PRÁTICAS EDUCATIVAS, MEMÓRIAS E ORALIDADES

Rev.Pemo – Revista do PEMO

# A look beyond the COVID-19 pandemic: the use of ICTs in education

**ARTICLE**

**Cristiano Balbino da Silva**[i]
Instituto Federal de Educação, Ciência e Tecnologia, Belém, PA, Brasil
**Denilson Cursino de Oliveira**[ii]
Instituto Federal de Educação, Ciência e Tecnologia, Fortaleza, CE, Brasil
**Maria de Lourdes da Silva Neta**[iii]
Instituto Federal de Educação, Ciência e Tecnologia, Fortaleza, CE, Brasil



**Abstract**
The desire for education integrated into the digital world has grown significantly in recent years and the COVID-19 pandemic forced the Brazilian educational system to transition to teaching mediated by information and communication technologies. This study reports data from a survey with teachers from two public educational institutions, regarding the use of digital information and communication technologies in the school context, before, during and after the COVID-19 pandemic, with the aim of identifying the legacies left for the experience of teaching practice in this chaotic period of humanity. This research has indicated that approximately 61% of teachers used technological resources to mediate the teaching and learning process. In the post-pandemic scenario, 34% use it sometimes and only 5% said they stopped using it. Upon returning to face-to-face classes, teachers noticed simple changes in the institutions' infrastructure.
**Keywords:** ICT. Education. Teaching and learning. Pandemic.

## TDICs na educação: um olhar para além da pandemia de covid-19

**Resumo**
O anseio por uma educação integrada ao mundo digital tem crescido bastante nos últimos anos, e a pandemia de covid-19 forçou o sistema educacional brasileiro a transitar para o ensino mediado pelas tecnologias da informação e comunicação. Este estudo reporta os dados de uma pesquisa com docentes de duas instituições públicas de ensino, referente ao uso de tecnologias digitais da informação e comunicação no contexto escolar antes, durante e pós-pandemia de covid-19, com o objetivo de identificar os legados deixados pela vivência da prática docente neste período caótico da humanidade. A pesquisa indicou que, aproximadamente, 61% dos docentes fizeram uso de recursos tecnológicos para mediar o processo de ensino e aprendizagem. No cenário pós-pandemia, 34% utilizam às vezes e apenas 5% afirmaram parar de utilizar. Ao retornarem às aulas presenciais, os docentes notaram mudanças singelas nas infraestruturas das instituições.
**Palavras-chave:** TDICs. Educação. Ensino e aprendizagem. Pandemia.

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

## 1 Introduction

The use of Information and Communication Technologies (ICTs) in education has been a much sought-after demand over the years. Various documents guiding Brazilian education, such as the Lei de Diretrizes e Bases da Educação (Law of Guidelines and Bases of Education – LDB[1]) and currently the Base Nacional Comum Curricular (National Common Curricular Base – BNCC) bring in their orientations a yearning for the use of educational technologies as a complementary and essential tool in teacher training and in the teaching process to encourage learning. For education, the BNCC has as some of its general competences the understanding, use and creation of information and communication technologies in a critical, meaningful, reflective and ethical way in various social practices, including school activities (Brasil, 2018).



Nowadays, it is unthinkable to look at some sectors of society and dissociate them from the use of technology, such as hospitals, banks, supermarkets or even our homes. However, this insertion of educational systems into the technology-mediated scenario does not seem to keep pace with technological advances, leaving the feeling that the potential of such tools in the educational field falls short of what is expected for a generation that is becoming more connected every day.

Several factors contribute to the slow pace at which digital technologies are being introduced into the teaching and learning process in educational institutions. Branco, Adriano and Zanatta (2020) and Silva and Teixeira (2020) identified infrastructure deficits, lack of materials and equipment, and limited access to technology as major obstacles to the effective use of technology in education. Castro *et al*. (2022) found that although access to new technologies has improved, it is still insufficient in the face of social inequality in Brazil.

COVID-19, a disease caused by the SARS-CoV-2 virus (Severe Acute Respiratory Syndrome Coronavirus 2), had its first recorded case in the city of Wuhan,

[1] LDB. Law n. 9394/96. Available at: https://www2.senado.leg.br/bdsf/bitstream/handle/id/529732/lei_de_diretrizes_e_bases_1ed.pdf. Accessed on: August 10, 2023.

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

China, in December 2019, and soon spread around the world, becoming a pandemic and causing thousands of deaths worldwide (Valência, 2020; Baloch *et al*., 2020; Kumar *et al.*, 2021; Rezaei, 2021). Only in May 2023 the World Health Organization (WHO[2]) declared an end to the public health emergency caused by COVID-19. The Brazilian educational scenario changed radically, as schools, a place that was conducive to gatherings and which should be avoided so as not to spread the deadly virus, ended up being one of the first institutions to "close its doors" to its community and one of the last to allow the return of face-to-face activities. As the days of confinement lengthened and the pandemic worsened, strategies had to be devised to mitigate the impact of the absence of face-to-face classes. In this period, the education system came to rely heavily on technology in so-called emergency remote teaching.



The transition from face-to-face teaching to technology-mediated teaching took place abruptly and intensely. Teachers have found themselves in a frantic search to learn how to use previously unknown digital tools so that they can continue to provide students with a home study routine, thus mitigating the impacts caused by the COVID-19 pandemic on education. For Santos *et al*. (2021), the use of digital educational technology in the school environment has been crucial in the context of the pandemic, causing changes in the school environment in Brazil and around the world.

In Brazil, a country of continental dimensions, multiple scenarios have been observed during the COVID-19 pandemic with regard to education mediated by information and communication technologies (ICTs). Each state, each region or even each school presented unique difficulties and advances that have been reported in various academic works. Macedo (2023), for example, explores in his work the impact of the pandemic on educational processes and highlights the deepening of educational inequalities due to unequal access to electronic devices, which corroborates the study by Silva, Alencar and Carvalho (2022), who found that the lack of access to technologies and programs generated social inequalities for teachers, managers and students.

