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Flexible curriculum, educational inequalities, and artificial intelligence in public schools: challenges for contemporary secondary education

Currículo flexível, desigualdades educacionais e inteligência artificial na escola pública: desafios para o ensino médio contemporâneo

Currículo flexible, desigualdades educativas e inteligencia artificial en la escuela pública: desafíos para la educación secundaria contemporánea

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Abstract:
The curricular reconfiguration of Brazilian secondary education, consolidated through Law 13.415/2017 and the National Common Curricular Base, introduced new forms of school organization based on curriculum flexibility and training pathways. At the same time, the rapid advancement of digital technologies and artificial intelligence has significantly transformed educational practices and access to knowledge. This study critically analyzes the relationship between curricular flexibility, educational inequalities, and the emerging use of artificial intelligence in public schools. It is a qualitative theoretical study based on bibliographic review and documentary analysis of recent educational policies. The study discusses how curriculum flexibility may expand educational opportunities but also reproduce structural inequalities when implemented in contexts marked by disparities in infrastructure and teacher training. It argues that artificial intelligence has the potential to transform teaching and learning processes; however, unequal access to such technologies may reinforce disparities between school systems. The study concludes that democratizing access to educational technologies and scientific knowledge is essential for ensuring that curriculum flexibility contributes to educational equity in Brazilian secondary education.

Keywords:
Curriculum; secondary education; educational inequalities; artificial intelligence; educational policies.

Resumo:
A reconfiguração curricular do Ensino Médio brasileiro, consolidada a partir da Lei nº 13.415/2017 e da Base Nacional Comum Curricular, introduziu novas formas de organização da formação escolar baseadas na flexibilização curricular e na adoção de itinerários formativos. Ao mesmo tempo, o avanço acelerado das tecnologias digitais e da inteligência artificial tem produzido transformações profundas nas práticas pedagógicas e nas formas de acesso ao conhecimento. Nesse contexto, este estudo analisa criticamente as relações entre flexibilização curricular, desigualdades educacionais e o uso emergente da inteligência artificial na escola pública. Trata-se de uma pesquisa teórica de natureza qualitativa, fundamentada em revisão bibliográfica e análise documental de políticas educacionais recentes. O estudo discute como a flexibilização curricular pode ampliar possibilidades formativas, mas também reproduzir desigualdades estruturais quando implementada em contextos marcados por assimetrias de infraestrutura e formação docente. Argumenta-se que a incorporação da inteligência artificial na educação possui potencial para transformar processos de ensino e aprendizagem, porém sua adoção desigual pode reforçar disparidades entre redes escolares. Conclui-se que a democratização do acesso às tecnologias educacionais e ao conhecimento científico constitui

elemento fundamental para que a flexibilização curricular contribua para a equidade educacional no Ensino Médio brasileiro.

Palavras-chave:
currículo; ensino médio; desigualdades educacionais; inteligência artificial; políticas educacionais.

Resumen:
La reconfiguración curricular de la educación secundaria brasileña, consolidada a partir de la Ley n.º 13.415/2017 y de la Base Nacional Común Curricular, introdujo nuevas formas de organización de la formación escolar basadas en la flexibilización curricular y la adopción de itinerarios formativos. Al mismo tiempo, el avance acelerado de las tecnologías digitales y de la inteligencia artificial ha producido profundas transformaciones en las prácticas pedagógicas y las formas de acceso al conocimiento. En este contexto, este estudio analiza críticamente las relaciones entre flexibilización curricular, desigualdades educativas y uso emergente de la inteligencia artificial en la escuela pública. Se trata de una investigación teórica de naturaleza cualitativa, fundamentada en revisión bibliográfica y análisis documental de políticas educativas recientes. El estudio analiza cómo la flexibilización curricular puede ampliar posibilidades formativas, pero también reproducir desigualdades estructurales cuando se implementa en contextos marcados por asimetrías de infraestructura y formación docente. Se argumenta que incorporar inteligencia artificial a la educación tiene potencial para transformar la enseñanza y el aprendizaje, aunque su adopción desigual puede reforzar disparidades entre redes escolares. Se concluye que democratizar el acceso a las tecnologías educativas y al conocimiento científico es fundamental para que la flexibilización curricular contribuya a la equidad educativa en la educación secundaria brasileña.

