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Artificial Intelligence and undergraduate courses in Brazil: an analysis of guidelines and guiding documents

Abstract

This article investigated the presence of specific guidelines for integrating Artificial Intelligence (AI) in licentiate degree programs in Brazil, through an analysis of the national curriculum guidelines and guiding documents from the Ministry of Education. The research revealed the absence of clear recommendations on the incorporation of AI into teacher training curricula, identifying gaps in how technologies should be inserted into education curricula to prepare teachers for the responsible use of AI. The results showed that AI is little discussed in the guidelines and that, when we find it, they are more related to the usability of tools. The lack of guidelines ultimately leads to a greater acceptance of the education platforming phenomenon, which increasingly results in educational systems dependent on products and training from big companies. The study pointed to the importance of greater integration of AI in curriculum guidelines to prepare future teachers to deal with the challenges and opportunities offered by technologies already used in education.

Keywords: Platformization of education; educational technologies; teacher training.

Inteligência Artificial e os cursos de licenciatura no Brasil: uma análise das diretrizes e documentos norteadores

Resumo

Este artigo investigou a presença de orientações específicas para a integração da Inteligência Artificial (IA) nos cursos de licenciatura no Brasil, por meio da análise das diretrizes curriculares nacionais e documentos norteadores do Ministério da Educação. A pesquisa revelou a ausência de recomendações claras sobre a incorporação da IA nos currículos de formação de professores, identificando lacunas sobre como as tecnologias devem ser inseridas nos currículos de forma a preparar os docentes para um uso responsável de IA. Os resultados mostraram que a IA é pouco abordada nas diretrizes e que, quando as encontramos, estão mais relacionadas à usabilidade de ferramentas. A falta de orientações acaba levando a maior aceitabilidade do fenômeno de plataformização da educação, que tem cada vez mais sistemas de ensino dependentes de produtos e formação de grandes empresas. O estudo apontou para a importância de uma maior integração da IA nas diretrizes curriculares para preparar os futuros professores para lidarem com os desafios e oportunidades oferecidos pelas tecnologias já utilizadas na educação.

Palavras-chave: Plataformização da educação; tecnologias educacionais; formação de professores.

Introduction

The use of Artificial Intelligence (AI) in education is becoming increasingly prevalent, just as we have already witnessed its applications in fields such as economics, healthcare, document processing, media consumption, and information access. The development of AI is not a recent phenomenon. Research in this field began over 70 years ago, but in a relatively short period, we have witnessed significant advances. AI has had a major impact over the past decade and is likely to continue shaping the next, with profound effects across various aspects of society.

Based on machine learning and deep learning, current AI applications make use of artificial neural networks (ANNs), which are inspired by the functioning of the human brain. ANNs are complex networks interconnected by simple processing units capable of performing multiple operations simultaneously, such as parallel computations for information processing and knowledge representation. From ANNs, Generative AI models have evolved and become capable of identifying patterns and creating generalizations without the need for labeled or supervised data.

According to Miao et al. (2021), there are already several promising examples of AI use in the field of education. Some examples mentioned by the authors refer to educational chatbots that facilitate administrative processes between universities and students or that can directly support learning by answering students' questions. These tools can be used 24 hours a day, seven days a week. There are also intelligent tutoring systems that, through the analysis of data collected from student interactions, help create personalized learning plans tailored to students' preferences or needs. Additionally, ABCD systems, based on communication and dialogue, employ natural language processing (NLP) and other AI techniques to support online tutoring. In this case, rather than offering ready-made instructions and answers, ABCD systems guide students to discover solutions on their own. Exploratory learning environments (ELEs), grounded in a constructivist approach, encourage students to actively build their own knowledge by exploring the learning environment and making connections with their prior knowledge. Other notable tools include language learning and reading platforms that provide automatic feedback to help students improve their pronunciation or that detect and analyze reading skills to offer personalized feedback. In distance education, AI-powered systems are already being used to monitor discussion forums within virtual learning environments (VLEs), helping optimize teachers' time by categorizing and responding to multiple students efficiently.