[2] WHO. Available at: https://www.who.int/pt. Accessed on: August 10, 2023.

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Beyond the limiting perspectives, the pandemic period has also brought positive points to the education system. Rocha *et al*. (2020) found that teachers faced difficulties in using digital technologies due to students' lack of access, as well as teachers' limitations in articulating their use in the teaching process, in an attempt to mediate learning. However, they also saw opportunities to use various digital resources, providing differentiated lessons for the students. Branco, Adriano and Zanatta (2020) discuss the potential of digital technologies in distance learning, highlighting the need for schools and teachers to reflect on their use and improve their technological skills. Dias-Trindade, Henriques and Correia (2022) point out that the COVID-19 pandemic has emphasized the importance of integrating digital environments into education and has made digital teacher training more urgent.

Overall, the papers suggest that the pandemic has had both positive and negative effects on the work of Brazilian teachers, with digital technologies providing opportunities for communication and differentiated lessons, but also contributing to dissatisfaction and mental health problems, exacerbating existing inequalities in the Brazilian education system and showing that there is a need for a comprehensive and equitable response to address these challenges. Therefore, in this investigation, we aim to identify the legacies left by the experience of teaching practice during the pandemic period. In this sense, we need to reflect on whether there are repercussions after the end of the pandemic and the return to face-to-face classes. Has this forced immersion in the digital universe been beneficial to the educational system in some way, pushing education to a new level, or does this troubled period show signs that it could turn into trauma, causing an even greater distancing between educators and the use of digital tools as a conductor of the teaching and learning process?

Faced with these concerns, the researchers, who also worked as teachers throughout the pandemic period in public schools, experiencing the challenges and possibilities of teaching mediated by ICTs, realized the need to carry out research on this topic to understand how efforts to mediate the teaching process during the COVID-19 pandemic changed the dynamics of the Brazilian education system, in a post-pandemic

scenario, thus contributing to the academic community. In an attempt to systematize the research, the article is organized into two sections, the first of which is aimed at socializing the methodological path taken by the researchers, and the other at the results and discussions, with a view to enhancing the research findings, providing an opportunity for reflection on the subject.



## 2 Methodology

In this section, we will reveal the paths taken in the investigation, highlighting the research approach, the technique and the data collection instrument. This research is exploratory, consisting of a qualitative-quantitative approach, because, according to Souza and Kerbauy (2017), by combining qualitative and quantitative methods, a degree of comprehensiveness can be achieved that neither approach can achieve alone and, in the case of educational research, has helped to understand phenomena that present themselves in multiple facets. Wood and Welch (2010) argue that the dichotomy between quantitative and qualitative research is often assumed to coincide, but there are many potentially useful possibilities that are omitted by this dichotomy. Both qualitative and quantitative research can be useful for identifying patterns and trends, and combining the two approaches can provide a more comprehensive understanding of the research question.

In order to understand the panorama of the teaching-learning process mediated by digital information technologies during the COVID-19 pandemic in Brazilian basic education, we first carried out a bibliographic survey to understand the discussions and impressions of researchers on this topic in the academic environment. Gil (2008) points out that the main advantage of this activity is that it gives the researcher a broad view of what is being produced on a given topic, making it possible to analyze in more detail what has been investigated and discussed about the changes in the educational system caused by the COVID-19 pandemic in Brazil.

The participants in this research are teachers from two educational institutions that are similar in their proposals, offering professional education integrated with high school, but in different spheres and states. One is located in the Northeast of Brazil, a full-time Escola Estadual de Educação Profissional (State School of Professional Education – EEEP) in the state of Ceará; the other is located in the North of Brazil and is a federal educational institution in the state of Pará. Both were chosen because they were educational institutions to which the researchers had access as teachers, during and after the COVID-19 pandemic. The requirement for teachers to take part in the research was to be employed by the institution, either as permanent or temporary staff, and to have taught classes during the pandemic and post-pandemic periods.

The two institutions, the *loci* of the research, although they have similar characteristics in terms of teaching – offering integrated technical courses at high school level – have particularities due to their locations, which differ significantly. The EEEP, which is the subject of this research, is located in the urban area of the capital of the state of Ceará. It has 37 teachers and serves around 500 high school students every year, and has been in operation for 10 years. The other institution studied, located in the North and with rural characteristics, has 54 teachers and serves around 1,200 students a year, many of whom live in regions without any connectivity, the institution has been operating in the region for 13 years.

In order to understand how the teaching and learning process took place in these educational institutions during COVID-19, as well as the use or absence of ICTs from the face-to-face return, an online questionnaire was applied, via digital form, between July 26, 2023 and August 6, 2023. The invitation to take part in the survey came from sharing the link to the form on the WhatsApp[3] group of teachers from each institution, followed by a presentation on the purpose of the research and the Termo de Consentimento Livre e Esclarecido (Free and Informed Consent Form – TCLE), informing them of the confidentiality and secrecy of the data obtained. Participants remained anonymous

[3] WhatsApp: Application used to exchange instant text messages, as well as videos, photos and audios via an internet connection.

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

throughout the process. All the information presented here is only from teachers who have agreed to provide it. Fifty-six teachers from the two educational institutions took part in the study in equal proportions. Based on this information, we can draw parallels and identify the positive and negative points of the emergency use of technological resources in education due to the COVID-19 pandemic, as well as the transformations it has imposed after the return to the classroom. The results and discussions will be shown in the following section.



## 3 Results and Discussion

In order to get to know the research audience better, we asked some initial questions. We found that some teachers also occupy other positions within educational institutions, such as direction or coordination. It is worth noting that all members, regardless of their position, have had to use technology to a greater or lesser extent to work remotely during the COVID-19 pandemic. According to the survey, 49 (87.5%) members of staff were carrying out the role of teacher in the teaching and learning process.