Palabras clave:
Currículo; educación secundaria; desigualdades educativas; inteligencia artificial; políticas educativas.

Introduction

In recent decades, Brazilian education has undergone major structural changes related to curricular reorganization, expanded access to schooling, and the incorporation of digital technologies into teaching and learning processes. These changes include the secondary education reform established by Law No. 13,415/2017, which redefined curricular organization at this stage of basic education by introducing a division between basic general education and educational pathways (BRASIL, 2017).

Curricular flexibility was proposed as a strategy to make secondary education more attractive to students, increase school systems' autonomy, and diversify educational pathways. However, this reform is being implemented in a context marked by deep educational inequalities in Brazil, involving significant differences in school infrastructure, teacher education, and access to pedagogical resources across state school systems (KRAWCZYK, 2021).

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Alongside curricular changes, advances in digital technologies and artificial intelligence have significantly transformed knowledge production and circulation. Artificial intelligence tools, adaptive platforms, and virtual learning environments are gradually being incorporated into everyday education, influencing both teaching practices and interaction between teachers and students (LUCKIN et al., 2016).

The growing presence of these technologies in schools raises new questions about democratizing access to knowledge, teacher education, and curricular organization. Although artificial intelligence has the potential to expand educational opportunities, its unequal implementation can intensify existing disparities among schools and education systems (SELWYN, 2021).

Against this background, the following guiding question emerges: how does curricular flexibility in secondary education interact with contemporary technological transformations, and what are its implications for reproducing or overcoming educational inequalities?

This article aims to critically analyze relationships among curricular flexibility, educational inequalities, and the emerging use of artificial intelligence in Brazilian public schools. It seeks to discuss how these transformations can affect access to scientific knowledge and the educational opportunities offered to secondary school students.

Theoretical framework

Curriculum, power, and educational inequalities

The school curriculum is one of the main instruments for organizing knowledge in schools and plays a central role in mediating culture, society, and education. Far from merely being a neutral set of content, the curriculum expresses political and epistemological choices about which forms of knowledge should be legitimized and passed on to new generations. As Apple (2019) argues, the curriculum should be understood as a space of symbolic struggle in which different social groups seek to define which knowledge is considered socially valid and relevant.

In this sense, curricular organization is deeply linked to power relations in society. Content selection, the definition of priority areas, and the structure of educational pathways reflect educational projects that can contribute either to democratizing knowledge or to reproducing social inequalities. As Saviani (2021) emphasizes, schools occupy a strategic position in the struggle to democratize access to scientific knowledge, enabling different social

groups to access systematized forms of knowledge historically restricted to particular segments of society.

The sociology of curriculum has emphasized that unequal access to knowledge is one of the main mechanisms reproducing educational inequalities. Young (2014) introduces the concept of "powerful knowledge" to describe forms of knowledge that enable people to understand and interpret the world beyond everyday experience. According to the author, educational democratization depends on ensuring that all students have access to this knowledge, because it expands intellectual horizons and develops analytical abilities essential for social participation.

However, education systems marked by structural inequalities often show significant differences in access to such knowledge. Schools in different socioeconomic contexts have varying material resources, infrastructure, and cultural capital, which directly influence the educational opportunities offered to students. As Dourado (2019) observes, educational inequalities in Brazil are associated not only with families' socioeconomic conditions, but also with historical disparities in funding and infrastructure across school systems and institutions.

This reality shows that curricular reforms must be analyzed in light of the concrete conditions for implementation within education systems. Changes in curricular organization can produce different effects depending on schools' institutional conditions and available resources. Discussions of curricular flexibility in Brazilian secondary education must therefore consider the structural inequalities characterizing the country's education system.

Curricular flexibility and secondary education reform

Brazilian secondary education reform, consolidated by Law No. 13,415/2017, introduced significant changes in curricular organization at this stage of basic education. One of the main changes was the creation of educational pathways allowing students to choose advanced study in particular areas of knowledge or technical and vocational education (BRASIL, 2017).

