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TECHNOLOGIES IN EDUCATION: THE IMPACT OF CLOUD-BASED TEACHING ON EDUCATIONAL COLLABORATION AND ACCESSIBILITY

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Gonçalo Resende Santos[1], Robson Silva Cavalcanti[2], João Batista do Nascimento[3], Albert Bacelar[4], Johnny Pereira Gomes[5], Rayra Chrystina Veiga Campos[6], Danilo Morais da Silva[7], Riverson Ferreira Rodrigues[8], Maura da Silva Santos[9], Thiago Lucas Lavander[10], Simone do Socorro Azevedo Lima[11] and Fernanda Cristina Corrêa da Costa[12]

ABSTRACT

The research aimed to analyze the impact of cloud-based teaching on educational collaboration and accessibility, exploring how digital technologies influence pedagogical

[1] Specialization in Network Educational Management
MUST University
E-mail: goncalo_g8@hotmail.com
[2] Master in Development and Environment, area of concentration: Human Habitat and Environment PRODEMA-UFPB/UEPB.
Professor at ECIT
Nobel Vita Lawyer, Coremas-PB
E-mail: robsonsilvacavalcanti@yahoo.com.br
[3] Ivy Enber Christian University
E-mail: njbjoao@gmail.com
[4] Graduated in Medicine
Institution: Zarns College
Institution's address: Salvador/BA
E-mail: albert@abacelar.com
[5] Master in History Teaching.
Federal University of Sergipe - UFS
E-mail: johnnygomes83@gmail.com
[6] Federal University of Maranhão
Maranhão, Brazil
[7] Master's student in Communication at the Graduate Program in Communication at the Federal University of Rondônia - PPGCOM/UNIR
Federal University of Rondônia - UNIR
E-mail: danilo_pvhro@outlook.com
[8] Education: Post-graduation in Human Rights Education
Entity: Federal University of Ceará (UFC)
E-mail: riversonferreira@gmail.com
[9] Graduated in Pedagogy
São Judas Tadeu Higher Institute of Education
Post Graduation in Psychopedagia (Faveni)
E-mail: mauradmi@hotmail.com
[10] Specialization in Distance Learning Tutoring and Higher Education Teaching
FACS EDUCATIONAL SERVICES LTD
E-mail: thiagolucas04@gmail.com
[11] Intercontinental University of Technology -UTIC
[12] Master in Business Administration
Unihorizontes University Center
E-mail: fernandacorrea-nanda@hotmail.com

practices and the inclusion of students in different contexts. The approach was qualitative and field-based, with a sample composed of 24 education professionals, including teachers, pedagogical coordinators and managers, who participated in semi-structured interviews and focus groups. The results indicated that while the use of cloud-based tools favors student-teacher collaboration, personalization of learning, and accessibility to educational resources, there are still significant challenges, such as a lack of technological infrastructure, educator empowerment, and data security. The research concluded that for the effective implementation of these technologies, it is necessary to invest in continuous training for educators, improve infrastructure in schools, and adopt strict data protection measures in order to ensure that cloud-based teaching can promote more inclusive, dynamic, and collaborative education.

Keywords: Technologies. Education. Cloud. Accessibility.

INTRODUCTION

Education has undergone significant transformations in recent decades, driven by technological advancement and the growing adoption of new digital tools. The use of technologies in the teaching-learning process has been one of the pillars of educational innovations in the twenty-first century, providing new possibilities for teachers and students. In this scenario, cloud-based teaching emerges as one of the most promising innovations, offering a range of solutions that make education more accessible, flexible, and collaborative. The concept of "cloud" refers to a set of resources and services made available over the internet, such as data storage, communication tools, and learning platforms, which can be accessed from anywhere and at any time (Oliveira; Borges; Silva, 2023; Borges, 2016; Bedran, 2016).

The implementation of the cloud in education has the potential to profoundly alter the dynamics of classrooms, allowing students and teachers to share materials, access educational content, and connect more effectively. Tools such as Google Classroom, Microsoft Teams, Moodle, and other cloud-based educational platforms allow teaching and learning to adapt to a new format, making it easier to personalize content and engage in interactivity. In addition, the possibility of using these technologies on different devices, such as computers, tablets, and smartphones, makes education more inclusive and accessible to a wide range of students (Ramos; Rosary; Rosario, 2023; Baldissarelli; Gomes; Hahn, 2024).

