Ciência

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REVIEW ARTICLE

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Conflict of interest: Not applicable.

Funding: Not applicable.

Digital information and communication technologies incorporation at Brazilian educational system

Incorporação das tecnologias digitais de informação e comunicação no sistema educacional brasileiro
Incorporación de las tecnologías digitales de información y comunicación en el sistema educativo brasileño

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ABSTRACT

Digital Information and Communication Technologies (DICT) incorporated into active teaching-learning strategies can contribute significantly to the individual and collective development of competencies, skills, and attitudes by students. To establish an overview of the use of TDIC in kindergarten, elementary, secondary, and higher education in Brazil, an integrative review was conducted based on articles indexed in the SciELO, LILACS and CAPES journal portal. In addition, documentary research was carried out in official publications of the Ministry of Education to foster reflections on the importance of TDIC in the process of teaching learning in contemporary times. Although the use of DITC in the classroom has been enhanced in the last two decades, especially with the advent of emergency remote teaching during the coronavirus pandemic, the continuing education of teachers and the adequacy of physical facilities and virtual environments are fundamental for the holistic rupture of traditional pedagogical practices and advancement in the incorporation of TDIC in all teaching modalities.

Keywords: DICT. Education. Digital skills.

RESUMO

As Tecnologias Digitais de Informação e Comunicação (TDIC) incorporadas nas estratégias ativas de ensino-aprendizagem podem contribuir significativamente para o desenvolvimento individual e coletivo de competências, habilidades e atitudes pelos estudantes. Para estabelecer um panorama da utilização das TDIC no ensino infantil, fundamental, médio e superior no Brasil, foi conduzida uma revisão integrativa baseada em artigos indexados nas bases SciELO, LILACS e no portal de periódicos da CAPES. Adicionalmente, foi realizada uma pesquisa documental em publicações oficiais do Ministério da Educação para fomentar reflexões sobre a importância das TDIC no processo de ensino aprendizagem na contemporaneidade. Embora a utilização de TDIC em sala de aula tenha sido potencializada nas últimas duas décadas, principalmente com o advento do ensino remoto emergencial durante a pandemia do coronavírus, a formação continuada de docentes e a adequação das instalações físicas e dos ambientes virtuais são fundamentais para a ruptura holística de práticas pedagógicas tradicionais e avanço na incorporação das TDIC em todas as modalidades de ensino.

Palavras-chave: TDIC. Educação. Competências digitais.

Introduction

The accelerated movement of digital media in recent years updates has boosted the promotion of the theme of digital information and communication technologies (DICT) in Brazilian education. This has become even more recurrent after social distancing during the pandemic. Digital technologies emerged between the end of the 50s and 70s, after the third industrial revolution. The current Law of Guidelines and Bases of Education (*Lei de Diretrizes e Bases da Educação* - LDB) was published in 1996, more than 20 years after the emergence of the digital age, but there is no mention of digital technologies, only technologies, in general, and

only from elementary school and with a focus on professional and distance education. Even though there is no more forceful legal framework on the part of the main legislation of national education, it is possible to perceive a great movement in several educational institutions, at different levels of education, to incorporate the digital world into the educational context. In the official documents of the National Common Curricular Base (Base Nacional Comum Curricular - BNCC)[1], there are mentions of DICT for integration into teaching practices, enabling more effective learning processes and consistent with the context of interconnectivity in which students are immersed[2].

The use of DICT in active teaching-learning strategies raises connection with the world outside the classroom, bringing a diversity of opinions and ideas that can favor the development of critical attitude and interdisciplinary thinking in the student. The conduct of these activities fosters an autonomous posture of the student, consistent with Freire assumptions, and enhances social interaction, providing significant cognitive development from the perspective of Vigotsky[3-5]. Moreover, the incorporation in the learning process of the DICT used in the daily routine can instigate students, contributing to the establishment of the indispensable predisposition to the constructivism of knowledge according to the Ausubelian theory[4,6].

In practice, the effective implementation of digital information and communication technologies in educational institutions is linked to the restructuring of infrastructure and reconfiguration of socio-educational processes with changes in the teaching and class plans of the curricular units, updating of didactic material and alignment of pedagogical practices associated with the continuing education of teachers[7,8]. The continuous training of mediators is one of the pillars for the incorporation of DICT and appreciation of new forms of knowledge production in the network, since the technological apparatus is still explored in an incipient way in teaching practices[9]. Given this scenario, this integrative review article establishes an overview of the use of DICT in kindergarten, elementary, secondary and higher education in Brazil and presents reflections on the importance of DITC in the process of teaching learning in contemporary times.

