks increased: Instagram (66.6%), YouTube (63.3%), and Facebook (50%).

As a possible conclusion, we have that the ERE did not necessarily leave its mark on the greater use of platforms for teaching and learning purposes. With the return of presential classes, the continuity of use has not yet been representative, at least among the courses covered in this research. The use of social networks for more recreational purposes has increased, indicating that their use for other purposes still has a long way to go. Regarding what students do with the devices they have, they were asked what skills they have (question 9). Among the alternatives, there were skills understood by Scolari (2018) as "transmedia", related to the production, sharing and consumption of interactive digital technologies, whether related to problem solving or content sharing, such as social networks. The respondent could choose more than one.

As can be seen in graph 4, for both ERE and presential students, the production skills selected by the majority are still basic to more traditional academic activities, namely: "using writing software

[18]Members of the university community were able to migrate their institutional accounts to the email service and other work tools offered by *Google* , free of charge. With the period of social isolation resulting from the Covid-19 pandemic, and the need for worldwide adaptation to remote teaching, *Google* allowed video calls via *Google Meet* , as well as unlimited recording and file storage via *Google Drive*, to be made free to all users. In August 2021, with the gradual resumption of in-person activities, it was announced that such availability would end in January 2022.

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and applications" (such as Microsoft Word and the like) for 51.4% of ERE students and 60% of face-to-face students; and "creating and editing written productions" for 45.7% and 53.3%, respectively. For both skills, we found an increase in mastery among presential students compared to distance students.

Writing is certainly one of the basic skills for everyday academic life, essential for carrying out many activities required in the classroom, so it is important that students master it. However, we cannot ignore the fact that of the classes that responded to the questionnaire, practically half of the students (whether ERE or presential) did not select these options. We then noticed a difficulty that persisted from one period to the next, and even became more pronounced after the return of presential activities. Even though these are first-year students, i.e., students in the process of exploring and developing writing skills, this will be very necessary for their professional performance as future first-year teachers.

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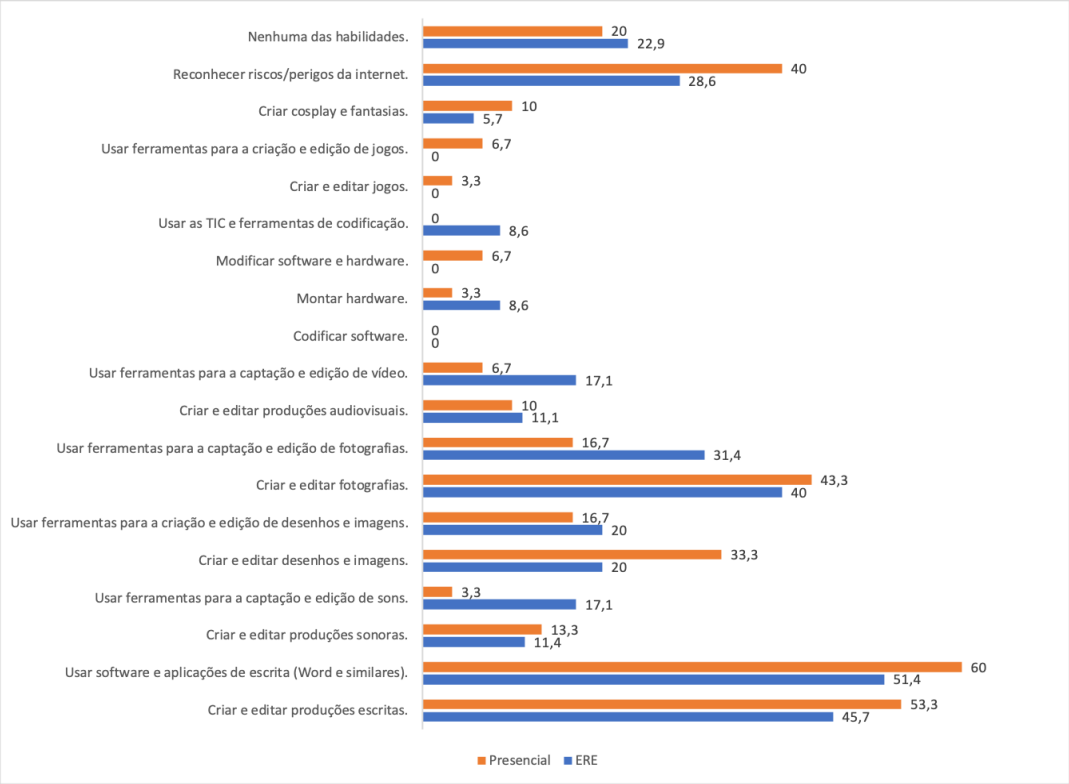
Graph 4 – Skills you have