With widespread adoption across different levels and modalities of education, AI has become increasingly present not only in mediating the teaching and learning process but also in institutional management systems, with access to extensive databases on students, teachers, and educational institutions.

Understanding the potential and challenges of artificial intelligence during teacher education is essential to prepare future educators in a conscious and critical manner. According to Souza (2020), teacher training should go beyond the superficial use of technology and include a deep understanding of how AI can be meaningfully and effectively applied to enhance student learning. It is crucial to equip teachers to leverage the opportunities offered by AI while considering students' individual needs and promoting personalized learning.

A major challenge for the dissemination and responsible use of AI in Brazil is teacher training, since it is teachers who can extend the reach of potential changes throughout the national territory via basic education. Beyond the professionals currently in practice, when it comes to AI, the Ministry of Education faces the challenge of not only restructuring the curriculum to include AI literacy in a cross-curricular manner, but also of developing a national regulation specifically aimed at the training of in-service teachers, who are now confronted with a reality that differs significantly from what they experienced during their undergraduate education.

Given the context presented, this article aims to analyze the guidelines of undergraduate teacher education programs and key policy documents in order to identify

recommendations related to the use of technology in the classroom, highlighting the presence or absence of artificial intelligence in these directives.

Methodology

The methodology chosen for this study was a qualitative approach based on document analysis. Accordingly, the selection, collection, and analysis of information contained in primary and secondary documents related to guidelines on the use of artificial intelligence in education were carried out, with a focus on aspects concerning teacher training. Regarding document research, it is essential to understand who the authors of the documents were, the political and social context surrounding their development, and other factors that influenced their format and content.

> Official documents – generally constitute the most reliable source of data. They may pertain to individual acts or, conversely, to political actions with municipal, state, or national scope. The researcher's responsibility lies in the fact that they do not exercise control over how the documents were created. Thus, the researcher must not only select what is relevant but also interpret and compare the material to make it usable. (Lakatos; Marconi. 2003, p. 178)

The following documents were selected for analysis:

Table 01 – Official Documents Analyzed

Document	Date	Content
National Education Plan [PNE – *Plano Nacional de Educação*]	2024-2034	Establishes guidelines, goals, and strategies for the development of education in Brazil through 2034.
National Curriculum Guidelines for Teacher Training in Basic Education	CNE/CP Resolution No. 2, dated July 1, 2015, revised in 2019 by CNE/CP Resolution No. 2, dated December 20, 2019.	They establish guidelines for the organization of undergraduate teacher education programs, including minimum workload, curricular structure, internships, and complementary activities.

National Curriculum Guidelines for Initial Higher Education of Teaching Professionals for Basic School Education	CNE/CP Resolution No. 4, dated May 29, 2024	Establishes the National Curriculum Guidelines for Initial Higher Education of Teaching Professionals for Basic School Education (including licentiate programs, pedagogical training programs for non-licensed graduates, and second-degree licentiate programs).
National Core Curriculum [BNCC – *Base Nacional Comum Curricular*]	CNE/CP Resolution No. 2/2017, and in 2018, CNE/CP Resolution No. 4/2018, for High School Supplement 2022	Defines the knowledge, skills, and competencies that all Brazilian students are expected to develop, including aspects related to teacher's training.

Source: Author's own elaboration (2024).

As guiding references for reflection, we can also point to other documents, such as the Opinions and Resolutions of the National Education Council [*Pareceres e Resoluções do Conselho Nacional de Educação*], issued in response to demands from higher education institutions or the academic community, which regulate the organization and functioning of teacher education programs. Additionally, the Institutional Development Plans of Higher Education Institutions reflect how national curricular guidelines and educational policies are implemented at the institutional level. In some cases, we also identified documents issued by state and municipal education departments, which may establish specific regulations aligned with national guidelines for teacher education programs. However, as these documents vary by region and are more frequently updated, they are not the primary focus of this analysis. This study centers on national-level guidelines, which serve as the foundation for local, state, and institutional directives.