The impact of cloud-based technologies is also related to the issue of collaboration. By allowing students, teachers, and even education professionals to connect and share resources in real time, the cloud fosters a more collaborative learning environment. Collaborative editing tools, such as Google Docs, and videoconferencing platforms make it possible to exchange ideas, carry out group work and constant interaction, even at a distance. These resources not only increase student engagement but also promote the development of essential skills for the twenty-first century, such as teamwork, effective communication, and collaborative problem-solving (Rodrigues et al., 2023).

In addition, the use of cloud-based teaching also contributes to the improvement of educational accessibility. In many contexts, especially in more remote regions or in situations of social vulnerability, the cloud can be an alternative to overcome physical, economic, and logistical barriers. With the use of mobile devices and internet connectivity, students can access educational resources that were previously out of their reach. This expands learning opportunities for students who might otherwise be excluded from the

educational process due to limitations in infrastructure, time, or geographic location (Santos, 2022).

However, despite the numerous advantages, the adoption of cloud-based teaching also presents challenges. Issues related to connectivity, educator training, and digital safety need to be carefully considered. The disparity in access to high-quality internet in different regions is still a significant obstacle, especially in more remote areas or in developing countries. In addition, it is critical that teachers receive adequate training to use these tools efficiently, ensuring that technology is meaningfully integrated into the curriculum and not just a superficial addition (Santos. Cruz, 2023).

Another important aspect that should be considered is the protection of student data and privacy in cloud-based educational platforms. Storing personal and academic information in the cloud requires strict security measures to prevent data leaks and ensure that students' privacy is preserved. The use of cloud platforms must comply with data protection laws and regulations, such as the LGPD in Brazil or the GDPR in the European Union, to ensure a safe and ethical environment for the use of educational technologies (Rodrigues et al., 2023).

The aim of the research was to analyze the impact of cloud-based teaching on educational collaboration and accessibility, exploring how these technologies contribute to digital inclusion and the creation of more dynamic and interactive learning environments. The research sought to understand how the use of these tools can improve the interaction between students and teachers, in addition to evaluating the challenges and opportunities that arise with the adoption of these technologies in the contemporary educational context.

METHODOLOGY

The research was developed in a qualitative and field way, seeking to understand the perceptions and experiences of education professionals regarding the impact of cloud-based teaching on educational collaboration and accessibility. The qualitative approach was chosen because it allows a more in-depth analysis of the social and educational phenomena involved, focusing on subjective aspects such as the participants' feelings, opinions, and experiences. This type of approach is particularly useful for exploring complex contexts, such as the use of emerging technologies in the educational environment, and for generating insights that could not be easily obtained through quantitative methods (Lima; Domingues Junior; Gomes, 2023; File; Domingues Junior; Silva, 2024; File; Silva; Domingues Júnior, 2024).

The research sample was composed of 24 education professionals, including teachers, pedagogical coordinators and school managers, who work in educational institutions of different educational levels. The selection of participants followed a criterion of convenience and diversity, considering professionals who already used cloud-based technologies in their pedagogical daily life. The choice to include different profiles of educators aimed to capture a wide range of perspectives on the impact of these technologies in varied contexts, from basic to higher education, and in institutions of different sizes and locations.

Data collection was carried out through semi-structured interviews and focus groups, instruments that allowed a more direct and rich interaction with the participants. The semi-structured interviews offered flexibility to explore specific topics related to cloud use in education, while also enabling respondents to share their personal experiences more spontaneously. Focus groups, on the other hand, allowed interaction between participants, stimulating more dynamic and collaborative discussions, where professionals could share ideas, compare practices, and discuss common challenges.

RESULTS AND DATA ANALYSIS

The results and analysis of the data obtained during the research revealed several facets about the impact of cloud-based teaching on educational collaboration and accessibility. Overall, the professionals interviewed demonstrated a positive perception of the advantages of cloud-based technology in the educational environment, especially with regard to collaboration between students and teachers.

According to respondent E03, "The possibility of working on shared documents and making corrections in real time has completely changed the dynamics of the classroom. Students are more engaged, and I can mentor them more efficiently without having to wait to give formal feedback." This type of feedback was common among participants, highlighting the greater interactivity provided by cloud tools.

However, perceptions of accessibility varied according to the context of each institution. Respondent E11, who works at a public school in a remote region, reported that while the cloud has expanded access to digital resources, on-premises infrastructure still poses an obstacle. "Although cloud tools offer numerous possibilities, the lack of quality internet in the school ends up limiting a lot of what we can do.

