



CHALLENGES AND OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE IN PUBLIC EDUCATION: A CASE STUDY IN BARÃO DOS COCAIS - MG

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ABSTRACT

Objective: Considering the use of Artificial Intelligence (AI) by teachers in public high schools in Barão de Cocais faces challenges, such as the lack of specific training and inadequate infrastructure, along with concerns about pedagogical autonomy, the objective is to investigate the impacts of these technological tools on the teaching-learning process.

Theoretical Framework: This research presents the main concepts and theories that underlie the work. The use of artificial intelligence in public education, the ethical and pedagogical challenges of using artificial intelligence in teaching and the infrastructure and public policies for artificial intelligence in education stand out, providing a solid basis for understanding the context of the investigation.

Method: A qualitative methodology is applied, based on semi-structured interviews with teachers, aiming to capture their experiences and perceptions regarding the use of AI in their pedagogical practices.

Results and Discussion: The results obtained revealed that it is essential to incorporate digital skills development into teacher training curricula, in addition to promoting public policies that encourage the conscious and appropriate use of AI in the educational context.

Research Implications: Content analysis allows the identification of patterns and recurring themes, providing a broad understanding of the implications of this technology in education. It is observed that AI is seen by teachers as a promising tool, particularly for automating tasks and personalizing learning. However, there is a significant gap in teacher training and in the schools' infrastructure, hindering more efficient adoption.

Originality/Value: This study contributes to the emerging literature on the implementation of AI in Brazilian public education, offering valuable insights into the challenges and opportunities surrounding the adoption of these technologies in educational institutions in specific regions, such as Barão de Cocais.

Keywords: Artificial Intelligence, Public education, Teacher training, Teaching-learning, Educational technologies.

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DESAFIOS E OPORTUNIDADES DA INTELIGÊNCIA ARTIFICIAL NO ENSINO PÚBLICO: UM ESTUDO DE CASO EM BARÃO DOS COCAIS – MG

RESUMO

Objetivo: Considerando que o uso de Inteligência Artificial (IA) por professores nas escolas públicas de ensino médio de Barão de Cocais enfrenta desafios, como a falta de formação específica e infraestrutura inadequada, além de preocupações com a autonomia pedagógica, o objetivo deste estudo é investigar os impactos dessas ferramentas tecnológicas no processo de ensino-aprendizagem.

Referencial Teórico: Esta pesquisa apresenta os principais conceitos e teorias que fundamentam o trabalho. Destacam-se o uso da inteligência artificial na educação pública, os desafios éticos e pedagógicos do uso da inteligência artificial no ensino e a infraestrutura e políticas públicas para a inteligência artificial na educação, fornecendo uma base sólida para a compreensão do contexto da investigação.

Método: Aplica-se uma metodologia qualitativa, baseada em entrevistas semiestruturadas com professores, buscando capturar suas experiências e percepções sobre a utilização da IA em suas práticas pedagógicas.

Resultados e Discussão: Os resultados obtidos revelaram que é essencial incorporar o desenvolvimento de habilidades digitais ao currículo de formação de professores, além de promover políticas públicas que incentivem o uso consciente e adequado da IA no contexto educacional.

Implicações da Pesquisa: A análise de conteúdo permite identificar padrões e temas recorrentes, proporcionando uma visão ampla das implicações dessa tecnologia no ensino. Desse modo, observa-se que a IA é vista pelos professores como uma ferramenta promissora, especialmente para automação de tarefas e personalização do aprendizado. No entanto, há uma lacuna significativa na formação docente e na infraestrutura das escolas, dificultando uma adoção mais eficiente.

Originalidade/Valor: O estudo contribui para a literatura emergente sobre a implementação de IA no ensino público brasileiro, fornecendo insights valiosos sobre os desafios e oportunidades que envolvem a adoção dessas tecnologias em instituições de ensino de regiões específicas como Barão de Cocais.

Palavras-chave: Inteligência Artificial, Educação pública, Formação de professores, Ensino-aprendizagem, Tecnologias educacionais.

DESAFÍOS Y OPORTUNIDADES DE LA INTELIGENCIA ARTIFICIAL EN LA EDUCACIÓN PÚBLICA: UN ESTUDIO DE CASO EN EL BARRIO DOS COCAIS - MG

RESUMEN

Objetivo: Considerando que el uso de Inteligencia Artificial (IA) por parte de los profesores en las escuelas públicas de educación secundaria en Barão de Cocais enfrenta desafíos, como la falta de formación específica y la infraestructura inadecuada, además de preocupaciones sobre la autonomía pedagógica, el objetivo es investigar los impactos de estas herramientas tecnológicas en el proceso de enseñanza-aprendizaje.