Of the 56 responses obtained in the survey, 29 (51.8%) were from the EEEP and 27 (48.2%) from the federal public institution. The almost equal distribution of responses allowed both an overview, based on the total number of responses, and a case-by-case analysis. The data obtained will be presented in groups/subgroups, named as: general staff, which corresponds to the total number of teachers (56), EEEP teachers (29), teachers from the other institution (27), Base Comum Curricular[4] teachers (36) and teachers from the Technical Base[5] (20). In this way, it will be possible to draw parallels between the two educational institutions and the subgroups formed, highlighting the similarities and differences based on the responses collected.

As the two institutions offer professional courses integrated with high school, they have teachers assigned to teach propaedeutic subjects (Base Comum Curricular –

[4] Base Comum (Common Base) – Subjects on the high school curriculum.
[5] Technical Base – Subjects for the professional course integrated with high school.

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Common Curricular Base) and teachers focused on the technical subjects of the courses offered. The EEEP offers technical courses in electromechanics, information technology, multimedia and audio and video production; the other institution offers technical courses in information technology, agriculture and the environment, as well as undergraduate courses in rural education and agroecology and subsequent courses in fish farming and environmental management.



Technical subjects are generally more active with technological resources and, because of this, they are indispensable for understanding the overall picture of the data obtained. The EEEP, because it only offers professional high school courses, has a higher number of teachers focused on technical subjects, which is reflected in the data obtained in our research. On the other hand, the federal institution, which provides undergraduate higher education courses, technical courses integrated with high school, and subsequent technical courses, has a greater number of teachers focused on the technical base.

The age group of students is an important parameter for understanding the acceptance of new technologies in education. An audience that has had more contact with technology is likely to find it easier to learn and use a new tool, incorporating it into their activities; on the other hand, those who have had little or no contact with technological resources to mediate the teaching and learning process are resistant. Regardless of this resistance or ease, the pandemic has forced the use of technology, being a simpler and less stressful process for a portion of teachers and students. Corroborating this fact, the survey showed that half of the teachers in the 25 to 34 age bracket, who are 15 (26.8%), followed by teachers between 35 and 45, who total 28 (50%), said they were more familiar with the use of technological resources and the internet, resulting in 76.8% of the total number of teachers who took part in the survey.

After these initial questions, we moved on to some questions aimed at our general objective, which is to understand how the teaching and learning process mediated by technologies took place during the COVID-19 pandemic in these institutions and whether this period led to changes/transformations for post-pandemic teaching. To do this, we asked questions in blocks, trying to find out what the use of technological

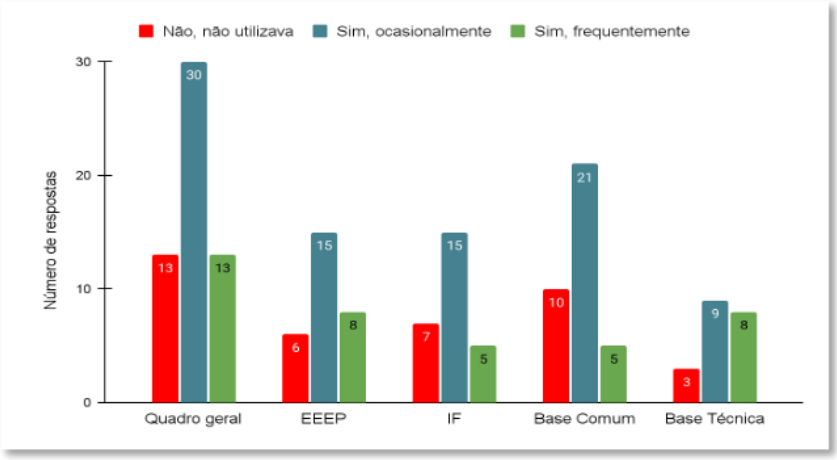
Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

tools was like before and during the pandemic, as well as how it is today, years after the WHO declared the pandemic over and the return to face-to-face classes.

When we asked about the use of ICTs to teach classes or support the teaching and learning process before the COVID-19 pandemic, 30 (53.6%) teachers said they only used them occasionally, 13 (23.2%) said they didn't and 13 (23.2%) said they used them frequently. Proportionally, when we look at the institutions separately, as well as the teachers who make up the common base, we see the same profile in the answers, with 53.6% of teachers saying they used it occasionally. As for the teachers who are part of the technical base (20 teachers), the number of teachers who said they frequently use ICTs as a teaching tool, 8 (38%), is equal to those who said they use them occasionally, 9 (43%), and 3 (14%) answered that they did not use them before the pandemic. These results may be a reflection of the fact that many technical courses use ICTs in the student training process, such as those in information technology, multimedia, audio and video production, offered by the institutions where we conducted the questionnaire. The survey showed that the teachers in these subgroups were already familiar with a range of ICTs even before the pandemic. Figure 1 shows a graph of the data obtained:



**Figure 1 – Use of ICTs by teachers before the COVID-19 pandemic**




Source: Authors (2023).

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

When we asked whether teachers had received any training on how to use ICTs in the classroom before the COVID-19 pandemic, the results were as follows: 34 (60.7%) replied that they had not received any training; 12 (21.4%) had received training, but it was insufficient; and 9 (16.1%) said they had received adequate training, i.e. it enabled them to use ICTs without difficulty. Proportionally, the same profile can be seen in the responses from the group of teachers from the EEEP and the common curricular base. However, when we look at the data for the group of teachers from the federal educational institution and the teachers from the technical base, we notice that there is an inversion, with the number of teachers who said they had received adequate training being higher than those who said they had received insufficient training, unlike what was observed in the other groups. It is worth noting that at the federal institution we had a similar number of teachers from the technical base to those from the common curricular base, and that a considerable number of teachers from the technical base claimed to use ICTs frequently or occasionally, a fact that may be related to the greater use of ICTs by this group of teachers, as indicated previously.