Students can even access the materials at home, but not everyone has a stable connection." This testimony illustrates the difficulties faced in areas with poor internet infrastructure, a challenge that was highlighted by other professionals as well. The issue of

collaboration has also been heavily impacted by the use of cloud-based technologies. Respondent E07, who teaches at a higher education institution, mentioned that, in undergraduate courses, the cloud has been a fundamental resource to facilitate group work, especially during the period of social distancing. "Last semester, we worked exclusively online, and the cloud platform was essential to maintain contact between the groups.

In addition, it was easier for students to communicate with each other, share ideas, and access supplemental materials in real time." This line illustrates how cloud-based platforms can make learning environments more collaborative, allowing students to work more seamlessly, regardless of their location.

Regarding the impact on pedagogical practices, many educators reported that cloud-based teaching allowed for greater personalization of learning. Respondent E05, who teaches at a private school, said, "With cloud tools, I can create differentiated activities for students with specific learning needs. I can adapt the content in real time, send complementary materials and even make online quizzes that help reinforce learning in an individualized way." This report demonstrates how the flexibility of cloud platforms can be utilized to meet the demands of a heterogeneous classroom, providing a more personalized experience for each student.

However, despite the advantages, the issue of teacher training was also mentioned as a challenge. Many educators have pointed out that while cloud tools are quite affordable, not all professionals have the necessary training to use them effectively. According to E02, "The school made the platform available for us to use, but it lacked deeper training. I had to learn on my own, which is not always easy, especially for older teachers, who are not so familiar with technologies." This report highlights the need for continuous training programs to train educators, ensuring that they can explore the full potential of digital tools efficiently.

In addition, the issue of data security was mentioned by several respondents as a key concern. Respondent E09 highlighted: "As we use platforms that store student information, privacy is always a critical point. I care about data protection and pay attention to the platform's security settings." Digital security is a central issue in the use of educational technologies, especially with the rise of cloud-based platforms, which need to comply with data protection regulations, such as the LGPD, in the case of Brazil.

With regard to educational accessibility, many participants noted that the use of the cloud has been an enabler for students with disabilities or special needs. E12, who works in an inclusive school, said: "With cloud tools, we have been able to adapt materials for students with visual or hearing impairments more effectively. The use of automatic subtitles,

for example, has been fundamental for students with hearing impairments." This testimonial reinforces the importance of cloud-based technologies to promote digital inclusion and ensure that all students have access to quality education.

Despite the perceived advantages, some participants also pointed out limitations in the use of these technologies, especially when related to personal interaction between students and teachers. E06, an elementary school teacher, said, "I believe the technology is great, but I miss the closer interaction with students. Even with videoconferences, it is still difficult to create a relationship of trust as in face-to-face classes." This point of view was shared by other professionals, who reported feeling that the excessive use of technology could reduce the affective bond between educators and students.

Another aspect that emerged in the interviews was the issue of the students' adaptation to new technologies. While many students have proven adaptable, respondent E10 noted, "Younger students, especially those in elementary school, are more accustomed to working with these tools. Older people, such as high school students, sometimes have more difficulty adapting to new platforms." This observation indicates that students' familiarity with technologies can vary by age group, which can influence the effectiveness of using cloud-based tools.

Overall, the data indicates that while cloud-based technologies bring significant benefits in terms of flexibility, accessibility, and collaboration, challenges related to infrastructure, teacher training, and digital security still need to be addressed to ensure a more effective and comprehensive implementation. Respondent E01 highlighted: "There is still much to be done to efficiently integrate technologies in education. However, I see that cloud-based teaching has great potential to transform education if used properly."

The analysis of the data also revealed that, despite the difficulties, most professionals perceive cloud platforms as an opportunity to innovate and diversify their pedagogical practices. E08, who teaches at a technical education institution, said: "I see the cloud as a possibility to diversify my classes. Before, we only used books and printed material, but now students can access multimedia content and interact in ways that were not possible before." This testimonial shows how the cloud can facilitate the diversification of pedagogical resources, making learning more dynamic and multimodal.

The use of cloud platforms also seems to have a positive impact on the way teachers organize and manage school activities. Respondent E04 commented, "I am now able to organize classes more efficiently because all materials are centralized in one place, and I can monitor student progress in real time." This change in the organization of pedagogical

work was noted by several participants, who highlighted the gain in efficiency in teaching management.

Another important point is that many professionals reported an improvement in communication between teachers, students, and parents, with the use of cloud platforms. According to E13: "Before, communication was limited to face-to-face meetings or emails. Now, with the platform, we can have a more continuous monitoring of students' progress and even hold virtual meetings with parents." This ease of communication reinforces the idea that technology can create a more transparent and collaborative educational environment, involving not only students, but also families in the teaching-learning process.