Marco Teórico: Esta investigación presenta los principales conceptos y teorías que subyacen al trabajo. Se destacan el uso de la inteligencia artificial en la educación pública, los desafíos éticos y pedagógicos del uso de la inteligencia artificial en la enseñanza y la infraestructura y políticas públicas para la inteligencia artificial en la educación, brindando una base sólida para comprender el contexto de la investigación.

Método: La metodología adoptada para esta investigación es una metodología cualitativa basada en entrevistas semiestructuradas con los profesores, con el fin de captar sus experiencias y percepciones sobre el uso de la IA en sus prácticas pedagógicas.

Resultados y Discusión: Los resultados obtenidos llevan a la conclusión de que es esencial incorporar el desarrollo de habilidades digitales en los programas de formación de profesores, además de promover políticas públicas que fomenten el uso consciente y adecuado de la IA en el contexto educativo.

Implicaciones de la investigación: El análisis de contenido permite identificar patrones y temas recurrentes, proporcionando una comprensión amplia de las implicaciones de esta tecnología en la educación. Se observa que



los profesores ven la IA como una herramienta prometedora, especialmente para la automatización de tareas y la personalización del aprendizaje. Sin embargo, existe una brecha significativa en la formación docente y en la infraestructura de las escuelas, lo que dificulta una adopción más eficiente.

Originalidad/Valor: Este estudio contribuye a la literatura emergente sobre la implementación de IA en la educación pública brasileña, ofreciendo valiosas ideas sobre los desafíos y oportunidades relacionados con la adopción de estas tecnologías en instituciones educativas en regiones específicas como Barão de Cocais.

Palabras clave: Inteligencia Artificial, Educación pública, Formación docente, Enseñanza-aprendizaje, Tecnologías educativas.

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1 INTRODUCTION

The incorporation of Artificial Intelligence (AI) into the educational environment has been a global trend, promoting debates about its impact on the personalization of teaching and the automation of pedagogical tasks. However, in the context of Brazilian public schools, this adoption faces significant barriers, mainly related to the lack of specific public policies and inadequate infrastructure.

According to Selwyn (2019), while AI has the potential to transform education by offering new forms of engagement and learning, its application is still limited by the resilience of some teachers and the absence of ongoing training. In many public schools, such as those of Barão de Cocais, this reality is reflected in the difficulty teachers have in integrating these technologies into their daily practices.

To Holmes *et al.* (2019), lack of institutional preparation and support is one of the main barriers to effective AI uptake in education, as teachers often lack the resources to adapt to technological innovations. Furthermore, Rogers (2003), in his model of diffusion of innovations, points out that the adoption of new technologies by teachers tends to be a gradual process and influenced by factors such as the available infrastructure and the support offered by the institution.

The research of Reyes-Villalba *et al.* (2024) aimed to examine current educational practices related to the understanding and use of artificial intelligence in the educational field. The authors concluded that while there is a variety of educational practices involving AI, challenges such as lack of resources, teacher training, and ethical issues still persist. Lengua-Cantero *et al.* (2024) explored the relationship between autonomous learning, artificial intelligence and 21st century skills. The researchers concluded that, while artificial intelligence



is still in development, it is strongly related to autonomous learning and skills such as critical thinking, collaborative work and problem solving.

Faced with these challenges, this study seeks to investigate the use of AI by teachers in public secondary schools in Barão de Cocais, analyzing both the perceived benefits and the obstacles faced in the process of implementing these tools. The research aims to provide valuable insights into how AI can be effectively integrated into the Brazilian educational context, with a focus on the insights and experiences of local teachers. Understanding these dynamics is essential for the development of public policies that encourage the conscious and efficient adoption of AI in schools, promoting more inclusive and personalized teaching.

2 THEORETICAL FRAME

2.1 ARTIFICIAL INTELLIGENCE IN EDUCATION

According to Selwyn (2019), Artificial Intelligence (AI) has played an increasingly important role in a number of sectors, including education. The use of AI in the educational environment is expanding the possibilities of teaching personalization, automation of pedagogical processes and predictive analysis of student performance. With the help of advanced technologies, AI can provide education more tailored to students' individual needs, optimizing teacher time and promoting more efficient management of administrative tasks.

According to Luckin (2018), AI has the potential to profoundly transform education by creating systems that can adjust content according to the learner's pace of learning, identifying knowledge gaps, and suggesting resources to meet those needs.

One of the main applications of AI in the educational environment is the implementation of intelligent tutoring systems. These systems, as pointed out by Holmes *et al.* (2019), are able to offer personalized support to students, adapting the content according to their needs and difficulties, promoting a more autonomous and efficient learning. Intelligent tutoring systems use *machine learning* algorithms to analyze student performance in real time, identifying learning patterns and adjusting the pedagogical approach according to the data collected (Zawacki-Richter *et al.*, 2019). In addition to helping to personalize teaching, these tools also help reduce the workload for teachers, who can focus their efforts on more complex and strategic activities.