Results and Analysis

The National Core Curriculum (BNCC) in Brazil was developed starting in 2015, with the participation of various groups, including experts, educators, and administrators. The process involved public debates and consultations, which, although aimed at fostering dialogue with educational stakeholders and refining different versions of the document, did not

allow sufficient time for in-depth discussions on sensitive and complex issues. The document was officially approved in 2017 for Early Childhood Education and Elementary Education, CNE/CP Resolution No. 2/2017, and in 2018 for High School, CNE/CP Resolution No. 4/2018. This limited opportunity for broad-based debate was largely due to the context described below:

> The implementation of the BNCC in different contexts constitutes a challenge, considering the country's diversity in terms of an extensive network of educational systems distributed across a vast territory, as well as varying social, economic, and cultural dimensions and realities. Within this context, the construction of the BNCC with arguments ranging from opposition to the conception of a centralized and rigid curriculum, which could limit teacher autonomy and disregard regional specificities, to those who viewed the BNCC as merely a collection of content, disconnected from an effective educational project, potentially resulting in the use of manuals and ready-made solutions (CALAZANS; SILVA; NUNES *apud* RATIER, 2018, p. 1657).

BNCC has a significant impact on education in Brazil. By establishing the essential knowledge, skills, and competencies that all students are expected to develop, it seeks to promote national alignment in the design of school curriculum, outlining and defining the understanding of contemporary demands within the educational context. Given its central role, it is essential, when discussing artificial intelligence, to closely examine how BNCC addresses technology-related teaching.

The 2017 and 2018 versions of BNCC were developed before Generative AI gained prominence, which has since introduced a range of innovations in education, such as the creation of personalized and adaptive educational content, as well as the development of more interactive and immersive learning environments, including simulations. These advances have been accompanied by significant challenges, including the need to ensure the quality and accuracy of AI-generated content and concerns regarding ethical implications. The following section presents the references to technology found in the BNCC:

Table 02 – BNCC Guidelines for Basic Education

General Guidelines (Early Childhood Education, Elementary Education, and High School)	p. 9 “To understand, use, and create digital information and communication technologies in a critical, meaningful, reflective, and ethical manner within various social practices including school-related ones), to communicate, access and disseminate information, produce knowledge,

	solve problems, and exercise agency and authorship in both personal and collective life.”
General Guidelines (Only High School)	p. to ensure the contextualization of knowledge, articulating the dimensions of work, science, technology, and culture;” p. 467 “to appropriate the languages of digital technologies and become fluent in their use.”

Source: Author’s own elaboration (2024).

The word "technology" appears throughout the BNCC document and suggests the need to prepare students for the critical and responsible use of such tools. However, to what extent is this reflected in the provisions outlined in the official documents?

The focus of this study is Elementary Education and High School, that is, basic education. For the final years of Elementary Education, the document mentions the need to increase the complexity of the topic, given that reality is changing.

> It should also be considered that digital culture has promoted significant social changes in contemporary societies. Due to the advancement and proliferation of information and communication technologies, along with increased access through the greater availability of computers, cell phones, tablets, and similar devices, students are dynamically immersed in this culture, not only as consumers. (Brazil, 2018, p.59)

However, despite this indication, the skills and actions to be developed are not clearly articulated. Relevant concerns are found, for example, in the BNCC for elementary education, which defines the need for "more democratic uses of technologies and more conscious participation in digital culture,” and, and, as highlighted in the general competencies, the necessity to “understand, use, and create digital information and communication technologies in a critical, meaningful, reflective, and ethical manner”. (Brazil, 2018, p.59 and p.63). However, most references refer to the usability of technology across different knowledge areas, emphasizing knowledge related to STEM fields. There is emphasis on the various areas of knowledge, but primarily focused on the usability of technologies to communicate, access and disseminate information, produce knowledge, and solve problems. Nevertheless, how can such a proposal be implemented reflectively and critically if teachers are not adequately prepared?