Another question raised to investigate the use of ICTs before the pandemic was which ones the teachers used to employ in the teaching and learning process. Both in the general picture and in the subgroups of trained teachers, we have the same profile of responses in proportion. Teachers used file-sharing tools, social networks and communication applications to a greater extent. Still prominent in the list of ICTs used by teachers before the pandemic were online learning platforms and videoconferencing platforms, among others.

After the block of questions on the use of ICTs before the COVID-19 pandemic, we moved on to the period during which the pandemic lasted. We know that the world has been taken by surprise by the pandemic and that sectors of society have had to reorganize themselves to carry out their activities in the face of the chaos that has been created by the presence of an unknown and deadly virus. The EEEP and the federal educational institution where this research was carried out “closed” its physical doors to the community, but continued to provide support to students, using the most varied

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

technological resources. We then asked whether the teachers had received any kind of training to use ICTs in the teaching and learning process during the COVID-19 pandemic.

Generally speaking, the answers most often cited by teachers point to the lack of training during this period, forcing them to learn how to use ICTs on their own. Although some reported having had training, they did not consider it sufficient for them to be able to use these technologies well. This profile of responses is reflected when we look at the two institutions individually and at the common curricular base teachers. A small difference can be seen when analyzing the data for teachers from the federal educational institution and the technical base, where the number of affirmative answers regarding receiving adequate or superficial training is equal to that of those who have not received it. This difference may also be related to these teachers' greater contact with technological tools in the development of their subjects, even before the pandemic.



The fact that, in the same educational institution, or in the same group of teachers, some say that they have received adequate training and others have not may cause some surprise, but what we saw was a great deal of cooperation between peers in terms of cooperation/sharing knowledge, given the delay in an institutional position to this end. This explains the divergent answers given by teachers who felt helpless by their institutions during the pandemic. Barberia, Cantarelli and Schmalz (2021) found that remote education programs, adopted by state and municipal governments, were delayed and did not guarantee access to technologies that encourage learning, interaction and supervision of students remotely.

We asked again about the use of ICTs in the teaching process by teachers, now during the pandemic, as we had done previously for the pre-pandemic period. As we have seen, before the pandemic, the use of ICTs was characterized by the predominance of social networks, communication applications and file sharing tools; during the pandemic, teachers began to use other ICTs more frequently, such as videoconferencing platforms and online learning platforms, as well as greater use of file-sharing tools and communication applications. This reflects the use of these tools, which have been so widespread during the pandemic, to mediate meetings in real time (synchronous) and

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

bring teachers and students closer together. The same profile of responses is repeated to a lesser extent when we look at the data by the institution surveyed and by the curricular basis to which the teachers belong.

Although the two educational institutions have taken initiatives to continue with the task of bringing the school to their students' homes in a virtual space, mediated by technologies, this process has not been simple. Each student and teacher had unique barriers that contributed to a complex adaptation to the new routine imposed by the pandemic. Rodrigues *et al*. (2021) interviewed teachers from different cities in Brazil and found that the pandemic aggravated social inequality in access to remote education and led teachers and students to face difficulties in adapting to new teaching and learning processes. Considering the findings presented in Rodrigues, we asked the teachers at the two institutions about the difficulties and challenges they have faced in teaching during the pandemic.



Table 1 gives an overview of the answers given by teachers at the two institutions. One of the challenges faced by the institutions under study was the limited access to the internet by students, reported by 42 (75%) of the teachers. Another difficulty at the time was maintaining student engagement and participation in synchronous meetings, reported by 40 (71.4%) of the teachers, followed by the lack of equipment for students, reported by 34 (60.7%) of the teachers. The following are also pointed out as neuralgic points of the pandemic period in ICTs-mediated teaching: i) the lack of adequate training in the use of digital tools, by 28 (50%) of the teachers, ii) difficulties in adapting face-to-face activities to the digital environment, by 27 (48.2%) of the teachers, iii) work overload, by 26 (46.4%) of the teachers, iv) technical difficulties in using digital platforms and tools, by 24 (42.9%) of the teachers, v) difficulties in finding digital content aligned with the curriculum, by 20 (35.7 %) of the teachers, among others. Added to this, a gigantic apprehension about the contagion of the disease, which was killing hundreds of people a day, caused teachers and students to become physically and mentally ill. Souza (2021) found that teachers had to adapt to a new teaching format that

demanded great technological skills from them, while facing long working hours, mental fatigue and emotional fragility.

**Table 1 – Main challenges faced by teachers when using ICTs in teaching during the COVID-19 pandemic period**

| Challenges faced by teachers in teaching during the pandemic | QTD / (%) |
|---|---|
| Limited internet access by students | 42 (75.0%) |
| Difficulty in maintaining student engagement and participation | 40 (71.4%) |
| Lack of equipment (computers, tablets, etc.) for students | 34 (60.7 %) |
| **Challenges faced by teachers in teaching during the pandemic** | **QTD / (%)** |
| Lack of adequate training in the use of digital tools | 28 (50.0%) |
| Lack of financial resources to purchase equipment and quality internet access | 27 (48.2%) |
| Difficulty in adapting face-to-face activities to a digital format | 27 (48.2%) |
| Work overload | 26 (46.4%) |
| Technical difficulties in using digital platforms and tools | 24 (42.9%) |
| Difficulty in finding quality digital content aligned with the curriculum | 20 (35.7%) |
| Resistance or lack of institutional support for the adoption of digital technologies in teaching | 10 (17.9%) |
| Other | 1 (1.8%) |

Source: Authors (2023).

Once the most difficult period of the pandemic was over, schools returned to in-person teaching. But what about school in the post-pandemic world? Will we take advantage of the learning acquired in such a painful and intense way, bringing the school closer to the digital world, or will we regress to the previous times?