According to supporters of the reform, curricular flexibility would make secondary education more attractive and aligned with contemporary societal and labor-market demands. Diversifying educational pathways could expand learning possibilities and provide educational experiences more closely connected to students' interests (KRAWCZYK, 2021).

However, several researchers have noted that this reform is being implemented in a deeply unequal education system. Where schools have significant differences in infrastructure,

teaching staff, and pedagogical resources, curricular flexibility may produce differentiated effects on educational provision. Ramos (2020) argues that curricular diversification may create different educational pathways across schools, widening disparities in access to scientific knowledge.

Frigotto (2020) also highlights this concern, criticizing educational reforms guided by flexibility associated with curricular segmentation. For the author, reducing the centrality of particular curricular components may undermine students' comprehensive education, especially where schools are the main setting for access to systematized knowledge.

Moreover, implementing educational pathways depends on institutional conditions that are not always present in public school systems. A diverse range of pathways requires teachers with specific qualifications, suitable infrastructure, and pedagogical resources enabling varied educational experiences. In many regions, these conditions remain limited, potentially restricting students' actual choices.

The curricular flexibility introduced by secondary education reform therefore requires critical analysis of its potential implications for educational equity. Expanding educational possibilities may represent important progress, provided it is accompanied by public policies ensuring equitable implementation conditions across school systems.

Digital technology, artificial intelligence, and education

Alongside curricular transformations, advances in digital technologies have profoundly changed educational practices. The development of artificial intelligence systems, digital learning platforms, and educational data analysis tools has expanded possibilities for pedagogical innovation in schools.

Artificial intelligence can generally be defined as technologies capable of performing tasks traditionally requiring human intelligence, such as pattern recognition, natural language processing, and data-based decision-making (HOLMES; BIALIK; FADEL, 2019). In education, these technologies have been used to develop adaptive learning systems, intelligent tutoring platforms, and tools supporting pedagogical planning.

According to Selwyn (2021), incorporating artificial intelligence into education has often been presented as a solution to contemporary educational challenges, including personalized learning, improved academic performance, and expanded access to knowledge. Algorithm-based systems can analyze large volumes of educational data and identify learning patterns, offering personalized support to students.

Recent research indicates that artificial intelligence tools can help develop learning environments more responsive to students' individual needs. Content recommendation systems, for example, can suggest specific activities based on student performance, while intelligent tutoring platforms can provide immediate feedback during tasks (ZAWACKI-RICHTER et al., 2019).

However, adopting these technologies also raises important issues of educational equity. Unequal access to technological resources is one of the main challenges to effectively integrating artificial intelligence into education. In many school contexts, especially socially vulnerable regions, digital infrastructure remains limited, hindering more advanced technological solutions (OECD, 2023).

Furthermore, using artificial intelligence systems requires specific teacher education to ensure pedagogically meaningful use. Teachers need digital competencies enabling them to integrate technologies critically and reflectively into teaching. As Bates (2019) argues, simply providing technological resources does not ensure educational innovation; these tools must be incorporated into consistent pedagogical strategies.

Another relevant aspect concerns the ethical implications of algorithms and automated systems in education. Data privacy, algorithmic transparency, and possible biases in artificial intelligence systems have been widely discussed in recent literature (UNESCO, 2021). These concerns indicate that integrating artificial intelligence into education must be accompanied by regulatory policies and ethical guidelines ensuring responsible use.

Artificial intelligence, curriculum, and new educational inequalities

The relationship between school curriculum and digital technologies becomes particularly relevant when considering the potential impact of artificial intelligence on teaching organization. Advances in these technologies have expanded access to knowledge while introducing new forms of pedagogical mediation in schools.

On the one hand, artificial intelligence can expand learning opportunities by offering personalized educational resources accessible in different contexts. Algorithm-based digital platforms can provide diverse educational content, allowing students to explore different areas of knowledge independently. This feature can directly engage with the logic of curricular flexibility in contemporary educational reforms.