Methodology

To establish an overview of the use of DICT in kindergarten, elementary, secondary, and higher education in Brazil, the authors of this study opted for the design of an integrative literature review study, based on the qualitative method of investigation. Scientific papers from the SciELO, LILACS and CAPES journal portal were prospected, combining descriptors associated with DICT in the languages Portuguese, Spanish and English, without temporal or spatial restriction and study design. However, in addition to the literature review, this study followed the methodological path of documentary research, considering the investigative character in national references, which point to the implementation of the DICT in teaching, as well as in documents of the Ministry of Education.

The use of digital technologies in early childhood education and elementary school

After the fourth industrial revolution, advances in technology were enormous in all fields and sectors of society and it is possible to perceive the growth in people's daily lives, with numerous facilities. The use of digital technologies and facilities in the field of education grew gradually, trying to keep pace.

In December 2018, after several discussions and public hearings, the BNCC was approved for the entire stage of Basic Education. The BNCC is the guiding document of all early childhood education, primary and secondary education, so it is essential in the discussion that permeates the use of technology in schools [1].

The importance of digital culture can be perceived from one of the 10 general competencies of BNCC:

> Understand, use, and create digital information and communication technologies in a critical, meaningful, reflective, and ethical way in the various social practices (including school practices) to communicate, access and disseminate information, produce knowledge, solve problems and exercise protagonism and authorship in personal and collective life[1].

In the modality of Early Childhood Education, the BNCC, about the rights of learning and development in early childhood education, provides that the child explores, among other issues, movements, and gestures inside and outside the school, to expand their knowledge also in technology.

Technology in early childhood education should be experienced as a way of expanding knowledge. The use of technological instruments by increasingly young children in recent years has been very recurrent, so the presence of this learning in school is a way to make this knowledge formal.

In elementary school, according to BNCC, the theme of new technologies should consider new languages, new forms of communication, and the diversity of media and digital offerings. Thus, "by taking advantage of the communication potential of the digital universe, the school can institute new ways of promoting learning, interaction and the sharing of meanings between teachers and students"[1]. Considering the competencies and skills necessary for early childhood education and elementary school related to digital technologies, various systems, software, and instruments have been adopted in Brazilian schools.

In Early Childhood Education, few studies have proposed to talk about the use of digital technologies in early childhood education, among the few studies are those of Queiroz and Rocha[10] (2021) and Barbieri[11] (2021). The first research reveals a successful experience of pedagogical activities using *t*ablets in a school of the municipal network of the Southeast[10] and the second exposes a gap between

technologies and teacher training, which may have contributed to the absence of technological instruments in that modality of education[11].

In the first stage of elementary school, some studies reveal that many schools use basic technological tools, such as notebooks, printers, tablets, Datashow and smartphones[12-15]. As digital communication tools, they use applications and websites such as Facebook, Whatsapp, Google Meet, Microsoft Teams, and Google for Education. These surveys also reveal that the communication platforms mentioned began to be used with greater intensity during remote classes, which occurred during the Covid-19 pandemic[13,15].

Use of educational technologies in primary and secondary education

The use of technology as an educational tool in elementary and secondary education has provided multiple possibilities for educators to renew and expand their teaching methodologies. This new way of teaching facilitated the assimilation of contents, promoted the interest of students, and facilitated access to more comprehensive complementary materials, encouraging and improving the search for new knowledge.

The technology used in the educational processes is a very important and essential demand of the entire school community. In addition to information and communication technologies already being present in the BNCC, these new tools promote help and assist in the process of school information management, establishing and promoting good relationships with those responsible for the students as well as with school employees[1].

These resources seek to create motivating ways of learning and to reinforce school content, motivating learning, promoting a very clear point: the achievement of increasingly better results for both students and the school community. This makes the institution become a reference in teaching, making technology also a good competitive differential.

According to Bruzzi:

> An educational technology such as the computer or the internet, through interactive network resources, favors new forms of access to information and communication, and expands the sources of research in the classroom, creating new conceptions within the current reality, opening space for the entry of new mechanisms and tools that facilitate the necessary connections in order to meet the new cognitive process of the twenty-first century[16].