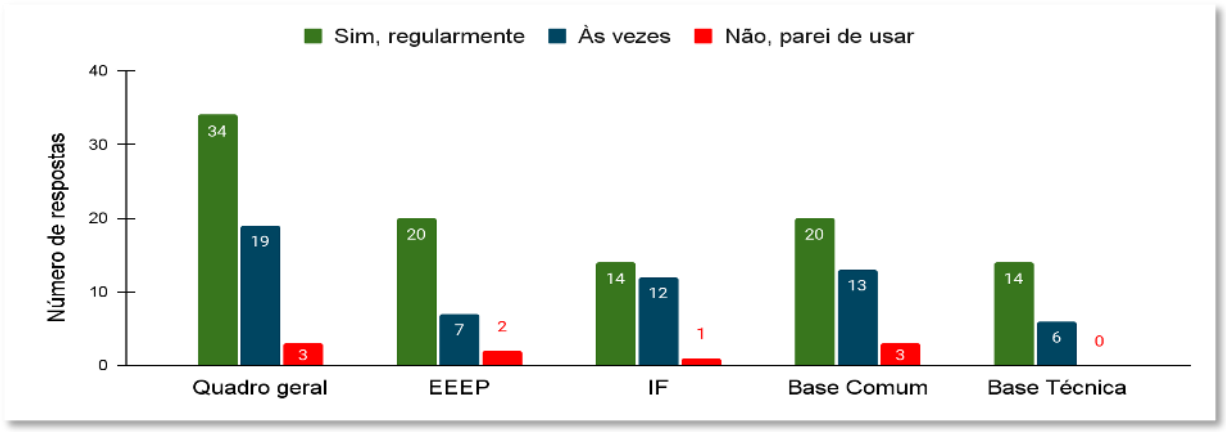
To find out how the teachers used ICTs in the post-pandemic period, we asked them if they continued to use ICTs in their teaching practices after returning to in-person teaching. Figure 2 shows the data for this question. In general terms, taking into account the total number of answers to this question, 34 (60.7%) teachers answered that they continue to use ICTs regularly, 19 (33.9%) of the teachers used them sometimes and only 3 (5.4%) of the teachers who answered the question said that they had stopped using ICTs in their practices, according to them due to the lack of an adequate technological structure in the work environment, a preference for traditional methods, among other reasons.



Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

This scenario is also repeated when we look at the data for individual institutions and for the group of common curricular base teachers. As for the teachers who make up the technical base, none said they had stopped using ICTs in their teaching practices, most continue to use them regularly and the rest use them occasionally. The scenario outlined by the data from this questionnaire shows that teachers who used ICTs in the teaching process during the pandemic continue to use these tools in their post-pandemic practices, reverberating the digital learning acquired by teachers during the troubled period of the COVID-19 pandemic and, indirectly, showing that these tools can be allies in the teaching and learning process.

**Figure 2 – Use of ICTs by teachers in their teaching practices post COVID-19 pandemic**




Source: Authors (2023).

When asked which tools teachers continue to use after the end of the pandemic and the return to face-to-face teaching, the following stood out: i) online collaboration tools, ii) social networks for educational purposes, iii) online learning platforms, iv) interactive resources, among others. We observed a similar profile/relationship of responses from both institutions, as well as from the teachers who make up the common curricular base and the technical base.

Another question raised in the research was what challenges teachers are facing when using ICTs in post-pandemic teaching. Silva (2020) argues that teachers, students

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

and families were not prepared for the sudden switch to remote education, and that continuing teacher training is necessary to develop competencies and skills to face future crises. Some well-known problems continue to hamper the implementation of ICTs in teaching practices, such as: i) difficulty in keeping students engaged in online activities, reported by 40 (75.5%) of the teachers, ii) lack of adequate access to the internet and mobile devices, reported by 32 (60.4%) of the teachers, iii) the need for additional training in order to use technology effectively, reported by 22 (41.5%) of the teachers, iv) difficulty in finding quality digital resources, reported by 12 (22.6%) of the teachers, among others.



Even in the face of these difficulties, teachers continue to use ICTs, which they have used in the context of the pandemic. We then asked about the reasons for continuing to use ICTs in the post-pandemic scenario. Among the reasons listed by teachers are: i) enrich the teaching and learning process, 44 (84.6%), ii) expanding access to educational resources, 37 (71.2%), iii) facilitating communication with students and their families, 34 (65.4%) and iv) preparing students for today's digital world, 30 (57.7%), among others. It can be seen that the teachers at both educational institutions see ICTs as allies in the teaching process, when they highlight the advantages they can gain from using these resources. In this sense, Aguiar, Camargo-Cruz and Resende (2021) highlighted the challenges and perspectives for rethinking basic education in Brazil in the post-pandemic, emphasizing the need for planning, evaluation, monitoring and redirection of face-to-face teaching.

Transformation in education also requires changes in the school environment. And what do we find when we return to in-person teaching? We asked the teachers if, when they returned to face-to-face teaching, they found the teaching institution better prepared for teaching mediated by ICTs. To this question, 27 (50.9%) teachers answered that they had noticed changes, but in a simple way that didn't have a major impact on the use of technology. Another 13 teachers (24.5%) answered that yes, there have been significant improvements in internet access and infrastructure that will provide better use of digital information technologies, and another 13 teachers (24.5%) answered that no, there have been no significant changes to support teachers in the use of ICTs. Carvalho

*et al*. (2023) in their study found that, despite some improvements in ICTs in Brazilian public schools, there was no evidence of resources inherited from these technologies as a legacy of government policies related to education in the COVID-19 period.

In an attempt to understand whether the use of ICTs will continue on a permanent basis in teaching practices, we asked a series of questions to probe teachers' opinions and identify the degree of importance and credibility they are giving to the use of technologies. We first asked what elements they considered essential to ensure the successful continuation of the use of ICTs in teaching. Among the answers most cited by teachers are: i) investment in the technological structure of schools, 50 (89.3%), ii) equal access to the internet and mobile devices for all students, 51 (91.2%), iii) training and ongoing support for educators, 46 (82,1%), iv) development of public policies to encourage the use of technology, 42 (75%), among others. In this sense, Carneiro *et al*. (2020) pointed out the need for digital inclusion policies to reduce regional inequalities in internet access, a necessary condition for the success of any distance learning strategy, while Santos (2020) argued that the Brazilian government did not effectively use digital technologies to support public school students during the pandemic, leading to increased social inequality and reduced learning opportunities.