On the other hand, unequal integration of these technologies can deepen existing educational disparities. Schools with greater technological infrastructure tend to incorporate

advanced digital tools more quickly, while institutions in socially vulnerable settings may struggle to implement these innovations. As Castells (2020) emphasizes, the network society produces new inequalities associated with differential access to information and digital technologies.

In this context, democratizing access to educational technologies is essential for artificial intelligence to effectively contribute to reducing educational inequalities. Public policies promoting digital inclusion, investments in school infrastructure, and teacher education are indispensable to ensuring that technological innovations benefit all students.

Furthermore, schools play a central role in educating citizens capable of critically understanding technological transformations in contemporary society. Education should go beyond instrumental technology use and encourage reflection on its social, economic, and cultural implications. As Morin (2020) states, future education must prepare individuals to understand the complexity of the contemporary world, including emerging technologies' impacts.

Thus, connecting curriculum, technological innovation, and educational equity is one of the main challenges for current educational policies. Building more democratic education systems requires integrated approaches combining curricular flexibility, digital inclusion, and guaranteed universal access to scientific knowledge.

Results and discussion

Artificial intelligence and classroom transformation

The incorporation of artificial intelligence (AI) into education is one of the most significant transformations in education systems in recent decades. Algorithms capable of analyzing large volumes of educational data, identifying learning patterns, and adapting pedagogical content have driven new ways of organizing teaching and learning.

In contemporary education, artificial intelligence has been used across different dimensions of the educational process. Applications include adaptive learning systems, intelligent tutoring platforms, educational data analysis (learning analytics), and automated formative assessment tools (HOLMES; BIALIK; FADEL, 2019). These technologies enable real-time monitoring of student performance and personalized pedagogical recommendations, enhancing more individualized learning processes.

According to Luckin et al. (2016), artificial intelligence-based education systems can significantly contribute to early identification of learning difficulties. By analyzing students' behavior in digital environments, these systems can identify gaps in conceptual understanding and suggest specific pedagogical interventions. This opens up new academic support strategies, especially in educational contexts with large classes and limited pedagogical resources.

Furthermore, intelligent digital platforms can expand curricular organization possibilities. Adaptive systems allow differentiated learning pathways, adjusting content and activities to students' individual pace and needs (ZAWACKI-RICHTER et al., 2019). This feature directly engages with curricular flexibility principles in contemporary educational reforms, including the reorganization of Brazilian secondary education.

However, introducing these technologies into schools involves tensions. Researchers have highlighted important ethical, pedagogical, and institutional challenges in incorporating artificial intelligence into education. Selwyn (2021) argues that the growing presence of algorithms raises questions about technological system transparency, educational data privacy, and the risk of excessive automation of pedagogical decisions.

Another relevant aspect concerns the possible reproduction of biases in algorithms used by artificial intelligence systems. Since these systems are trained on large datasets, historical inequality patterns in educational data may be reproduced or even amplified by automated systems (UNESCO, 2021). Their use therefore requires critical attention from educational institutions and public policymakers.

Integrating artificial intelligence into education also changes teachers' roles. Far from replacing teachers, these technologies tend to redefine their pedagogical functions. Instead of acting exclusively as content transmitters, teachers become increasingly important as knowledge mediators, learning-process guides, and interpreters of data generated by digital teaching systems (BATES, 2019).

In this scenario, teacher education becomes central to effective implementation. Teachers need digital competencies allowing critical, pedagogical, and contextualized technology use. Integrating digital resources with the curriculum's educational objectives becomes one of the main professional competencies in digital education.

However, public school systems show that this transition faces significant structural challenges. Many schools still have limitations in technological infrastructure, internet access, and digital equipment availability. These directly affect the possibilities for incorporating advanced educational technologies into everyday schooling.

The expansion of artificial intelligence in education therefore cannot be analyzed solely as a technological phenomenon, but also as a social and political process interacting with existing inequalities in education systems. Understanding its impacts on public schools requires considering material implementation conditions, teacher education processes, and the public policies regulating adoption.