In the High School BNCC, there is a movement toward deepening certain information related to the use of technologies in contemporary Society. According to the document, beyond knowing how to search for data and information, it is also necessary to understand their potential risks, to appropriate digital culture, and to produce and comprehend content from various media. Furthermore, students should be able to propose and implement solutions (processes and products) involving different technologies to identify, analyze, model, and solve complex problems across various areas of everyday life, effectively exploring logical reasoning, computational thinking, investigative spirit, and creativity. (Brazil, 2019, pp. 475-476)

Thus, in high school, we also identified a strong incorporation of the use of technologies, in other words, their usability across different areas of knowledge. In the general BNCC document, there is a section named “Digital Technologies and Computing,” which highlights the omnipresence of technologies and the constant adaptation required by those involved in preparing future generations. Although it states that such concerns are reflected in the core competencies for Basic Education related to computing and digital technologies, we did not find clear recommendations on how teachers should work with digital technologies in the classroom. Regarding this item, it presents some relevant points:

> - computational thinking: involves the ability to understand, analyze, define, model, solve, compare, and automate problems and their solutions methodically and systematically, through the development of algorithms;
> - digital world: refers to learning about ways to process, transmit, and distribute information securely and reliably across various digital artifacts – both physical (computers, mobile phones, tablets, etc.) and virtual (the internet, social networks, cloud storage, among others);
> - understanding the contemporary importance of encoding, storing, and protecting information;
> - digital culture: encompasses learning aimed at fostering more conscious and democratic participation through digital technologies. This implies understanding the impacts of the digital revolution and the advancements of the digital world on contemporary society; developing a critical, ethical, and responsible attitude toward the wide range of media and digital content available; understanding the possible uses of different technologies and the content they disseminate; and achieving fluency in the use of digital technologies to express solutions and cultural manifestations in a contextualized and critical manner. (Brazil, 2019, p. 474 and 475)

These guidelines present a major challenge for teacher training in Brazil, as they indicate the need for ongoing preparation to integrate digital technologies into education. To effectively teach computational thinking, teachers must master fundamental computer science concepts such as algorithms, data structures, and problem-solving. They should be capable of guiding students in breaking down complex problems into smaller parts, identifying patterns, and creating algorithms for their resolution. Moreover, teachers need to be familiar with programming tools and environments that support hands-on and challenging activities, allowing students to develop their skills in this area. It is also crucial for educators to understand how to integrate computational thinking across various disciplines and educational contexts, promoting interdisciplinarity and the practical application of these concepts in different fields of knowledge. However, is it feasible, and even desirable, to expect such demands to be met within teacher education?

Considering these recommendations, educators need to acquire competencies related to the processing and secure transmission of information in digital environments. They must be proficient in using digital tools available in the classroom and in promoting a culture of online safety among students.

Equally important, the BNCC provisions state that teachers must be prepared to guide students toward conscious and critical participation in the digital world. This involves fostering an understanding of the social and ethical impacts of digital technologies, encouraging responsible behavior toward digital content, and empowering students to use technology creatively and reflectively.

Therefore, teacher training cannot be limited to the technical mastery of digital technologies; it must also encompass a broader understanding of the pedagogical, ethical, and social implications of these tools. Educators need to be prepared to face the challenges and seize the opportunities brought by a constantly evolving digital world.

The following are the Guidelines for Teaching Education Programs, CNE/CP Resolution No. 2, December 20, 2019, and the updated version in CNE/CP Resolution No. 4, dated May 29, 2024.

CNE/CP Resolution No. 2, of December 20, 2019, begins by stating that teacher education programs must be based on the National Core Curriculum (BNCC-Basic Education). Accordingly, this resolution amended CNE/CP Resolution No. 2 of July 1, 2015, and established the National Core Curriculum for Initial Teachers Training (BNC-Training).

The document states in Article 2 that “Teacher training implies the development, by the undergraduate student, of the general competencies outlined in the BNCC-Basic Education” (BRAZIL, 2019, p.2). Thus, there is an expectation to find guidelines for teacher preparation that address current technology-related issues.

In article 7, by acknowledging the right to acquire “knowledge, skills, values, and attitudes essential for successful course completion and future teaching practice,” the document also emphasizes the importance of teacher education that addresses the demands of the 21st-century educational context. The section in Article 8, which highlights the commitment to innovative methodologies and significant learning aligned with BNCC, is closely linked to the need to critically teach technology to educators, especially considering the growing significance of artificial intelligence.

How can we talk about technologies without including the topic of artificial intelligence in the curriculum for teacher education programs? And how can we ignore AI in the preparation of future educators?