Another question raised was what advantages teachers identified in the continuous use of ICTs in education. The most cited answers were: i) access to more diverse and up-to-date educational resources, ii) facilitating communication and collaboration between students and educators, iii) the possibility of personalizing learning for students, iv) flexible working hours and v) greater student engagement in school activities, among others.

We then asked whether the use of ICTs can contribute to improving the quality of teaching in Brazil. To this question, 38 (67.9%) teachers answered yes, to some extent, 17 (30.4%) answered yes, definitely, and only 1 (1.8%) answered that they don't believe it makes a significant difference. We emphasize here the significant number of teachers who answered yes, definitely and yes, to some extent, which together total 55 (98.3%) of

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

the answers collected, which shows that teachers see ICTs as strong allies in the teaching process, providing learning opportunities.

Another aspect of the questions concerns inclusion through ICTs in educational spaces. The teachers were asked whether the use of ICTs can promote a more inclusive and accessible education. Of the total responses, 50 (89.2%) said yes, technologies can reduce barriers and reach more students, while 6 (10.7%) said no, technologies are not capable of promoting truly inclusive and accessible education. Finally, we asked the teachers if the use of ICTs is essential for the future of education: 33 (58.9%) of them said that yes, ICTs are essential for keeping up with changes in society and the job market; and 23 (41.1%) said yes, but they should be used in a complementary way to traditional practices. Another interesting fact in this research was that we didn't get any responses opposing the use of ICTs, showing the need to have an education linked to the technological world in the future.



It is worth noting that economic and social factors have an impact on the pedagogical use of ICTs. In this sense, Branco, Adriano and Zanatta (2020) pointed out that the main obstacles to the implementation of digital tools in classrooms during the COVID-19 pandemic were the lack of materials and technological equipment in schools; while Assis *et al*. (2019) point to the importance of training teachers in the use of digital technologies for teaching and management, emphasizing the role of universities in facilitating this transformation.

## 4 Conclusions

The COVID-19 pandemic has brought a series of challenges and at the same time possibilities in the field of education. There have been many reports in the literature about the experiences of teachers in educational institutions during this period, highlighting the positive and negative points in multiple scenarios in Brazil, which has unique characteristics among its regions and states that imply specific problems and require targeted measures. The chaotic context in which education professionals have

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

been exposed during the COVID-19 period has undoubtedly been one of the most challenging in recent decades, in which well-known problems such as the lack of support and infrastructure in schools to offer education linked to technology, unequal access to technological resources due to the different financial conditions of students and the lack of teacher training to use ICTs have been exposed on the national scene.



The two institutions researched in this paper had specific difficulties related to the local and regional context. The EEEP, being located in a large urban center with quality internet access for most teachers and students, quickly devised strategies to maintain the school calendar and mediate teaching and learning through ICTs, managing to reach almost all of its audience. As for the federal educational institution located in a rural area surrounded by rivers and forests, where quality internet is not available, even for those with better financial conditions, it took longer to organize, since the students are from communities that do not have internet and cell phone signal available, leading the institution to mix activities mediated by ICTs and the making of printed modules for those students who could not access activities digitally. These difficulties caused a delay in the institution's academic calendar, which returned to normal after the pandemic and a considerable number of students were unable to keep up with the proposed activities.

Despite the numerous difficulties, educational institutions have not stopped serving their public, creating strategies to mitigate the impacts generated by the absence of face-to-face classes. There has been a significant change in the use of new technologies by teachers during the pandemic period, which continues to this day, showing that the tools used in emergency remote teaching can continue to be part of teaching practices, becoming allies in the teaching and learning process.

The pandemic has forced teachers to rethink their teaching practices and adapt to new challenges, including technological and social barriers. For the education of the future, the teachers believe that ICTs are essential to make education more accessible and inclusive, but that in order to do this, it is necessary: i) investment in technological infrastructure in schools, ii) equal access to the internet and mobile devices for all students, iii) training and ongoing support for education professionals and iv)

development of public policies that guarantee the availability and encourage the use of technologies in education. The lack of support for integrating technology into their practice represents a threat to educators' desires to permanently change and support a transition to ICTs-mediated teaching and learning.



The research portrayed a panorama of potentialities experienced by the teachers of two public educational institutions during the COVID-19 pandemic period and which may have been different from countless others that went through the same situation with their own specificities, but it makes us reflect on how far we need to go to offer quality education mediated by technological resources. We hope that this research can generate concerns and provide opportunities for similar studies and that, based on them, we can mobilize for a transformation in the reality of Brazilian public schools through the use of digital technologies.

## References

AGUIAR, D. R. C.; CAMARGO-CRUZ, P. E. A.; RESENDE, F. G. **Efeitos da Pandemia COVID-19 na Educação Básica**: Desafios e Perspectivas para o século XXI. Fórum Ambiental da Alta Paulista. v. 17, n. 1, 2021.

ASSIS, T.; SANTOS, J. V.; BARBOSA, J. F. S.; MARTINS, F. R. N.; SILVA, A. A. Formação de professores da EJA para uso de TDIC no ensino e gestão: uma experiência da extensão universitária. *In:* Congresso Brasileiro de Informática na Educação, 8., 2019, Brasília. **Anais** [...]. Porto Alegre: Sociedade Brasileira de Computação, 2019, p. 178-186. DOI: https://doi.org/10.5753/cbie.wie.2019.178. Disponível em: https://sol.sbc.org.br/index.php/wie/article/view/13166/13019. Acesso em: 23 set. 2024.

BALOCH, S.; BALOCH, M. A; ZHENG, T.; PEI, X. The Coronavirus Disease 2019 (COVID-19) Pandemic. **The Tohoku Journal of Experimental Medicine**, [*S.l.*], v. 250, n. 4, p. 271–278, 23 abr. 2020. Disponível em: https://www.jstage.jst.go.jp/article/tjem/250/4/250_271/_pdf/-char/en. Acesso em: 23 set. 2024.