Artificial intelligence, curriculum, and learning flexibility

The expansion of digital technologies has increased possibilities for curricular reorganization in education systems. In contemporary educational reforms, curricular flexibility has frequently been associated with digital tools capable of personalizing learning experiences.

In Brazil, secondary education reform introduced educational pathways, allowing students to choose different areas of knowledge. This proposal seeks to make curricula more flexible and aligned with students' interests while bringing schools closer to contemporary societal demands (KRAWCZYK, 2021).

Artificial intelligence can strengthen this curricular model by enabling personalized educational pathways. Adaptive digital learning systems can offer differentiated content and adjust activities to student performance. This may foster more diverse educational trajectories aligned with individual learning needs.

However, researchers warn that combining curricular flexibility and digital technologies can produce new mechanisms of educational segmentation. Ramos (2020) emphasizes that curricular diversification requires appropriate institutional conditions ensuring equitable access to educational opportunities. When these are not ensured, curricular flexibility may result in unequal educational trajectories.

In this sense, incorporating artificial intelligence into education may reinforce existing inequalities across schools. Institutions with greater technological infrastructure tend to use more sophisticated digital tools, increasing personalized teaching possibilities. Conversely, schools with limited resources may struggle to implement these technologies, restricting pedagogical innovation opportunities.

According to Castells (2020), contemporary society is characterized by new inequalities associated with differential access to digital technologies and information. In education, this dynamic can create what some authors call an "educational digital divide," in which students from different socioeconomic contexts have unequal access to the technological tools structuring contemporary learning.

The relationship among curriculum, technology, and inequality is therefore one of the main challenges facing current educational policies. Digital technologies can significantly expand schools' pedagogical possibilities, but their benefits depend on public policies ensuring equitable access to technological infrastructure and the teacher education required for their use.

Challenges and prospects for education in the context of artificial intelligence

The growing presence of artificial intelligence in contemporary society poses new challenges for education systems. Schools play a fundamental role in educating citizens capable of understanding, using, and critically questioning the digital technologies permeating social life.

Education therefore needs to incorporate new competencies related to computational thinking, critical data analysis, and digital ethics. According to the Organisation for Economic Co-operation and Development (OECD, 2023), education for digital society requires complex cognitive skills, including critical thinking, problem-solving, and interpreting information in digital environments.

However, integrating these competencies into school curricula depends on educational institutions' ability to keep pace with ongoing technological transformations. Brazilian public schools face significant obstacles related to unequal resources and infrastructure.

The main challenges to integrating artificial intelligence into education include:

inequalities in access to digital infrastructure among schools and regions;

insufficient systematic teacher education programs for the pedagogical use of digital technologies;

limited educational funding for acquiring and maintaining technological equipment;

difficulties connecting curricular policies with technological innovation policies.

These factors indicate that incorporating artificial intelligence into education cannot be treated solely as a technological issue. The process involves political decisions, public investments, and redefined pedagogical strategies.

At the same time, digital advances open new opportunities to strengthen public education. Artificial intelligence tools can expand access to knowledge, offer individualized pedagogical support, and develop new forms of collaborative learning.

To realize these possibilities, educational policies must prioritize equity and digital inclusion. School connectivity programs, teacher education, and digital educational resource development can reduce existing inequalities and expand learning opportunities for all students.

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Building education oriented toward the artificial intelligence era therefore requires technological innovation and a commitment to social justice and knowledge democratization.

Final considerations

The analysis in this article showed that recent transformations in Brazilian secondary school curricula cannot be understood in isolation, as they are deeply connected to broader structural changes in contemporary society. Curricular flexibility introduced by secondary education reform and the increasing incorporation of digital technologies, particularly artificial intelligence, simultaneously redefine the organization of school knowledge, pedagogical practices, and educational opportunities available to students.

In this context, curricular flexibility clearly has an ambivalent character. On the one hand, it can expand students' educational possibilities, enabling more diverse trajectories potentially connected to individual interests and contemporary societal demands. Educational pathways and opportunities for deeper study in specific areas can foster innovative pedagogical experiences, encourage student agency, and promote greater integration among fields of knowledge.

