RCMOS – Revista Científica Multidisciplinar O Saber. ISSN: 2675-9128. São Paulo - SP.
Ano VII, v.1 2026 | submissão: 13/07/2026 | aceito: 10/07/2026 | publicação: 16/07/2026

Digital Technologies in Brazilian Basic Education: Uses, Benefits, Challenges, and Pathways for Teacher Education in Public-School Systems

Tecnologias Digitais na Educação Básica Brasileira: Usos, Benefícios, Desafios e Caminhos para a Formação Docente nas Redes Públicas

Tecnologías Digitales en la Educación Básica Brasileña: Usos, Beneficios, Desafíos y Caminos para la Formación Docente en las Redes Públicas

Lielson Pinheiro Torres
Ivanise Nazaré Mendes

Abstract: This article analyzes the use of digital technologies in Brazilian Basic Education, highlighting their main benefits, challenges, and repercussions for the teaching and learning process. The investigation is based on official documents, such as the National Common Curricular Base (BNCC), which establishes the critical and ethical use of Digital Information and Communication Technologies (DICT), and on recent data from the ICT in Education 2023 survey, which provide a detailed overview of access, infrastructure, and digital practices in Brazilian schools. In addition, structural public policies are considered, such as the National Connected Schools Strategy (ENEC) and the Connected Education Innovation Program (PIEC), as well as the expansion of Digital Educational Resources (DERs) offered by the Digital PNLD. The study also addresses contemporary discussions related to the adoption of Artificial Intelligence (AI), a topic under analysis by the National Council of Education (CNE). It concludes that the effective integration of DICT depends on adequate infrastructure, continuing teacher education, and ethical data governance, ensuring conditions for meaningful and equitable pedagogical experiences. Thus democratizing teachers' and students' access to and use of digital technologies in a safe and healthy manner within the teaching-learning process.

Keywords: Digital technologies; Basic Education; Teacher education; School connectivity; BNCC.

Resumo: Este artigo analisa o uso de tecnologias digitais na Educação Básica brasileira, evidenciando seus principais benefícios, desafios e repercussões no processo de ensino e aprendizagem. A investigação fundamenta-se em documentos oficiais, como a Base Nacional Comum Curricular (BNCC), que estabelece o uso crítico e ético das Tecnologias Digitais de Informação e Comunicação (TDIC), e em dados recentes da pesquisa TIC Educação 2023, que expõem um panorama detalhado sobre acesso, infraestrutura e práticas digitais nas escolas brasileiras. Além disso, são consideradas políticas públicas estruturantes, como a Estratégia Nacional de Escolas Conectadas (ENEC) e o Programa de Inovação Educação Conectada (PIEC), bem como a ampliação dos Recursos Educacionais Digitais (REDs) ofertados pelo PNLD Digital. O estudo também contempla discussões contemporâneas relacionadas à adoção de Inteligência Artificial (IA), tema em análise pelo Conselho Nacional de Educação (CNE). Conclui-se que a integração efetiva das TDIC depende de infraestrutura adequada, formação docente contínua e governança ética dos dados, garantindo condições para experiências pedagógicas significativas e equitativas. Democratizando assim o acesso e uso das tecnologias Digitais por professores e alunos de forma segura e saudável ao processo ensino aprendizagem.

Palavras-chave: Tecnologias digitais; Educação Básica; Formação docente; Conectividade escolar; BNCC.

Resumen: Este artículo analiza el uso de las tecnologías digitales en la Educación Básica brasileña, destacando sus principales beneficios, desafíos y repercusiones en el proceso de