Reflecting on AI education involves not only how to use different technological tools but also the ability to guide students regarding the benefits, risks, and ethical implications of these technologies.

To understand the workload specifically destinated to training aligned with the guidelines set forth in BNCC, it is important to note that, out of the total minimum workload of a course, 3,200 (three thousand two hundred) hours, 1,600 (one thousand six hundred) hours are dedicated to learning the specific subject matter of the areas as well as mastering the pedagogical aspects of these contents.

In the new guideline issued in May 2024, when examining the topics related to technologies, one might have expected a move toward addressing the gaps left by the 2019 guideline. However, this is not the case, as no significant changes have been introduced. The same elements from the previous guideline were maintained: mastery and use of technologies; the use of Information and Communication Digital Technologies to enhance pedagogical practice; the use of educational technologies and various didactic-pedagogical resources and strategies; and the recontextualization of media language for educational purposes.

In both the 2019 and 2024 guidelines, the same issue was identified: although the documents state that orientations would be provided by the BNCC, the BNCC itself includes only a few contents to be addressed within specific subject areas. That is, it does not delve into the technological specificities that teachers are expected to develop. While the BNCC acknowledges the importance of the critical and responsible use of educational technologies as an integral part of the educational process, it fails to provide clear guidance on how such training should occur. As a result, it leaves room for interpretations focused solely on the usability of technologies, without encouraging the necessary critical reflection on how these technologies are developed, what their objectives are, who produces them, and how data collected by major tech companies is handled. The vague manner in which the guidelines address technology in teacher education ultimately contributes to the intensification of a phenomenon that will be discussed in the following section: the platformization of education.

The accelerated pace of technological innovation in digital communication has been marked by a high concentration of content and tool provision by transnational corporations (an example is the so-called Big Techs). Scholars point to the dominance of companies such as Google, Apple, Facebook, Amazon, and Microsoft. According to Zuboff (2018), this reflects the organization of a new form of capitalism and capital accumulation, based on the ability to collect, store, process, and interpret personal data generated using computational resources. One of the core issues lies in the concentration of market power in the hands of a very small group of companies, which are now expanding their reach into the educational sphere.

Digital platforms became significantly more widely used in the educational context due to the demands imposed by the COVID-19 pandemic. According to a study conducted by Cetic.br in 2019, only 28% of educational institutions, both public and private, located in urban areas reported using some type of platform, with social media being one of the main channels of interaction between schools and families. However, the 2020 report revealed that “the use of commercial videoconferencing systems – particularly Google Meet, Zoom, and Microsoft Teams – as a resource to support the continuity of classes was reported by 80% of state schools, 75% of private schools, and 42% of municipal schools” (CGI, 2022). In other words, the use of digital platforms in educational institutions increased significantly.

The fact is that digital platforms have become embedded in education, and data and information are now transmitted in greater volume, controlled by an economic and pedagogical structure aimed at shaping a consumer-subject across social contexts and national borders. The adoption of a platform often implies the standardization and uniformity of teaching processes. Furthermore, the use of data from students and education professionals as a form of Exchange, currently lacking clear regulation in Brazil, has become a critical issue that warrants further investigation.

Major companies have increasingly sought to offer platforms and applications geared toward education. As Santos (2020) points out, companies like Google and Facebook have been integrating and developing customized products by offering extensions and connections between platforms, such as cloud storage, digital libraries, and communication systems. This enables the unrestricted flow of data from students, teachers, and schools. The author highlights that, even without proper testing and evaluation, such platforms continue to be adopted because they present solutions that are difficult to refuse, given that they are free or low-cost, and because there are no free or public alternatives available to replace them.

Added to this issue is, according to the CGI report (2022, p.15), “the absence of public oversight or auditing of the algorithms used to provide services to training centers, research institutions, and hubs for the dissemination of scientific knowledge in the country, as well as their use for advertising purposes.”

Thus, it seems relevant to address the use of digital platforms in teacher education from a critical perspective, given that the topic is still largely unfamiliar to public education administrators and teachers. It is urgent to consider algorithmic biases, the explainability of AI models used, and how datasets are constructed and fed, while also recognizing the need to identify situations in which the use of such technologies should be avoided, adapted, or even banned.