However, as studies in educational policy have shown, expanding curricular possibilities does not occur in a neutral social context. Educational reforms are implemented in systems marked by deep structural inequalities in funding, school infrastructure, teacher education, and access to pedagogical resources. Under these circumstances, curricular flexibility may produce different effects across school systems and educational territories, reproducing or even widening disparities in access to scientific knowledge and educational opportunities.

This becomes particularly relevant when considering the unequal distribution of educational resources in Brazil. Schools in more advantaged socioeconomic contexts tend to have a greater diversity of pedagogical resources, more robust technological infrastructure, and greater institutional capacity to implement diverse educational pathways. Conversely, institutions in socially vulnerable areas often face structural limitations restricting curricular provision.

Curricular flexibility may therefore produce concrete differences among students' educational pathways, creating scenarios in which certain social groups have greater access to more complex scientific and technological knowledge, while others remain restricted to limited

curricular offerings. This demonstrates the importance of public policies ensuring equitable reform implementation conditions.

Alongside these curricular transformations, the rapid expansion of digital technologies and artificial intelligence introduces new elements into contemporary educational debate. Algorithm-based tools, adaptive learning systems, and intelligent educational platforms have gradually become part of everyday schooling, influencing pedagogical practices, assessment methods, and teaching organization strategies.

Artificial intelligence has significant potential to support more personalized educational processes responsive to students' individual needs. Systems analyzing educational data and identifying learning patterns can offer differentiated pedagogical support, helping teachers identify specific difficulties and adapt teaching strategies. In theory, these technologies can expand educational opportunities and reduce learning gaps.

However, incorporating these technologies also raises fundamental questions about democratizing access to knowledge and educational equity. Access to advanced digital resources remains deeply unequal across regions and school systems. Inadequate technological infrastructure, limited connectivity, and insufficient teacher education for pedagogical technology use are significant obstacles to effective artificial intelligence implementation in schools.

Thus, as with curricular flexibility, introducing artificial intelligence technologies may have a paradoxical character. Although these tools can expand educational possibilities, unequal implementation can deepen existing disparities across schools and systems. In contexts marked by structural inequalities, technological innovations often initially benefit institutions already enjoying better material and institutional conditions.

It is therefore essential to recognize that curricular and technological transformations are not merely technical or pedagogical processes, but deeply political ones. Decisions about curricular organization, educational resource distribution, and digital technology incorporation reflect broader social struggles over which knowledge should be valued and which social groups will enjoy privileged access to it.

Building more equitable contemporary education therefore requires connections among curricular policies, digital inclusion policies, and teacher education strategies. Democratizing access to educational technologies is fundamental for artificial intelligence-based pedagogical innovations to effectively expand educational opportunities.

Furthermore, teacher education plays a central role. Teachers must be prepared to use technological tools and critically understand their pedagogical, social, and ethical implications.

Integrating pedagogical knowledge, technological proficiency, and critical reflection is essential for artificial intelligence to expand educational possibilities rather than reproduce inequalities.

Another important aspect is strengthening public schools as spaces of democratic access to scientific knowledge. As Michael Young argues, educational democratization depends on universal access to "powerful knowledge"—systematized forms of knowledge that enable understanding and transforming social reality. Curricular reforms should therefore ensure all students have a solid foundation in scientific and humanistic knowledge, regardless of their specific educational pathways.

Building a flexible curriculum that effectively promotes educational equity thus requires public policies committed to reducing structural inequalities in education. This involves investing in school infrastructure, expanding educational funding, ongoing teacher education, and digital inclusion policies ensuring universal access to educational technologies.

Finally, advances in artificial intelligence make debates about technology, ethics, and digital citizenship increasingly urgent within school curricula. Schools must prepare students to use digital technologies and critically understand their social, economic, and cultural impacts.

Thus, connecting curricular flexibility, technological innovation, and commitment to educational equity is one of the main challenges for contemporary educational policies. Addressing it requires integrated approaches combining pedagogical innovation with social justice, ensuring that ongoing transformations effectively expand learning opportunities and promote more democratic education.

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