enseñanza y aprendizaje. La investigación se fundamenta en documentos oficiales, como la Base Nacional Común Curricular (BNCC), que establece el uso crítico y ético de las Tecnologías Digitales de la Información y la Comunicación (TDIC), y en datos recientes de la encuesta TIC Educación 2023, que presentan un panorama detallado sobre el acceso, la infraestructura y las prácticas digitales en las escuelas brasileñas. Además, se consideran políticas públicas estructurantes, como la Estrategia Nacional de Escuelas Conectadas (ENEC) y el Programa de Innovación Educación Conectada (PIEC), así como la ampliación de los Recursos Educativos Digitales (RED) ofrecidos por el PNLD Digital. El estudio también contempla debates contemporáneos relacionados con la adopción de la Inteligencia Artificial (IA), tema en análisis por el Consejo Nacional de Educación (CNE). Se concluye que la integración efectiva de las TDIC depende de una infraestructura adecuada, de la formación docente continua y de la gobernanza ética de los datos, garantizando condiciones para experiencias pedagógicas significativas y equitativas. Democratizando así el acceso y el uso de las tecnologías digitales por parte de docentes y estudiantes de forma segura y saludable en el proceso de enseñanza-aprendizaje.

Palabras clave: Tecnologías digitales; Educación Básica; Formación docente; Conectividad escolar; BNCC.

1. Introduction

The growing presence of digital technologies in the most diverse areas of postmodern society has increased educational demands for pedagogical practices aligned with digital culture. In General Competency 5, the National Common Curricular Base (BNCC) establishes that students must be able to understand, use, and create digital technologies critically, ethically, and responsibly, integrating them into diverse social and school practices. This guidance has driven public policies and government actions aimed at promoting educational innovation.

However, the data available in the ICT in Education 2023 survey reveal that, despite advances in connectivity, structural challenges persist, such as regional inequalities, limited access to equipment, and instability in schools' internal networks. These obstacles hinder the pedagogical appropriation of technologies and require integrated responses from education systems.

With a view to strengthening educational infrastructure, the federal government has implemented policies such as the National Connected Schools Strategy (ENEC) and the Connected Education Innovation Program (PIEC), which establish technical parameters, connectivity targets, and investment priorities. In this context, it is essential to understand which technologies are in use, their impacts on pedagogical practices, and the training needs of education professionals for more effective, objective, effective, and productive work with DICT.

2. Methodology

The research adopts a qualitative approach based on documentary and bibliographic review. Regulatory documents (BNCC, ENEC, and PIEC), data from the ICT in Education 2023 survey and the 2024 School Census, official materials concerning the Digital PNLD, Antônio Siemsen Munhoz's work "Educational Technologies," reports on educational platformization and data protection, as well as recent CNE opinions and debates on the use of AI in education were consulted. The analysis focused on triangulating information to identify trends, challenges, and perspectives for teacher education.

3. Digital Technologies in Use in Basic Education

3.1 Connectivity and Internal Network

When we speak of technology, it is common to associate the term almost automatically with smartphones, computers, and so on. However, it is important to understand that technology has always been present in different societies and, in its various forms, tends to serve the interests of groups that hold power. Throughout history, these resources have often been used in disputes and conflicts between groups (Pinto, 2005).

There is no doubt about the benefits of technology for society, including education. Moran (2017) emphasizes that broad access to digital technologies expands teachers' pedagogical possibilities. According to the author, these resources can make classes more motivating through games and videos on digital platforms and can reorganize the teaching process through the flipped classroom, in which students have prior contact with the content. In addition, technologies favor the personalization of learning, respect students' different paces, and enable the publication and sharing of the knowledge constructed.

The ICT in Education 2023 survey indicates that internet access in Brazilian schools has expanded; however, signal quality and availability for pedagogical use remain insufficient. In many systems, connectivity does not reach specific classrooms or fluctuates considerably, undermining proposed online activities. ENEC establishes that schools must reach minimum speed parameters, such as 1 Mbps per student, to ensure effective pedagogical experiences.

3.2 Educational Devices

Today, we live in an interconnected society in which technological resources are part of most people's daily lives. Consequently, many children encounter digital tools from an early age. Given this reality, the school, as the main space for educating the individual/citizen, also had to advance and keep pace with the connected student. Recognizing the importance of this change, according to Moran (2000, p. 11), “Many ways of teaching today are no longer justified. Both teachers and students have the clear feeling that many conventional classes are outdated.” Indeed, traditional methods are not successful today; therefore, it is necessary to evolve toward a more contextualized teaching process in harmony with reality and its social transformations.