In the section on specific competencies, the guidelines document does not include any issues related to technologies, leaving only brief remarks to be found in the final two items of the table included in the 2019 guidelines.

Table 03 - Training dimensions related to technologies in the 2019 Teacher Education Guidelines

DIMENSION OF PROFESSIONAL PRACTICE
1. Conduct educational curation, use digital technologies, virtual content, and other technological resources, and incorporate them into pedagogical practice to enhance and transform students' learning experiences and encourage an investigative attitude. 2. Use appropriate technologies in teaching practices.
DIMENSION OF PROFESSIONAL ENGAGEMENT
1. Be attentive to the different forms of physical and symbolic violence, as well as ethnic-racial discrimination practiced in schools and digital environments, in addition to promoting the ethical, safe, and responsible use of digital technologies.

Source: Author's own elaboration (2024).

The reference to the use of technology in the guidelines is quite broad, leading to reflections on the need for public policies that can ensure the conditions necessary for the development of these elements. Such conditions depend on financial investment to improve infrastructure, support training programs and research developed by and for teachers within different educational systems, and enable the use of free and open-source software that prevents educational institutions from becoming dependent on Big Tech companies.

To effectively meet the elements outlined in the 2019 guidelines, it is first necessary to make significant investments in both initial and continuing teacher education, so that educators are adequately prepared to integrate digital technologies into their pedagogical practices. This investment must go beyond training courses and workshops; it must also ensure that teachers have proper access to the necessary technologies. Educators require appropriate equipment and reliable internet access, especially considering the unequal conditions across Brazilian

schools. According to the 2023 School Census, although the municipal network accounts for the largest number of elementary education schools it is the one with the least access to technological resources, such as digital whiteboards (12.5%), multimedia projectors (58.8%), desktop computers (39.6%) or laptops (34.8%) for students, as well as internet access for student use (36.7%). This lack of infrastructure is also unevenly distributed across regions. For instance, only 47.8% of elementary schools in the North region have broadband internet access. The study also shows that access to the internet and broadband is more widespread in high school than in elementary school. The Southeast, Central-West, and Northeast regions have the highest percentages of schools with broadband internet access, with 97.0%, 89.4%, and 88.9%, respectively. The South has the lowest percentage, with 77.2% of schools connected. The Southeast leads in the availability of tablets for students, present in 34.1% of schools. The South stands out with the highest percentage of schools equipped with desktop computers (87.9%) and laptops (76.6%) for students. (Brazil, 2024).

Another important consideration is that pedagogical development must be centered on the teacher, who, even when adequately trained, will still require technical support from educational technology specialists. These professionals should provide ongoing guidance and assistance to teachers throughout the implementation of projects and educational processes within schools.

Although artificial intelligence is not explicitly mentioned in the Teacher Training Guidelines or the BNCC, there is also a lack of clarity regarding its use in the types of applications that have been present in the educational context since the early 2000s. Examples include chatbots, adaptive learning platforms, and educational data analysis systems, such as those employed by the National Institute for Educational Studies and Research Anísio Teixeira [INEP - *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira*], which uses data from the National High School Exam [ENEM - *Exame Nacional do Ensino Médio*] and the National Student Performance Exam [ENADE - *Exame Nacional de Desempenho dos Estudantes*]. These systems have incorporated AI in education for quite some time.

There is still no clear provision that the curriculum should be designed to promote the ethical and responsible use of technology, which raises concerns about what tools and frameworks future teachers will have at their disposal to foster critical digital literacy among their students.

A more recent document, developed with broader participation from various sectors of society, is the National Education Plan [PNE - *Plano Nacional da Educação*], which outlines the educational policies and guidelines to be implemented in Brazil over the next decade, covering the period from 2024 to 2034. The plan defines strategies and priorities for the development of the Brazilian educational system, aiming primarily at improving the quality of education, promoting equity, and strengthening the system as a whole. These more recent

guidelines will be analyzed with a particular focus on how they address the preparation for the use and implementation of technologies in schools and the specific actions that are proposed.

