The use of information and communication technologies (ICTs) as complementary methodology in the academic environment

ARTICLE

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Abstract
The growth in the use of technologies in the most diverse sectors of society has strengthened the debate in the educational area on the use of Information and Communication Technologies (ICTs). The main object of this work is to show the advantages of Information and Communication Technologies as a complementary support of the teaching methodology in the academic environment. For a better understanding of the subject, a study of the bibliographic research type was carried out. It is pointed out that such innovations announce new paths, without jeopardizing teaching planning or the student's path in their academic journey. The study concluded that the use of ICTs as an aid to teaching work brings advantages in academic training, allowing an education of authorship and co-authorship in a more flexible way, in a virtual environment generated by the use of technologies.
Keywords: Teacher. Education. Computing.

Uso das tecnologias da informação e comunicação (TICs) como metodologia complementar no ambiente acadêmico

Resumo
O crescimento do uso das tecnologias nos mais diversos setores da sociedade tem fortalecido o debate na área educacional do uso das Tecnologias da Informação e Comunicação (TICs). O objetivo principal deste trabalho é mostrar as vantagens das Tecnologias da Informação e Comunicação como apoio complementar da metodologia do docente no ambiente acadêmico. Para uma melhor compreensão do tema, foi realizado um estudo do tipo pesquisa bibliográfica. Aponta-se que tais inovações anunciam novos caminhos, sem prejuízo para o planejamento docente ou para o percurso do discente em sua jornada acadêmica. O estudo concluiu que o uso das TICs como auxiliar do trabalho docente traz vantagens na formação acadêmica, permitindo uma educação de autoria e coautoria de forma mais flexível, em um ambiente virtual gerado pelo uso das tecnologias.
Palavras-chave: Professor. Educação. Informática.

1 Introduction

The advance of technological innovations, especially in the early decades of this 21st century, has brought with it the peremptory need for society to adapt and review processes and concepts that were previously considered immutable in the way it organizes itself, works and communicates, at the risk of falling behind if it doesn't adapt to these technologies as tools for improvement. This has all been due to communication technologies that have been catalyzed exponentially by the Covid-19 pandemic, changing interpersonal relationships, work and, consequently, education.

The popularization of the internet has led to the emergence of ICTs (Information and Communication Technologies), which are integrations of technological resources such as equipment, programs and telecommunications. The function of these technologies is to automate, streamline and connect processes in a given environment with the world via a network of logical data (Bahiense; Moura; Silva, 2011).

Education, as a natural human process, has not been left out of this reality, so technological advances have become part of the process. Technology has enhanced the means of teaching and learning, allowing, among other things, Distance Education (DE) to take place in a more dynamic way and in less time, replacing old methodologies. These characteristics have been enhanced by the advent of the internet, which has enabled exponential advances in communications and learning. On the other hand, some teachers' pedagogical practices in the course of their work are at risk of becoming crystallized, because they remain traditional, with repetitive lessons that no longer attract students' attention. This can be due to various factors, such as a lack of resources, training and interest in using ICTs to build bridges and enrich the subject taught (Filho; Sales; Alves, 2020; Silva *et al.*, 2023).

It's worth considering that, unlike teachers, students are either digital natives or live in this technological environment. Therefore, they also want the school to keep up with the changes already taking place in an increasingly global society, technologically speaking, especially students in higher education. In this sense, the adoption of ICTs can speed up

educational processes, and can also bring teaching practice up to date, bringing new forms of interaction between basic knowledge and up-to-date knowledge. It can also help to improve lesson planning, as well as allowing students to be connected to many possibilities in the area of research and the construction of their own knowledge.

This article is justified by demonstrating the advantages of using technologies in the educational field, improving the teaching-learning process, mainly based on teacher training. Its aim is to present the advantages of using technologies as complementary support for the teacher's methodology in the academic environment, from the inclusion of technologies in the school environment to their use in the teacher's methodology.

This research begins with a brief history of educational technologies in Brazil, highlighting that the use of these tools for distance learning is expanding and that equitable access to these technologies is still a challenge in the country. The study then looks at the application and advantages of ICTs in education, highlighting the crucial role they play in transforming the teaching and learning process, providing teaching quality and versatility, as well as opportunities for more accessible education. Finally, it discusses the challenges in the use of ICTs by teachers, highlighting the training of these professionals as one of the main obstacles to be overcome in order to generate effective integration of these technologies into their teaching practices.

2 Methodology

This article is a bibliographical study. This type of research is usually directed throughout its development and does not seek to enumerate or measure events, nor does it use statistical instruments to analyze the data (Gil, 2002). This method consists of locating and consulting various sources of written information to collect general or specific data on a given topic, emphasizing points of view, approaches already developed and results obtained.