Although connectivity infrastructure has advanced, the ratio between available equipment and the number of students remains low. In several regions, the same computer or tablet is shared by many students, hindering practices that require continuous interaction with devices so that students become familiar with technological equipment in schools.

3.3 Digital Resources in Support of Education

Public-school systems have adopted platforms such as Google Classroom and Microsoft Teams, which assist with organizing activities, school communication, and material sharing. However, CGI.br studies warn of risks associated with data privacy and technological dependence on large companies, which becomes unfeasible for the democratization of digital information and communication technologies.

The popularization of Digital Information and Communication Technologies (DICT) in daily life, combined with the growing impact of media and digital networks, has allowed platforms to take a leading role in contexts they previously did not occupy. When revisiting the origin of these platforms, Poell, Nieborg, and van Dijck (2019) place the beginning of this phenomenon in the early twenty-first century, a period in which platforms were seen as promising digital structures, particularly in the administrative and game-development sectors.

Platforms can be defined as programmable or reprogrammable digital infrastructures that enable and shape personalized interactions between end users and partners, organized through continuous data collection, algorithmic processing, monetization, and circulation of those data (Poell; Nieborg; van Dijck, 2019). Digital platforms can also be understood as “[...] networks orchestrated by a controller, which may be a company or any other organization, such as the State or the academic community” (Chiarini et al., 2023, p. 7). These platforms include various forms of social media that allow users to share and communicate information in

multiple formats, such as videos, images, audio, and texts, as well as variations arising from their purposes.

In addition to educational platforms, the National Textbook Program - Digital PNLD itself provides books and learning objects in accessible and multimodal formats. These materials expand the possibilities for pedagogical use of DICT and align with BNCC competencies and skills, favoring innovative practices adaptable to the school context.

We also cannot fail to mention the use of Computer Graphics and Educational Robotics, which is gaining more and more space in schools.

The BNCC Computing supplement provides for work with computational thinking, digital culture, and the digital world from Early Childhood Education through Upper Secondary Education. Schools have incorporated practices such as visual programming and robotics, stimulating logical development and problem-solving. However, public authorities must commit to providing better physical infrastructure and robust technological conditions that guarantee not only access but also the right to remain in school.

In this context, Educational Robotics (ER) is a fundamental tool for the development of human education from a comprehensive perspective. It promotes the development of creative, critical, and responsible individuals who are capable not only of working as a team but also of overcoming challenges through problem-solving and the exercise of logical reasoning.

> Although the expansion of basic education provision remains the responsibility of schools, in the in-person modality, public policies increasingly encourage the use of new information and communication technologies with a view to implementing a new quality of learning, bringing it closer to the new patterns of social behavior and work practices of the information society. The objective of the new pedagogy is to form flexible subjectivities that relate, produce, and consume in a society whose technical base, driving the market, is microelectronics (Kuenzer, 2016, p. 16).

Another technological resource that cannot be left unexplored in education is the use of Artificial Intelligence - AI.

Artificial Intelligence (AI) has revolutionized education by providing new forms of teaching and learning and making processes more dynamic, interactive, and personalized. With the capacity to analyze large volumes of data and patterns of consideration, AI enables students to have a more efficient educational experience adapted to their individual needs. In addition, teachers and educational institutions can benefit from AI-based technologies to optimize administrative and pedagogical tasks, allowing greater focus on teaching quality.

Recent debates conducted by the CNE point to the need to regulate the pedagogical use of AI, ensuring teacher supervision and preventing the complete automation of assessment processes. The guidelines discussed notably include requirements for ethics, transparency, and critical education for teachers and students.

From Bartoletti's perspective (2020),

> Put simply, AI is (at least so far) about machines performing a task that humans perform and that is possible only because we humans taught them to do it. What we program them to do is recognize and act on the correlation between things (intelligere); things that, for us humans, constitute part of life and experience. Therefore, AI refers - to be more technical - to artifacts used to detect contexts or to carry out actions in response to detected contexts (Bartoletti, 2020, p. 21).