BARBERIA, L. G.; CANTARELLI, L. G. R.; SCHMALZ, P. H. S. S. An Assessment of Brazilian States and State Capitals Remote Public Education Programs during the COVID-19 Pandemic. **SSRN Electronic Journal**, [*S.l.*], p. 1- 38, 02 fev. 2021. Disponível

em: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3776366. Acesso em: 10 ago. 2024.

BRANCO, E. P.; ADRIANO, G.; ZANATTA, S. C. Educação e TDIC: contextos e desafios das aulas remotas durante a pandemia da COVID-19. **Debates em Educação**, Maceió, v. 12, n. Especial 2, p. 328-350, 30 dez. 2020. Disponível em: https://www.seer.ufal.br/index.php/debateseducacao/article/view/10712. Acesso em: 23 set. 2024.



BRASIL. Ministério da Educação. **Base Nacional Comum Curricular**. Brasília, DF: MEC, 2018.

CARNEIRO, L. de. A.; RODRIGUES, W.; FRANÇA, G.; PRATA, D. N. Uso de tecnologias no ensino superior público brasileiro em tempos de pandemia COVID-19. **Research, Society and Development**, [*S.l.*], v. 9, n. 8, p. e267985485, 4 jul. 2020. Disponível em: https://www.researchgate.net/publication/342703386_Uso_de_tecnologias_no_ensino_superior_publico_brasileiro_em_tempos_de_pandemia. Acesso em: 23 set. 2024.

CARVALHO, F. S. de.; PILATTI, L. A.; CARVALHO, H. A. de.; LIMA, I. A de. Information and Communication Technology in Brazilian Public Schools: A Sustainable Legacy of the Pandemic? **Sustainability**, [*S.l.*], v. 15, n. 6462, p. 1-14, 11 abr. 2023. Disponível em: https://www.mdpi.com/2071-1050/15/8/6462. Acesso em: 23 set. 2024.

CASTRO, M. P. P. P. de.; SCHIMIGUEL, J.; SIMÕES, G. S.; AMARAL, C. L. C.; SPINARDI, J. I.; FERRAZ, M. C.; SILVEIRA, I. F. Survey de tecnologias digitais de informação e comunicação utilizadas por professores durante a pandemia da COVID-19. **Research, Society and Development**, [*S.l.*], v. 11, n. 6, p. e42611629377, 2 maio 2022. Disponível em: https://www.researchgate.net/publication/360327192_Survey_de_tecnologias_digitais_de_informacao_e_comunicacao_utilizadas_por_professores_durante_a_pandemia_da_COVID-19. Acesso em: 23 set. 2024.

DIAS-TRINDADE, S. D.; HENRIQUES, S.; CORREIA, J. D. Teaching during the Pandemic: An Exploratory Study in Portuguese and Brazilian Secondary Education Teachers. **International Journal of Information and Education Technology**, [*S.l.*], v. 13, n. 2, p. 344–354, 1 jan. 2022. Disponível em: https://repositorioaberto.uab.pt/bitstream/10400.2/12327/1/2022_Teaching%20during%20the%20pandemic.pdf. Acesso em: 23 set. 2024.

GIL, A. C. **Métodos e técnicas de pesquisa social.** 6. ed. São Paulo: Atlas, 2008.

KUMAR, A.; SINGH, R.; KAUR, J.; PANDEY, S.; SHARMA, V.; THAKUR, L.; SATI, S.; MANI, S.; ASTHANA, S,; SHARMA, T. K.; CHAUDHURI, S.; BHATTACHARYYA, S.; KUMAR, N. Wuhan to World: The COVID-19 Pandemic**. Frontiers in Cellular and**

**Infection Microbiology**, [*S.l.*], v. 11, n. 596201, 30 mar. 2021. Disponível em: https://www.frontiersin.org/journals/cellular-and-infection-microbiology/articles/10.3389/fcimb.2021.596201/full. Acesso em: 23 set. 2024.

MACEDO, R. A. de. Educação e pandemia de COVID-19: um olhar sobre as desigualdades educacionais. **Revista de sociología de la educación**, [*S.l.*], v. 16, n. 2, p. 177–185, 2023. Disponível em: https://www.researchgate.net/publication/371201836_Educacao_e_pandemia_de_COVID-19_um_olhar_sobre_as_desigualdades_educacionais. Acesso em: 23 set. 2024.



REZAEI, N. (ED.). **Coronavirus Disease - COVID-19**. Cham: Springer International Publishing, 2021.

ROCHA, F. S. M. da.; LOSS, T.; ALMEIDA, B. L. C.; MOTTA, M. S.; KALINKE, M. A. O Uso de Tecnologias Digitais no Processo de Ensino durante a Pandemia da COVID-19. **Interacções,** [*S.l.*], v. 16, n. 55, p. 58–82, 30 dez. 2020. DOI: 10.25755/int.20703. Disponível em: https://revistas.rcaap.pt/interaccoes/article/view/20703. Acesso em: 23 set. 2024.

RODRIGUES, A.; SILVA. G. C. G. da.; NASCIMENTO, J. G. de. V.; SEVERINO, K. L.; ROLLIN, M.; PRIME, M.; MORAES, M. A. de. O.; CÊIA, M. das. G. da. S., SANTOS, M. S.; MOTA, R. D.; TIGOURDI, S. Educação básica e pandemia: Entrevista com professores de quatro países / Basic Education and pandemic: interview with teachers from four countries. **Pensares em Revista**, São Gonçalo, n. 20, p. 80-104, 5 jan. 2021. Disponível em: https://www.e-publicacoes.uerj.br/pensaresemrevista/article/view/56920. Acesso em: 23 set. 2024.