The starting point for the research was the collection of material already prepared, through exploratory research to develop familiarity with the subject. In this way, this work

was conceived based on the study of national and international scientific productions with relevance in the educational context in relation to the use of ICTs as a pedagogical resource.

For the data collection, websites were used on the following platforms: SciELO (Scientifc Electronic Online), JSTOR, EBSCOhost, Redalyc and DOAJ from 2022 to 2023. The following descriptors were used: teacher, education, informatics, ICTs. Publications from before 1993 and duplicates in the search were discarded. The second step was to select the works presented in the research, using the number of citations as a guide. The papers were then carefully read to be used as a theoretical reference and to support the construction of the research that underpinned the ideas supported. This choice was based on the premise that researchers with consolidated experience in the field can offer valuable insights and significant contributions to the development of the research. This stage involved detailed content analysis to identify relevant concepts, theories and results that served as the theoretical basis for the research. In addition, from the planning to the execution of the Maranhão Scientific Literacy Fair (FEMALEC), organized by the Center for Advanced Morphophysiological Studies (NEMO) of the State University of the Tocantins Region of Maranhão (UEMASUL) in its first edition in December 2023, were used as premises and including some works presented relating ICTs in the classroom.

3 Educational technologies in Brazil: a brief history

In order to understand the history of educational technologies in Brazil, it is necessary to look at some crucial moments, from the military period to the present day. It is important to understand that the relationship between technology and education takes shape in the principles and processes of educational action, generating instructional products used to solve pedagogical problems. It is therefore essential to observe, even if not in depth, how and when educational technologies were introduced in Brazil.

In Brazil, computer science applied to the school context had its beginnings in the 20th century. In the early 1970s, the first seminar on the subject was held, with the central

aim of promoting discussion about computers and their use in physics teaching. The event took place at the University of São Carlos. From then on, Brazil began its first efforts in the context of information technology applied to education. As a continuation of these efforts, public policies were established to enable scientific and technological qualification. The Commission for the Coordination of Electronic Processing Activities (CAPRE), the Brazilian Digital Company (DIGIBRÁS) and the Special Secretariat for Information Technology (SEI) represented the first results of the investments made in the country and were important in encouraging the progress of information technology in Brazil (Moraes, 1993).

Following on from this, several other initiatives and projects were implemented by the Ministry of Education in partnership with the country's public universities. For example, the FORMAR project, whose purpose was to train teachers in the public basic education system; the National Educational Informatics Program (PRONINFE), created in 1989 by Ordinance No. 549 of the Ministry of Education and Culture (MEC); PROINFO (National Informatics in Education Program), created by the MEC in 1997 through Ordinance No. 522; and the National Educational Technology Program, founded to boost the use of informatics in the pedagogical practices of schools in the public primary and secondary education system (Santiago, 2017).

In the 1980s, the expansion of knowledge channels, such as Telecurso 2000, a TV program that broadcast video lessons on basic and technical education, made it easier to acquire knowledge at a distance, especially for people who were unable to attend school for various reasons. However, distance education gained prominence in Brazil in the following decade, as an alternative to traditional face-to-face education, allowing education at that time to break down the barriers of distance in the search for quality education (Meyer; Alverne, 2020).

In 1996, initiatives such as TV escola and the Continuing Education program called "Salto para o Futuro" brought training to basic education teachers. According to Belloni (2002, p. 117), this was "the first distance learning experience for basic education teachers in Brazil, the pedagogy degree developed in the state of Mato Grosso".

As a result of the Education Guidelines and Basis Law - LDB No. 9394 of 1996, the National Curricular Guidelines (DCN) for Basic Education of 2013 also established the principles of curricular organization for Primary and Secondary Education, determining that: "The common national basis of high school curricula will be organized into areas of knowledge, namely: languages, codes and their technologies; natural sciences, mathematics and their technologies; human sciences and their technologies." (art. 10 of Resolution CNE/CEP n. 03/98).

It is inevitable that the term information technology is associated with computers, computer networks, the internet, multimedia, databases and other resources that make up ICTs. All the other technologies that used to be used separately (radio, telephone, TV, video and audio) have now been integrated by the computer and smartphone and their peripherals. According to Abdala (1999) computer and communication technologies when applied to teaching processes can be divided into two classes: traditional media - television, radio and audiovisual reproduction devices; and integrated media - intelligent systems, computer systems, software and computer programs that allow audio and video resources to be played.

In 2017, MEC launched the National Innovation Policy for Connected Education, which included the initiative to bring the internet to more than 22,000 urban and rural public schools across Brazil, as well as establishing some guidelines that brought technology to the educational context in Brazil. According to Silva (2012), when information technology is introduced into schools, it becomes an instrument capable of providing differentiated pedagogical support for teachers and students, and is important for improving teaching in a way that can significantly alter teaching methods, making them more attractive and meaningful.