Bartoletti (2020) presents a fundamental view of Artificial Intelligence (AI), emphasizing that, up to the present, it is an extension of human capabilities, something that exists only because we human beings taught machines to perform certain tasks. This idea emphasizes the central role of human programming in the development of AI; that is, machines perform activities ultimately based on patterns or correlations that human beings identified and programmed into them.

4. Benefits and Challenges of Using Digital Technologies

The literature and official documents identify several benefits associated with the integration of DICT, notably: expanding students' authorship and creativity; access to diverse and up-to-date digital collections; the possibility of personalizing learning; improving school-student-family communication; developing digital competencies that are fundamental to contemporary life; and establishing national technical and pedagogical parameters through ENEC. Thus, teachers are fundamental elements in reaching these possible pathways with the intervention of AI and digital technologies.

The use of Information and Communication Technologies (ICT) in education is widely discussed because they comprise the various means of communication known today (TV, radio, telephone, newspapers, magazines), employing different types of language: oral, written, digital, and audiovisual.

Thus, we recognize that the relationship between technology and education is important, making it timely to consider and discuss how the use of technological artifacts can contribute to children's literacy process. According to Conte, Kobolt, and Habowski (2022), access to

information has become easy in this digital age, but functional illiteracy still prevails even among people with higher education, reaching around 47%.

This finding draws our attention to the process of understanding printed or digital readings and to how children are attracted to the texts to which they are exposed. In this sense, the challenges are numerous, and teachers must ask themselves “[...] how to mobilize educational processes with digital technologies, to interpret and ground social learning experiences, in order to develop the different human capacities and relationships with knowledge of reality” (CONTE, 2022, p. 43).

The main challenges include weaknesses in schools' connectivity and internal networks; a shortage of equipment for student use; insufficient teacher education focused on the pedagogical use of DICT; risks related to data privacy; regional inequalities that compromise equity; and the need for clear and ethical guidelines for the use of AI.

Final Considerations

It is concluded that consolidating digital culture in schools requires continuous investment in infrastructure, teacher education, and data-protection policies. Brazil has advanced in defining regulatory frameworks and structural programs, but the effective use of technologies depends on articulation among policies, school management, and contextualized pedagogical practices. Overcoming regional inequalities and ensuring teachers' leading role are essential for technologies to contribute to more equitable and meaningful education.

Thus, it is concluded that digital technologies occupy an ambiguous place in basic education: while they offer real possibilities for pedagogical innovation, they may also contribute to the continuation of traditional practices if appropriated uncritically and instrumentally. Overcoming this contradiction requires rethinking teacher education, curricula, teaching methodologies, and working conditions, recognizing that transforming educational practices depends not only on incorporating new resources but also on constructing a pedagogical conception committed to students' critical and democratic education.

As limitations of the study, the analysis is predominantly grounded in a literature review, which makes direct observation of technology-mediated pedagogical practices in everyday school life impossible. In addition, the scarcity of studies that investigate in depth whether digital technologies have promoted pedagogical innovation or merely updated traditional teaching limits comparisons among different educational contexts.

References

BRASIL. Decreto nº 11.713, de 26 de setembro de 2023. Institui a Estratégia Nacional de Escolas Conectadas. Disponível em: https://www.telebras.com.br/publicado-o-decreto-que-instituiu-a-estrategia-nacional-de-escolas-conectadas/. Acesso em: 26 fev. 2026.

BRASIL. Ministério da Educação. Base Nacional Comum Curricular (BNCC). Brasília: MEC/CNE, 2017. Disponível em: https://www.gov.br/mec/pt-br/cne/base-nacional-comum-curricular-bncc. Acesso em: 26 fev. 2026.

BRASIL. Ministério da Educação. Portal Formação – Mais Professores. Brasília: MEC, 2025 –2026. Disponível em: https://www.gov.br/mec/pt-br/mais-professores/portal-formacao. Acesso em: 26 fev. 2026.