In fact, PNE (2024-2034) broadens the debate and introduces significant strategies already highlighted by scholars in the field of AI in education. It is worth noting that the term artificial intelligence appears only once in the document; however, many other aspects related to its applicability in education are present, particularly in the discussion of risks and proposed actions.

Right in Axis I, the document emphasizes the importance of ensuring the use of educational technologies, assistive technologies, and accessible pedagogical resources appropriate to the teaching and learning process. It repeatedly reinforces the commitment to the development of the triad of education, science, technology, and innovation. The document highlights relevant aspects for the safe use of AI, such as “guaranteeing access, regulation, data protection, means, critical training, and socio-environmental management for the use of communication and information technologies.” It also points to the implementation of media literacy and critical education programs for the training and development of both education professionals and students.

The document is clear and contextualizes the Brazilian reality and its challenges. Item 263 proposes the creation of public platforms, funded by consortia of educational institutions and other entities, to support educational projects using open-source and publicly accessible technologies. This includes ensuring broadband access for all students and education professionals, thereby enabling equitable digital access across the country. Regarding teachers, the document highlights the need to guarantee “access to quality wired and/or Wi-Fi internet, digital and technological resources, technological infrastructure – including software, hardware, and assistive technology - for the planning and delivery of lessons, activities, training, and knowledge production, with a view to full digital inclusion.” (Brazil, 2024, p. 162).

The active participation of teachers, students, and local communities is essential for discussing and addressing educational challenges through the use of technology, especially when platforms are developed as part of the implementation of public policies. The issue of open-source technologies and the necessary caution in public-private partnerships is highlighted at several points in the document, as we can see below:

> Thus, it is necessary to ensure that educational reforms do not succumb to reductionist pressures from private interests and from a model that diminishes the role of the State, such as the neoliberal agendas that have grown in recent years within the educational field. Examples of policies reflecting such problems include the National Core Curriculum (BNCC), the National Common Base Training (BNC-Training), and the High School Reform (Law

> No. 13,415, dated February 16, 2017), which require revocation; the outsourcing of management of educational institutions through social organizations; the flexibilization of regulatory frameworks and evaluation of distance education; and pedagogical control through technologies and virtual platforms. In short, it is necessary to oppose all forms of devaluation of education and the financialization, privatization, outsourcing, and transfer of the State's responsibilities in education to the private sector (across all levels, stages, and modalities), as well as all attacks on the labor and social security rights of education professionals. (Brazil, 2024, p.58)

The document highlights the importance of understanding that the construction of public policies for education is a contested field, yet dominated by a certain hegemony of neoliberal norms and guidelines. It is in this sense that we attribute the recent set of changes to the character of counter-reforms. Carlos Nelson Coutinho (2012) points out that this is a Gramscian concept. Although somewhat peripheral within Gramsci's theoretical corpus, this concept has the capacity to more precisely define the conjuncture of public policies for Brazilian education, especially the current scenario of reforms in high school, vocational education, and higher education. For Coutinho (2012), unlike the "passive revolution"[1], another Gramscian concept presenting the "revolution-restoration", binomial, the counter-reform exhibits fewer elements of transformation as concessions to popular demands or those "from below,", but rather the predominance of the "old," restoration-conservation, although presented as a positive, progressive, and autonomous reform.

The construction of this "positive" and "progressive" image of counter-reforms occurs simultaneously with the accelerated process of drafting and approving these public policies. In studying the context and actions that led to the approval of the BNCC, Tarlau and Moeller (2018) attest that this process resulted from the practice of consensus through philanthropy.