SANTOS, G. M. T. dos. Tecnologías digitales frente al escenario del COVID-19: (in)efectividad del derecho educativo brasileño? **Brazilian Journal of Policy and Development**, [*S.l.*], v. 2, n. 3, p. 35-54, 2020. Disponível em: https://bio10publicacao.com.br/brjpd/article/view/270/150. Acesso em: 23 set. 2024.

SANTOS, M. N dos.; SANTOS, A dos.; BALBINOT, C.; NERLING, M. A. M. Análise sobre o uso de recursos tecnológicos em um contexto de aulas síncronas e assíncronas. **Ensino e Tecnologia em Revista**, Londrina, v. 5, n. 2, p. 125–143, 11 nov. 2021. Disponível em: https://periodicos.utfpr.edu.br/etr/article/view/14034. Acesso em: 23 set. 2024.

SILVA, C. C. S. C. da.; TEIXEIRA, C. M. de. S. O uso das tecnologias na educação: Os desafios frente à pandemia da COVID-19. **Brazilian Journal of Development**, [*S.l.*], v. 6, n. 9, p. 70070–70079, 18 set. 2020. Disponível em: Acesso em: 23 set. 2024. Disponível em: https://abrir.link/hOmGC. Acesso em: 23 set. 2024.

SILVA, E. J. L. da.; ALENCAR, M. F. dos. S.; CARVALHO, W. L. de. La Educación superior durante la pandemia de COVID-19 en Brasil: factores que influyeron en la participación de los estudiantes. **Research in Education and Learning Innovation Archives**, [*S.l.*], n. 29, p. 102–102, 15 jul. 2022. Disponível em: https://turia.uv.es//index.php/realia/article/view/23738. Acesso em: 23 set. 2024.

SOUZA, K. R.; KERBAUY, M. T. M. Abordagem quanti-qualitativa: superação da dicotoamia quantitativa-qualitativa na pesquisa em educação. **Educação e Filosofia**, Uberlândia, v. 31, n. 61, p. 21–44, 30 abr. 2017. Disponível em: https://seer.ufu.br/index.php/EducacaoFilosofia/article/view/29099. Acesso em: 23 set. 2024.

SOUZA, T. S. de. Desafios do professor na pandemia. **Revista Gênero e Interdisciplinaridade**, [*S.l.*], v. 2, n. 5, 3 dez. 2021. Disponível em: https://www.periodicojs.com.br/index.php/gei/article/view/514/391. Acesso em: 23 set. 2024.

VALÊNCIA, D. N. Brief Review on COVID-19: The 2020 Pandemic Caused by SARS-CoV-2. **Cureus**, v. 12, n. 3, 24 mar. 2020. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7179986/. Acesso em: 23 set. 2024.

WOOD, M.; WELCH, C. Are “Qualitative” and “Quantitative” Useful Terms for Describing Research? **Methodological Innovations Online**, [*S.l.*], v. 5, n. 1, p. 56–71, abr. 2010. Disponível em: https://www.researchgate.net/publication/228287852_Are_'Qualitative'_and_'Quantitative'_Useful_Terms_for_Describing_Research. Acesso em: 23 set. 2024.



[i] **Cristiano Balbino da Silva**, ORCID: https://orcid.org/0000-0003-3394-4393
Instituto Federal de Educação, Ciência e Tecnologia do Estado do Pará, *campus* Breves
Doutor e Mestre em Física. Licenciado em Física. Especialista em docência com ênfase na educação profissional. Professor do Ensino Básico, Técnico e Tecnológico do Instituto Federal de Educação, Ciência e Tecnologia do Pará – *Campus* Breves.
Authorship contribution: conceptualization, formal analysis, data curation and writing – first draft.
Lattes: http://lattes.cnpq.br/2076892488644749
*E-mail*: cristiano.silva1@prof.ce.gov.br

[ii] **Denilson Cursino de Oliveira**, ORCID: https://orcid.org/0000-0002-2002-5905
Instituto Federal de Educação, Ciência e Tecnologia do Estado do Ceará, *campus* Maranguape
Doutor em Informática Aplicada (UNIFOR). Mestre em Informática Aplicada (UNIFOR). Bacharel em Ciências da Computação (UNIFOR). Docente do Instituto Federal de Educação, Ciência e Tecnologia do Ceará (IFCE/*Campus* Maranguape).
Authorship contribution: formal analysis, methodology and supervision.
Lattes: http://lattes.cnpq.br/3976161784367385
*E-mail*: denilson.oliveira@ifce.edu.br

Rev. Pemo, Fortaleza, v. 7, e14077, 2025
DOI: https://doi.org/10.47149/pemo.v7.e14077
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

[iii] **Maria de Lourdes da Silva Neta**, ORCID: https://orcid.org/0000-0002-3726-4806
Instituto Federal de Educação, Ciência e Tecnologia do Estado do Ceará, *campus* Maranguape
Doutora em Educação (PPGE/UECE). Mestra em Educação (PPGE/UECE). Graduada em Pedagogia e Administração (UECE). Docente do Instituto Federal de Educação, Ciência e Tecnologia do Ceará (IFCE/*Campus* Maranguape).
Authorship contribution: formal analysis, supervision, writing – proofreading and editing.
Lattes: http://lattes.cnpq.br/5301006494209944
*E-mail*: lourdes.neta@ifce.edu.br



**Responsible publisher:** Genifer Andrade.

***Ad hoc* experts:** Antônio Luís Parlandin dos Santos, Gizeuda de Lavor da Paz and Juliana Roberta Paes Fujihara.

**How to cite this article (ABNT):**
SILVA, Cristiano Balbino da; OLIVEIRA, Denilson Cursino de; SILVA NETA, Maria de Lourdes da. TDICs na educação: um olhar para além da pandemia de covid-19. **Rev. Pemo**, Fortaleza, v. 7, e14077, 2025. Available at: https://revistas.uece.br/index.php/revpemo/article/view/14077

Received on September 26, 2024.
Accepted on December 20, 2024.
Published on January 24, 2025.