Source : research results.

Perhaps due to the use of social networks on the Internet, other skills that stood out for both groups were "creating and editing photographs" (40% of distance students and 43.3% of presential students) and "creating and editing drawings and images" (20% and 33.3%, respectively), which involve the use and manipulation of images. These skills can also be explored for pedagogical purposes in academic activities that do not necessarily require writing. Both increased from the distance to the presential period. We noticed some significant decreases, such as in the areas of "audio recording and sound editing tools" (17.1% of remote learning to 3.3% of in-person learning) and "video recording and editing" (17.1% to 6.7%), suggesting that these languages are not being fully explored by students. Certainly, this is a difficulty that many teachers may also have, but considering an increasingly digital world and the amount of multimedia stimuli that we have access to, investing in the use of these tools would bring promising potential for educational activities.

Finally, it is worth noting that the only skill from the "risk prevention" dimension (Scolari, 2018) available among the response options, "recognizing risks/dangers of the Internet", was chosen

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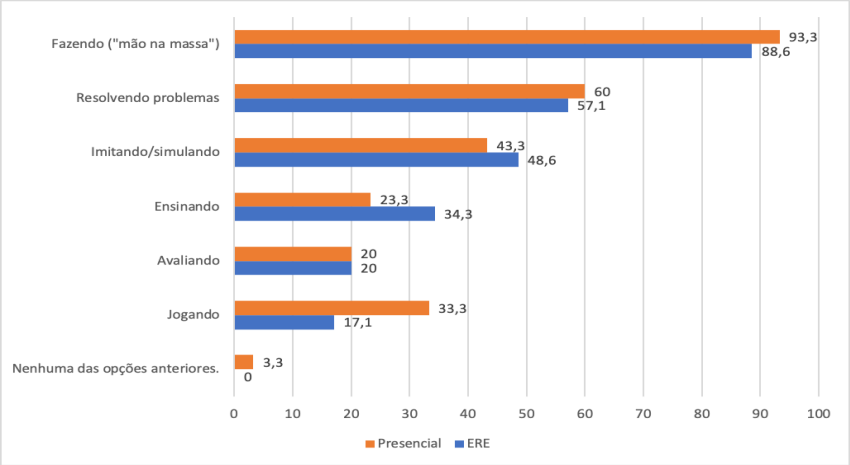
by 28.6% of the ERE students, which increased to 40% of the presential students. This is a crucial skill for future teachers in the early years, as it involves promoting a more critical and informed view on issues related to science, technology, society and citizenship. The dangers of fake news, with implications for politics and health, and the importance of data security have been widely discussed in class since the pandemic, and awareness of these issues may have increased.

It is worth making a connection between the skills discussed above and the ways in which students prefer to learn. The options were taken from Scolari (2018), whose research categorized learning strategies into six modalities. As shown in graph 5, in response to the question "How do you learn?" (question 10), the vast majority of respondents indicated learning by doing or "hands-on" (88.6% in ERE and 93.3% in presential).

Graph 5 – How do you learn?



Source : research results.