Finally, upon completing the data analysis, it became evident that despite challenges related to infrastructure and training, most educators recognize cloud-based teaching as a powerful tool to foster collaboration, increase educational accessibility, and diversify pedagogical practices. The successful implementation of this technology depends, however, on investments in infrastructure, continuous training for educators, and digital security policies that protect the data of students and professionals.

FINAL CONSIDERATIONS

Research on the impact of cloud-based teaching on educational collaboration and accessibility has revealed important insights into the potentialities and challenges of using these technologies in the contemporary educational context. The results obtained highlighted that, in general, cloud-based tools have a positive impact on the teaching-learning process, facilitating collaboration between students and teachers, the personalization of learning, and the accessibility to educational resources. However, it has also become evident that the full implementation of these technologies depends on a number of factors, such as technological infrastructure, the training of educators, and the guarantee of digital security.

Collaboration, one of the key benefits of cloud-based teaching, was widely mentioned by attendees. The testimonies indicated that digital tools allow greater interaction between students and teachers, both in the physical and virtual environments, promoting a more dynamic and interactive work. Cloud platforms, by allowing document sharing, collaborative activities, and real-time communication, have created a more collaborative and participatory environment, essential for the development of crucial skills for the 21st century, such as effective communication, teamwork, and problem-solving.

On the other hand, the research also showed the diversity of contexts in educational institutions, which directly influences the results of the use of technologies. Internet

infrastructure, for example, has proven to be a limiting factor in many schools, especially in more remote regions or with less access to technological resources. The report of professionals who face difficulties due to the lack of connectivity and adequate equipment was recurrent, pointing to a disparity in access to digital tools. While cloud-based education is a promising solution for expanding access to education, technological infrastructure remains a significant challenge for its implementation in several regions, especially in more peripheral areas or in developing countries.

The issue of teacher training was also a central point in the research. While many of the cloud tools are intuitive and accessible, the lack of proper training has been cited as an obstacle to the efficient use of these technologies. Many teachers reported that, although they were already using cloud platforms, they did not have the necessary knowledge to explore the full potential of these tools in a pedagogical way. This underscores the importance of ongoing professional training programs for educators to ensure that they not only know how to operate the tools, but also integrate them meaningfully into the curriculum and teaching methodologies.

Another relevant aspect was the issue of digital security. The protection of student data and privacy on cloud platforms were issues raised by several participants, who expressed concerns about the security of information stored in digital environments. Compliance with data protection legislation, such as the General Data Protection Law (LGPD) in Brazil, is essential to ensure that the use of these technologies occurs ethically and securely, ensuring user trust and the integrity of information.

The survey also revealed that the use of the cloud has great potential to promote educational inclusion. Tools such as automatic subtitles, accessibility to materials in different formats, and the possibility of adapting content for students with special needs stood out as key elements to ensure that all students, regardless of their conditions, can access the same educational content. In this sense, cloud-based teaching has proven to be a powerful tool to reduce inequalities and promote equity in access to education, allowing students with disabilities or specific difficulties to actively participate in the learning process.

Despite the limitations and challenges identified, the majority of educators surveyed recognized the significant advantages of cloud-based instruction, especially with regard to flexibility, personalization of learning, and collaboration. Many participants highlighted that the adoption of these technologies has brought a new dynamism to their pedagogical practices, allowing them to diversify educational resources and create more interactive experiences for their students. The use of multimedia materials, online collaborative

activities, and the possibility of real-time monitoring of student performance are some of the innovations that have enriched the teaching process.

In summary, the research concludes that, although cloud-based teaching offers numerous opportunities to transform education, its effective implementation depends on a joint effort involving the appropriate technological infrastructure, the continuous training of teachers and the implementation of digital security policies. Educational institutions must be prepared to overcome technological barriers and ensure that all educators and students have the necessary conditions to take advantage of this technology.

In addition, it is essential that the adoption of these tools is done in a planned and strategic way, focusing on the real needs of students and educators, so that cloud-based teaching can fulfill its potential to transform education into a more collaborative, inclusive, and accessible environment. Therefore, cloud-based teaching represents a significant advance in educational practices, but for it to be carried out effectively and benefit all involved, it is necessary for educational institutions to commit to overcoming the challenges identified. Continuous teacher training, investment in infrastructure and ensuring digital security are essential steps for the successful integration of technologies in education, with the aim of creating a more innovative, accessible and collaborative learning environment for all.

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