In general, Brazil is a country on the rise in the use of technology and is also open to its use in the educational environment. At higher education level, a considerable number of public and private universities and colleges already use internet resources for research, classes via the Virtual Learning Environment (VLE), projectors, smart boards and cloud storage, as well as other possibilities arising from ICTs. What is lacking is the dissemination

of this use to the entire education network at its various levels, especially in public universities far from the major centers.

4 Applications and advantages of ICT in education

People live surrounded by technology in their daily lives, in interpersonal relationships, in work relationships, in banking relationships, because technology has a creative charge and the ability to speed up processes, as well as improving life in society in its many segments in the most different areas, including education. In the educational field, they are increasingly present in classrooms, being used by students and teachers alike, from the use of notebooks and smartphones for internet research, pen-drives for transporting documents and assignments, digital whiteboards, which guarantee interactivity and deepen knowledge, to the use of internet resources such as the AVA, which has already been implemented and is widely used, especially in undergraduate and postgraduate courses, for training professionals in a wide range of areas, especially those in degree courses.

One type of VLE widely used in many educational institutions is the Modular Object-Oriented Dynamic Learning Environment (Moodle) platform. It was designed to run as a free software program (with no fees) and its content includes various resources that can take the classroom and its content to the student's home as a complement to the activities proposed by the teacher.

In addition to the resources mentioned before, there are other significant uses of technology in the educational environment. One example is the use of data show devices combined with multimedia presentations and videos. As well as replacing the old, static overhead projectors, data show has added to classroom productivity. This enables a bridge of knowledge that involves the methodology applied in the classroom by the teacher, the interactivity resources of the technology and the baggage of up-to-date knowledge that the student can carry with them on their academic journey. Studies show that the need to use ICTs not only facilitates learning, but also increases students' motivation to study and

promotes greater interaction between them (Araújo; Progetti; Santos, 2021; Flórez; Zuluaga, 2020; Brandão *et al.*, 2021).

Another application of technology aimed at education and the growing increase in its use running in real time is the resource called "cloud". Cloud is a type of online server storage that is available 24 hours a day, which makes it possible to speed up educational processes even more, as files and applications are not saved on a piece of hardware, but are available on any device connected to the internet, at any time.

It is important to stress that in relation to the possibilities of using ICTs, it is important to consider that certain social, cultural and financial contexts are related between the user and the technology, in the sense of limiting or broadening the relationship with ICTs at school. As well as integrating ICTs into the academic environment, it is necessary to integrate them with digital culture. This should be done by exploiting the functionalities and services offered by ICTs, especially the Internet, such as: real-time communication from anywhere a connection is available; the different navigation paths through links that make up hypermedia networks, an advanced form of computer networks that allow interaction and distribution of different types of digital media, such as text, images, audio and video, in an interconnected and multidimensional way.

Another advantage of using ICTs is in the training of academics in distance learning and hybrid courses, which would be very expensive without the use of technologies applied to education. These and other advantages brought by ICTs must be exploited to the full in order to optimize resources and bring higher education to as many people as possible who would not otherwise have access to the education system. Therefore, in order to make the most of the advantages brought by technologies in the academic environment, resistance to the use of ICT for education must be minimized. On this subject, it is important to note that:

> This scenario has undergone changes over the years, and the student's active participation in their learning has been more productive than the teacher's information alone. This process of change in education has brought challenges by breaking with the structures established in face-to-face teaching models (Mezarri, 2011. p. 115).

With regard to the disadvantages of using ICTs as a tool to support educational methodologies, it can be observed that some factors can be obstacles to their use, such as chaotic educational platforms, a lack of motivated tutors and mentors, difficulties in accessing the internet and the high cost of acquiring quality technological equipment. All of this, combined with the complexity of the use of new technologies, can have the opposite effect to that desired for the use of ICTs in the academic environment. Hence the need for technical support from IT professionals in the laboratories of educational institutions, as well as the importance of continuing training for teachers with courses, lectures and training so that they are able to use IT resources properly in the classroom, optimizing the process and extracting the maximum advantages from these resources.

5 Challenges in the use of ICTs by teachers

ICTs have emerged with the aim of revolutionizing the most diverse contexts in the world. These technologies are present in homes, in the workplace, in companies and, consequently, in the academic environment. Certainly, their use by a considerable proportion of students and teachers in their most diverse uses is noteworthy. In this sense, the perception that students and teachers have about the use of ICTs converges and is in line with the view of Lévy (2000), when he comments that:

> Technology is neither good nor bad, depending on the situations, uses and points of view, nor is it neutral, since it is conditioning or restricting, since on one side it opens up and on the other it closes off possibilities. It's not a question of evaluating its impacts, but of situating possibilities of use, although, while we discuss possible uses of a technology, some forms of use have already been imposed, such is the speed and renewal that they present themselves. (Lévy, 2000, p. 26).