Another relevant aspect of AI use in education is predictive analysis of student performance. This technology, as discussed by Williamson (2017), allows teachers and



educational managers to early identify students at risk of avoidance or poor performance, enabling more effective preventative interventions. From large volumes of data on student behavior, AI algorithms can predict which students are struggling and suggest strategies to improve their performance. According to Holmes *et al.* (2019), this ability to predict and anticipate problems can revolutionize educational management by allowing interventions to be more targeted and evidence-based.

In addition, the automation of administrative tasks is another significant potential of AI in the school context. AI-based systems can automate activities such as test correction, frequency records, and the organization of teaching materials, freeing teachers to focus on activities that require greater human interaction and creativity (Luckin, 2018). Automation can also improve the efficiency of school management by making it easier to monitor students' academic performance and make data-driven decisions.

While the potential of AI in education is promising, it is important to recognize the challenges that this technology presents. Integrating AI in schools requires a robust technology infrastructure and public policies that support its implementation. In addition, as discussed by Selwyn (2019), there are significant ethical concerns surrounding the use of AI in education, particularly regarding the privacy of students' data and the possibility of dehumanizing pedagogical relationships. If AI is to be fully integrated positively into the educational environment, a balance must be struck between the use of technology and respect for traditional pedagogical principles, which value the teacher's role as a knowledge mediator.

As pointed out by Dias and Moraes (2023), AI offers a range of tools and resources that can transform education, from personalizing teaching to automating tasks and predictive analysis of student performance.

However, Dias e Moraes (2023) points out that for these technologies to be effectively incorporated, it is essential that teachers receive adequate training and that schools have sufficient infrastructure to support these innovations. Only in this way will it be possible to make full use of the potential of AI in the educational environment, promoting a more inclusive teaching and adapted to the needs of each student.

2.2 ADOPTION OF EDUCATIONAL TECHNOLOGIES BY TEACHERS

The adoption of educational technologies by teachers is a complex process, influenced by a number of factors ranging from structural issues to cultural and individual aspects. Rogers's diffusion model of innovations (2003) provides a robust theoretical framework for



understanding how new technologies, such as Artificial Intelligence (AI), are incorporated into pedagogical practices. According to Rogers (2003), the process of adopting innovations follows five stages: knowledge, persuasion, decision, implementation and confirmation. These steps help explain why some teachers quickly adopt new technologies, while others face resistance or delay.

The first stage, knowledge, refers to the moment when teachers become aware of a new technology, such as AI, and begin to form an initial understanding of its functioning and potential. This phase is crucial, as access to information and training on AI use directly influences the level of interest and acceptance by teachers (Selwyn, 2019). The absence of specific training programs for the integration of AI into pedagogical practices may slow this process, as many teachers do not have adequate knowledge about how these tools can be applied in teaching.

The persuasion phase involves the formation of a positive or negative attitude towards innovation. At this point, perceptions about the benefits and challenges of using AI in education play a key role. Holmes *et al* (2019) points out that teachers tend to adopt new technologies more easily when they realize clear benefits for student learning, such as personalizing teaching and automating administrative tasks. However, worries about overwork, lack of technical support, and loss of pedagogical autonomy can lead to negative attitudes, making it difficult to adopt AI.

At the decision stage, the professor chooses to adopt or to reject the innovation. Rogers (2003) argues that this decision is often influenced by the school context and available resources. In schools where there is adequate infrastructure and supporting policies for the implementation of new technologies, the decision to adopt AI tends to be easier. On the other hand, in environments where technological equipment and specific training are lacking, the tendency is for teachers to choose not to use AI in their pedagogical practices.

According to Fullan (2015), the adoption of innovations is most effective when there is an institutional commitment to change, which includes providing resources and ongoing support.

The implementation stage refers to the practical use of innovation in the educational context. In this respect, the integration of AI into pedagogical practices depends not only on technical knowledge, but also on the adaptation of teaching methodologies to include new tools. As Selwyn (2019) points out, the success of AI implementation is strongly linked to teachers' continued education and their ability to tailor technologies to the specific needs of their students and classes.



Finally, the confirmation phase occurs when the teacher reflects on the use of the technology and decides to continue using it or abandon it. At this stage, student feedback, institutional support, and results observed in academic performance influence the decision to maintain AI use. As pointed out by Ertmer and Ottenbreit-Leftwich (2010), teachers are more likely to continue using technology when they notice tangible improvements in student learning and have access to ongoing technical support.