In elementary and secondary education, it is observed that the use of technologies promotes increased student participation, makes learning have a clear purpose and that the student is the protagonist of learning. These new teaching strategies allow effective learning, because when making the acquisition of knowledge will be explored

attributes that will allow to create ways for knowledge to be explored by various types of intelligence, developing essential skills for the life of students: empathy, organization, logical reasoning, teamwork, and creativity.

Moran states that "teaching with new media will be a revolution if we simultaneously change the conventional paradigms of teaching [...] Otherwise, we will be able to give a veneer of modernity, without touching the essentials" [17].

The teacher when using the new technologies establishes the condition of mediator in the orientation of the choices of information and activities of their interests, or that are directly linked to the school curriculum. This change makes the teacher more interactive, flexible, creative, and efficient, being able to direct their activities in an interdisciplinary way using the digital technologies that are at their disposal and innovating in the creation of their classes making students feel motivated to learn.

In the classrooms of elementary and high school there is a lot of insertion of cell phones, tablets, computers, and other various technological devices to strengthen the engagement of the class and the motivation with the activities, in addition to providing the activities in a playful environment. By presenting content interactively and with features such as gamification, "[...] We have more information, varieties of materials, channels, applications, resources. This variety requires the ability to choose, evaluate and concentrate" [17].

A more specific factor perceived in high school that is being monitored and mitigated with digital education is the problem of school dropout, because recurrent absences can impair student performance. With the technology present in the day to day, they become much less frequent, allowing the student to follow the classes, activities, and work at various times of the day, preventing him from moving away from the school walls.

Appropriation of DICT in Higher Education Institutions

In the educational field, the DICT quickly enable the distribution of content, socio-interactivity, and pedagogical collaboration, configuring themselves as primordial instruments for modern university institutions. The DICT foster the resignification of traditional teaching methods and learning contexts, raising organizational changes and perspectives for a more flexible and compatible education with the emerging challenges of contemporaneity [18,19].

The incorporation of technological innovations effectively in teaching-learning processes inherent to undergraduate and graduate curricular units constituted a relevant challenge at the beginning of the twenty-first century due to the still incipient support to the teacher and the student, as well as the paradoxical contact between digital migrant teachers and digital native students[20-22].

From 2020, after the insertion of emergency remote teaching because of the SARS-Cov2 pandemic, there was a strengthening of the use of DICT beyond the traditional distance learning modality (EAD).

In addition to the broad structuring in virtual learning environments and online classrooms such as google classroom, microsoft teams, moodle and blackboard, the teachers incorporated activities of the curricular units in various platforms such as instagram, facebook, youtube, pinterest, podcast and blogs. In the consolidation of this new transitional educational model, the relevance of applications that enhance dialogicity and collaboration between actors in the construction of knowledge in cyberspace was evidenced, such as padlet, poplet, mentimeter, kahoot and wordle [23,24].

A study conducted in the state of Bahia in 2021 revealed that 40% of university professors did not know and did not use DICT before the pandemic. In addition, it has been demonstrated that the time of experience in teaching is directly proportional to the probability of having experience with the DICT [23].

The elaboration of digital narratives in virtual environments during training in higher education courses evidenced greater reflection and appropriation of knowledge by the student[23], corroborating data from other studies that indicate that the integration of DICT in undergraduate courses enhances student-class-teacher interaction[25] and increases the rate of participation and student interest[24]. The benefits of the inclusion of DICT in learning go beyond the training of the students in the class, since platforms and social networks can be accessible to the population, exposing the material prepared by teachers and students and expanding the dissemination of knowledge in non-formal environments[24].

According to Kenski[26] (2013), "technological culture requires the radical change of behaviors and pedagogical practices that are not contemplated only with the incorporation of digital media into teaching." The clear distance between the potentialities of the use of DICT in teaching and their practical application by most of the professors of the universities points to the need for continuing education of teachers and the articulation of educational technological innovations in the curriculum of *Stricto sensu* graduate courses, especially at the master's level, so that the practical training in the teaching tyranny with the use of DICT enables the change of this paradigm with expansion of innovative processes suited to the demands of cyberculture [18, 27-28].

Final Considerations

Technologies are integrated into the daily routine of most of the population and their contribution to the effectiveness of the teaching-learning process in contemporary times is indispensable. Although emergency remote teaching, implemented between 2020 and 2022, has enhanced the use of DICT in the classroom, the continuing education of teachers and the adequacy of physical facilities and virtual environments are fundamental for the holistic rupture of traditional pedagogical practices and advancement in the incorporation of DICT in all teaching modalities.

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