It has to be considered that, although the use of information and communication technologies has its advantages, it is necessary to realize that there are challenges and obstacles present in this area. For Werner (2008), the most relevant adversities are for teachers. Many of them are not digital natives and therefore have difficulty mastering the

technologies or do not yet know how to choose the appropriate software to use in the classroom, taking into account the content to be taught. One way of solving this shortfall in teachers would be to promote teacher training in the use of educational technologies so that they are able to use these tools in the classroom. The right time for this is during the training of these professionals, i.e. during their degree and pedagogy courses, while they are still at university, because during this period they have more time and resources available for good training. Otherwise, they will have to seek out postgraduate or technical courses on their own.

This is all the more relevant when you consider the fact that not all teachers in their academic training have had the appropriate preparation to deal with the fundamentals of information technology in the teaching-learning process, in order to take advantage of all the possibilities that these technologies can provide, given that this educational revolution is new in the academic environment when compared to the traditional teaching model. As such, the role of technology in education has become even more important due to the possibility of training teachers through various platforms for the use of technological resources, in postgraduate courses and other training. In the study conducted by Varela-Ordorica and Valenzuela-González (2022), most of the teachers interviewed expressed that they still had an elementary knowledge of ICTs, but recognized the importance of remedying the limitations, since they reduce the frequency and variety of technological resources used in their classes.

Teachers need to use the tools that are available in their pedagogical practice in a way that dialogues with technology, given that today's pupils are drenched in technology outside of school. It is possible to observe data on the growth in the use of technology in popular circles. The use of smartphones and tablets already exceeds, for example, the number of televisions, even those with the same operating systems as smartphones that connect to the internet. Therefore, teachers need to be ready to use these resources in the classroom in order to take advantage of the benefits that ICTs can provide.

According to Neves (2009), one of the advantages for teachers of using ICTs in the academic environment is the promotion of a pedagogy of authorship and co-authorship in which:

> A convergência de mídias, inclusive a que já se encontra nos celulares e smartphones, adiciona elementos que revolucionam ainda mais a produção, a distribuição de conteúdo educacionais, a comunicação e a interatividade. Com uso intencional de todas as tecnologias disponíveis, o professor pode promover uma pedagogia de autoria e coautoria, ancorada em um ambiente educacional tecnológica e pedagogicamente rico, favorecendo a adoção de atitudes autônomas e criativas (NEVES, 2009, p. 18).

Therefore, technologies can enable teachers to use a liberating methodology, providing an education of authorship and co-authorship, where students can develop themselves within a digital environment. So, with regard to teaching and learning, it is necessary to point out that the use of technological methodologies in the academic environment leads students to improve their ability to learn and work in a collaborative, supportive way, centered on the speed and qualitative diversity of connections and exchanges, essential aspects for good educational coexistence. Perhaps this is the main advantage of using technology to complement the teacher's methodology in the academic environment.

In this sense, in addition to the need for a certain amount of technological knowledge in order to use these ICTs, the teacher needs to plan strategically in order to solve problems, as well as making content available to students in good time for future feedback. This provides the opportunity for capacity and self-development so that they can be authors and co-authors of the knowledge acquired.

It is worth pointing out that technologies do not replace the teacher, but they do allow some of the teacher's tasks and functions to be modified. The task of passing on information can be left to databases (cloud), books, videos, apps and other virtual media. Belloni (2011) points out the reasons for the coherent use of technologies in education when he states that:

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> The most general and important reason of all is also obvious: because they are already present and influential in all spheres of social life, it is up to schools, especially public schools, to act to compensate for the terrible social and regional inequalities (Belloni, 2011, p. 124).

Therefore, the use of ICT in education should be understood as a means and not an end in the educational context and we shouldn't place all expectations of change in this area on these technological premises. Furthermore, it is necessary to consider the real and massive expansion of the use of educational technologies around the world, a scenario in which educational institutions cannot stagnate in the face of the universe of possibilities that this expansion can offer the academic environment.

6 Conclusions

The advantages of using technologies as complementary support for the teacher's methodology in the academic environment make it possible to build bridges between established and up-to-date knowledge, promoting an education of authorship and co-authorship in which the student and the educator make use of the advantageous virtual environment to promote teaching and learning. The study pointed out that, since the 1970s, Brazil has made significant progress in the field of ICTs, but that it still faces challenges related to digital inclusion. The research demonstrated the need for professional training in the use of ICTs, which is fundamental to promoting a more dynamic, inclusive education in line with the demands of the 21st century.

Generally speaking, ICTs have not come to replace people or the teacher's perennial knowledge, but to serve as a support, because information and communication technologies are static and depend on the human element for their operation. In the academic environment, ICTs can add transformative elements that complement the teacher's subjects, without detracting from their basic knowledge. This can allow content to be updated, optimizing classroom processes and the interactivity of the methodology applied.

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