BRASIL. Ministério da Educação. Portaria nº 22, de 9 de maio de 2024. Define critérios da Política de Inovação Educação Conectada (PIEC) para repasse de recursos financeiros às escolas públicas no ano de 2024. Disponível em: https://assespropr.org.br/wp-content/uploads/2024/05/PORTARIA-No-22-DE-9-DE-MAIO-DE-2024-DOU-Imprensa-Nacional.pdf. Acesso em: 26 fev. 2026.

CGI.br – Comitê Gestor da Internet no Brasil. Estudo do CGI.br mapeia acordos entre plataformas digitais e a rede pública de ensino no Brasil. São Paulo: CGI.br, 2022. Disponível em: https://www.cgi.br/noticia/releases/estudo-do-cgi-br-mapeia-acordos-entre-plataformas-digitais-e-a-rede-publica-de-ensino-no-brasil/. Acesso em: 26 fev. 2026.

CGI.br – Comitê Gestor da Internet no Brasil. Pesquisa sobre o uso das Tecnologias de Informação e Comunicação nas escolas brasileiras – TIC Educação 2023. São Paulo: CGI.br/NIC.br, 2024. Disponível em: https://www.cgi.br/publicacao/pesquisa-sobre-o-uso-das-tecnologias-de-informacao-e-comunicacao-nas-escolas-brasileiras-tic-educacao-2023/. Acesso em: 26 fev. 2026.

CNN Brasil. CNE vota regras para uso de IA em sala de aula; entenda. 24 fev. 2026. Disponível em: https://www.cnnbrasil.com.br/educacao/cne-vota-regras-para-uso-de-ia-em-sala-de-aula-entenda-sobre-o-assunto/. Acesso em: 26 fev. 2026.

CONTE, E. Educação, Desigualdades e Tecnologias Digitais em Tempos de Pandemia. In: RONDINI, Carina Alexandra. (Org.). Paradoxos da Escola e da Sociedade na Contemporaneidade 1. ed. Porto Alegre, RS: Editora Fi, 2022, v. 1, p. 32-62. <https://www.editorafi.org/ebook/507paradoxos> 08 maio. 2026

CONTE, E.; KOBOLT, M. E. de P.; HABOWSKI, A. C. Leitura e escrita na cultura digital. Educação, v. 47, n. 1, e33/p. 1-30, 2022. Disponível em: <https://doi.org/10.5902/1984644443953> Acesso em: 08 maio. 2026.

FNDE/MEC. Portal do Livro Digital – PNLD Digital. Brasília: FNDE, 2023–2026. Disponível em: https://pnld.fnde.gov.br/. Acesso em: 26 fev. 2026.

G1. Conselho Nacional de Educação marca data para votar regras para o uso de inteligência artificial nas escolas. 23 fev. 2026. Disponível em: https://g1.globo.com/educacao/noticia/2026/02/23/conselho-nacional-de-educacao-marca-

data-para-votar-regras-para-o-uso-de-inteligencia-artificial-nas-escolas.ghtml. Acesso em: 26 fev. 2026.

INEP – Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira. Censo Escolar. Brasília: MEC/INEP, 2024. Disponível em: https://www.gov.br/inep/pt-br/areas-de-atuacao/pesquisas-estatisticas-e-indicadores/censo-escolar. Acesso em: 26 fev. 2026.

MEC. AVAMEC – Ambiente Virtual de Aprendizagem do MEC. Brasília: MEC, 2026. Disponível em: https://avamec.mec.gov.br/. Acesso em: 26 fev. 2026.

MUNHOZ, Antônio Siemsen. Tecnologias educacionais. São Paulo: Saraiva, 2016.

RNP – Rede Nacional de Ensino e Pesquisa. PNLD Digital. Brasília: RNP, 2024. Disponível em: https://www.rnp.br/projetos/pnld-digital/. Acesso em: 26 fev. 2026.