The practice of learning by doing involves students putting into practice the skills they need to develop through trial and error until they achieve their goal. This option suggests a more active role for students in the classroom, who expect to move from the position of mere listeners to experimenting with what they are learning from the outset. In the same direction, another prominent strategy is "solving problems" (55.1% of ERE and 60% of presential). Like learning by doing, it is also related

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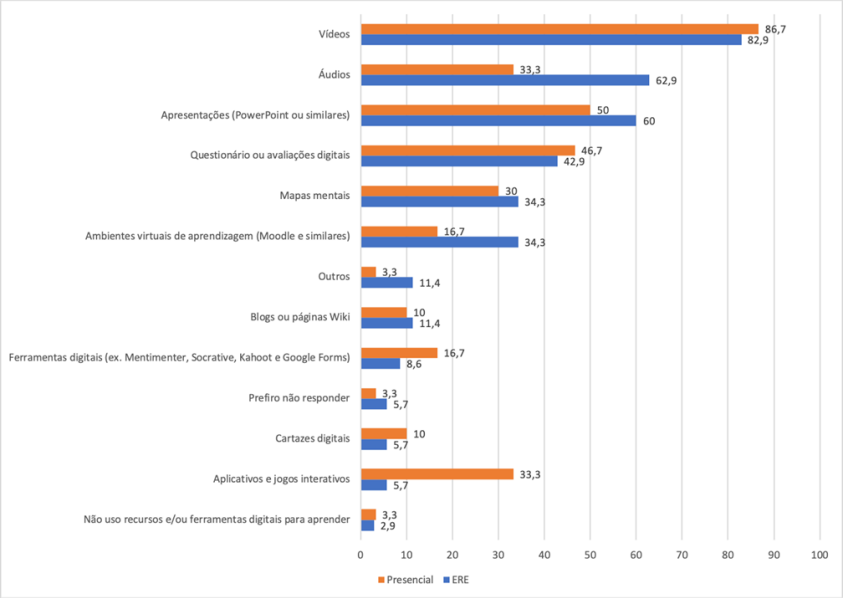
to the development of competencies, since it involves the activation of dimensions of knowledge, skills, attitudes and goals.

We noticed a decrease in the number of those who say they learn "by being taught" from 34.3% of ERE to 23.3% of presential classes. Considering that these are undergraduate classes, whose expected professional role is that of a teacher, this is a fact that deserves attention, as it indicates a certain lack of familiarity or even affinity with the chosen field. Still on the subject of learning, in graph 6 we can get an idea of the resources and/or digital tools appropriated by the students for these purposes.

Graph 6 – Digital resources and/or tools used for learning



Source : research results.

In line with the findings of question 9, in which students indicated that they had little knowledge of audio and video tools, these were the same digital resources or tools [19]indicated by

[19] The first "generically refers to any content published in a digital environment", which is easy to understand for those who access it (as opposed to "digital data", which requires analysis, processing and interpretation), while the second means "digital technologies used for a particular purpose or to perform a specific task" (Lucas; Moreira, 2018).

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respondents as the most used for learning, in the answers to question 11. Video comes first, with 82.9% of ERE students and 86.7% of face-to-face students, followed by audio, which almost doubles from one modality to the other. Audiovisual is therefore one of the most suitable languages for learning, but more from the point of view of assistance/consumption and not so much from the point of view of production.

Some resources remained balanced, such as "presentations" (PowerPoint or similar), "digital questionnaires and assessments", and "mind maps". These are already traditional in teaching activities, but they have acquired new contours and formats in the ERE. However, we noticed a decrease in the use of virtual learning environments (from 34.3% to 16.7%) when returning to the face-to-face model. Although the alternative mentions Moodle, it was no longer frequently used by the participants (as demonstrated in question 8), most likely because it is a distance learning resource, while the teaching regime of the classes studied was presential. The decrease may also indicate a decrease in the use of Google Classroom, which is related to the storage limitations of the GSuite for Education package at the university.

To conclude the analysis of responses to the questionnaire, in question 12, students were asked to indicate how they would describe themselves in terms of their use of digital technologies on a scale from "strongly disagree" to "strongly agree". The alternatives were: i) I find it easy to work with computers and other devices; ii) I use the Internet extensively and competently; iii) I am open and curious about new applications, programs, and resources; and iv) I am a member of several social networks.