> [...] when material resources, knowledge production, media power, and formal and informal networks are used by private foundations to achieve consensus among multiple social and institutional actors despite significant tensions, transforming the public policy in question into a widely accepted initiative. (Tarlau; Moeller 2018, p.554)

In the case of BNCC, which serves as the basis for the other counter-reforms, the authors point to the convergence of various corporations supporting the Movement for the

[1]For Gramsci, passive revolution is characterized as "a reaction by the ruling classes to the sporadic, elementary, non-organic subversion of the popular masses, through 'restorations' that incorporated some of the demands coming from below; it therefore involves 'progressive restorations' or 'revolution-restorations', or, alternatively, 'passive revolutions'." (Gramsci, 1999, p.393)

National Core Curriculum[2], with the Lemann Foundation being the most effective and concrete political force, also operating as the single most powerful actor in structuring consensus. The authors go further by highlighting that "corporate and private philanthropic influence in public education is not simply a neoliberal scheme to maximize profits" (Tarlau; Moeller, 2018, p.555), but essentially, "it is an attempt by corporate leaders and private foundations to gain power and influence at different scales and reshape public education in their own image and likeness" (Tarllau; Moeller, 2018, p.555). As asserted by Dardot and Laval (2018), neoliberalism is more than an economic paradigm; it is, in fact, a rationality that aims to organize and structure the most diverse aspects of social and human relations, such as education.

When focusing on the curricular aspect of the counter-reforms, it is worth refining the analysis through the lens of Ramos e Paranhos (2022), who highlight the articulation between "elements of ultra-neoliberal educational agendas, centered on competitiveness and efficiency, which accommodate the demands of the business sector" (Ramos; Paranhos, 2022, p.74), and "ultraconservative and reactionary educational agendas, structured around the concept of the 'traditional family' as the fundamental unit of social organization." (Ramos; Paranhos, 2022, p.74).

When addressing Distance Education in Brazil, as expected, the plan presents numerous considerations regarding the use of digital technologies. It highlights a particularly important aspect in the debate on artificial intelligence in education: the need to avoid a techno-solutionist perspective. Technology, in and of itself, does not solve the problems of education. Rather, it constitutes a set of tools that can support pedagogical or administrative actions planned by teachers and education professionals. Specifically concerning teachers:

> Most platforms also offer teacher training, often associated with the "mastery learning" methodology: training teachers to understand how to use the platform so they can assist their students. In other words, the teacher's role is reduced to selecting topics and checking for learning outcomes. This reconfiguration of the teacher's role positions them as an assistant to the platforms rather than as a central and consistent figure in guiding student development. Within this logic, teachers become easily replaceable, unlike the platforms. (BRAZIL, 2024, p.90)

The document further emphasizes that the implementation of digital technologies in education has increased teachers' workloads while reducing their involvement in the planning,

[2]According to its official website, it is "a non-governmental and nonpartisan network of individuals and institutions that, since 2013, has been dedicated to supporting and monitoring the quality construction and implementation of the National Core Curriculum [BNCC - *Base Nacional Comum Curricular*] and the New High School Reform." (*Movimento pela base*, 2024)

implementation, and assessment of student learning. Their traditional roles are being diminished, as digital platforms increasingly take on functions such as serving as sources of information and curriculum developers, thereby undermining teachers' control over the educational process.

The emerging indicators highlight essential needs for the use of digital technologies and AI, such as the provision of public, open, or flexible digital platforms. Considering the understanding of all processes and decision-making within the systems, technology cannot be used to "legitimize the absence, inaction, or negligence of public authorities in ensuring adequate conditions for regular, in-person schooling in all its dimensions (material and pedagogical)". (Brazil, 2024, p.90)

Thus, we can note that the document that best addresses the demands for teacher training regarding AI in contemporary society is the 2024 National Education Plan (PNE), which defines and guides important actions such as "supporting the training of teachers and other education professionals for the use of information and communication technologies, prioritizing the use of free, public, and open-source software and digital platforms." However, neither the Teacher Training Guidelines nor the BNCC provide clear directions on how to follow this path, leaving the recommendations in the Teacher Training Guidelines vague and open-ended, thereby creating a gap that allows private companies to define the agenda for training and the use of their educational systems and tools.

Final Considerations

The study highlighted existing gaps in addressing digital technologies within teacher education and raised concerns about these gaps being filled by advances in neoliberalism within the Brazilian educational context. Teacher training is a key element for the desired social changes and must be aligned with a conscious and responsible use of the various tools and technologies employed in education.

These factors highlight the importance of regulation and effective public policies regarding the use of artificial intelligence in Brazil, which can guide more impactful actions by the Ministry of Education and ensure that these technologies are used to promote equitable, democratic, and high-quality education.

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