In the first statement, we see a balance between ERE students (42.8%) and presential students (33.3%) who chose "I partially agree". However, it is important to take into account the number of people who marked "I completely disagree" and "I neither agree nor disagree", which represents 34.2% of ERE students and 43.3% of presential students, that is, representative numbers that are close to half and that are increasing even after the pandemic. This is in line with the provocations of Luz and Miranda (2023) that, despite being highlighted during the pandemic, the difficulties in using and accessing these devices were already a reality before the ERE and, even after all that it demanded, the situation has not changed and subjects historically excluded from the digitization processes of society continue in the process of exclusion.

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It is important to note, however, that the lack of ownership, connectivity, or fluency does not mean that these participants are excluded from the Internet. Of the ERE students, 60% said they "totally" or "partially" agreed with the second statement. Among presential students, this figure rises to 73.3%. However, this use seems to be related to social networks, in line with the data for alternative four. Here, 62.8% of the ERE participants and 70% of the presential students "totally" or "partially" agree. This brings us to the third statement. For both ERE (45.7%) and presential (40%), "I am open and curious about new applications, programs, and resources" was the one that received the most "I strongly agree" responses. One of the barriers that educators must overcome in order for students to achieve learning is precisely the interest of the subjects involved (Morán, 2018). In the case of the classes studied, we see that this interest already exists, which opens the door to planning and adopting strategies that include these technologies.

Based on the results analyzed, we can draw some conclusions. One of them is that, ratifying the indications of Silva, Machado, Behar (2022), the social and economic context must be considered in the process of assessing digital literacy. The socioeconomic difficulties of the participants translate into a lack of access to technologies, which results in little ease or limitation of use, especially with regard to the active participation of these subjects in the digital environment, which ends up being limited to the consumption and sharing of content in social networks.

Students' mastery of some digital technologies does not necessarily mean that they are used for learning purposes (Schorn; Silva; Behar, 2022). Public and/or institutional policies for access to and training in technologies must therefore be continuous, as we saw during the ERE period that the platforms and resources, when made available, were widely used. At the end of the pandemic, when restrictions on use were put in place, these same tools saw a decline in the use of their educational potential.

We agree with Schorn, Silva, and Behar (2022) when they state that the development of digital literacy is a complex process that requires, in addition to diagnosis, concrete interventions in the classroom context. Such skills need to be stimulated in everyday academic life in order to prepare students for their professional performance. In the case of this research, as future teachers of the first years, this is essential, because we see that if the teacher has few skills in the use of digital technologies, or makes limited use of them, this ends up affecting the education of the students, who increasingly show a desire to learn actively.

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6 CONSIDERATIONS

The analysis carried out showed that the socioeconomic profile of the ERE and the presential classes were similar, with the majority of students being over 25 years old, combining study and work, and living on a family income of less than two minimum wages. In both groups, the role of the smartphone and the WhatsApp platform stands out as the most used digital technologies. Among the skills that the students have the most, both classes pointed to still basic skills, such as writing production, as well as the willingness to "learn by doing", that is, to learn in practice, with the proper guidance of their educators.

Considering the context studied, one of the possibilities to be explored is access to mobile devices, such as smartphones, which are a medium for multiple languages, such as audio, video, and photography. These are among the most used by students as resources for learning. If we consider the need for more active participation by students, it is necessary to explore these resources not only from the point of view of enjoyment but also from the point of view of production, which is also controversial in the first years of education.

In this way, the development of digital literacy is a prerequisite for the full exploration of other life skills, such as learning and teaching, which are essential for future science teachers in a digital world, and cannot be achieved solely through immersion in digital technologies, but rather "through training that allows both students and teachers to rethink their role as citizens in a networked and demanding society" (Silva; Machado; Behar, 2022).

Studies like this can be further developed by combining quantitative data analysis with qualitative information, obtained from the perspective of the student himself, about how he sees himself and what he believes to be his strengths and weaknesses. Often, structural problems, unfortunately still present in many higher education institutions, can hinder the development of digital skills, but persistence is essential to transforming realities.

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