The adoption of educational technologies, such as AI, does not occur in an isolated manner. Rogers (2003) emphasizes that factors such as social context, teacher characteristics, and school infrastructure play a significant role in the adoption process. Teachers working in schools with a culture of innovation and robust technological support are more likely to adopt new technologies quickly. On the other hand, in schools with poor infrastructure and lack of incentive policies, adoption tends to be slow and uneven. This is especially relevant in the case of AI, which requires not only access to technological equipment, but also an institutional environment that favors experimentation and continuous learning (Williamson, 2017).

In addition, resilience to change is a common challenge in adopting educational technologies. As Rogers (2003) points out, many teachers are reluctant to adopt innovations that significantly change their routines or that require major adaptation efforts. To overcome this resistance, schools must provide ongoing support, such as teacher training programs, adequate infrastructure, and opportunities for teachers to experience and share their experiences with the new technology (Fullan, 2015). Creating a community of practice where teachers can collaborate and learn from each other can also facilitate the adoption of technological innovations.

2.3 ARTIFICIAL INTELLIGENCE IN PUBLIC EDUCATION

The insertion of Artificial Intelligence (AI) in the context of Brazilian public schools faces a series of challenges, both for educators and for students. One of the main obstacles is the lack of public policies that encourage the dissemination of this technology, especially in areas without adequate internet coverage and with poor physical infrastructure. The lack of technological support in educational institutions limits the implementation of innovative digital projects, essential for the development of more dynamic pedagogical practices adapted to the needs of contemporary society.

The resistance of education professionals themselves to the use of new information and communication technologies (ICTs) aggravates the scenario. Many teachers, due to lack of



knowledge or specific training, encounter difficulties in handling digital tools, which creates a mismatch between the rapid technological evolution and the reality of public schools. As Tardelli and Paula (2011) point out, students born in the digital age deal with these innovations in a natural way, while many teachers still see the act of teaching in a traditional way, which generates insecurity in relation to the use of AI and other technologies.

In this sense, globalization and the scientific-technological revolution have significantly altered social relations and the labor market, which demands a reconfiguration not only of educational policies, but also of the role of the teacher and the school structure itself (Tardelli and Paula, 2011).

However, many educational systems are still based on outdated practices, which contribute little to the training of students able to face the challenges of modern society. According to Morin (2009), it is necessary to abandon a fragmented education that separates knowledge into disconnected blocks and adopt a more holistic approach, capable of understanding the complexity of the world and preparing young people to interact critically with new technologies.

This reflection leads to the need to rethink the school curriculum. Children and young people already master many of the available technologies outside the school environment, including AI, without any pedagogical guidance. As Tedesco (2015) points out, the creation of a just society in the future depends on the ability to design an education that values the conscious and critical use of these technologies, preventing them from being used inadequately, as is often observed in digital media.

2.4 CUSTOMIZATION OF EDUCATION WITH AI

Teaching personalization is one of the main promises of Artificial Intelligence (AI) in the educational field, offering the possibility to adapt the content to the rhythm and individual needs of each student.

According to Martins and Rocha (2023), AI allows learning platforms to analyze real-time data about student performance, automatically adjusting content and activities to optimize understanding and retention of information.

This type of personalization, as pointed out by Ferreira and Gonçalves (2023), goes beyond traditional differentiation, creating a highly adapted learning experience that enhances each student's abilities.



In addition, AI can automate repetitive tasks such as exercise correction and progress monitoring, freeing teachers to focus on activities that require more creativity and human interaction (Garcia and Santos, 2023).

However, as noted by Selwyn (2019) and Holmes *et al.* (2019), that approach is not without limitations. Dependence on algorithms can reduce the complexity of the teaching process, since pedagogical decisions are in part transferred to automated systems, which can lead to superficiality in teaching more complex skills such as critical thinking and creativity.

In short, AI has the potential to transform teaching by adapting content accurately and quickly to each student's needs. However, it is crucial that educators play an active role in integrating these technologies to ensure that personalization does not replace human interaction, which is essential in the educational process.

2.5 ETHICAL AND EDUCATIONAL CHALLENGES OF AI IN EDUCATION

The implementation of AI in education raises a number of ethical and pedagogical challenges, which need to be carefully considered. One of the main challenges concerns the privacy of student data. As Braga and Costa (2023) state, AI platforms collect and analyze large volumes of personal data, which can expose sensitive student information. The lack of clear regulation on the use of such data increases the risk of privacy violations, making it necessary to develop strict policies that ensure the protection of information.

Another important ethical aspect is the issue of equal access to technology. In many contexts, technological infrastructure is inadequate, which hinders widespread adoption of AI in public schools, especially in more vulnerable regions (Tardelli and Paula, 2011). Lima and Souza (2023) highlight that this technological inequality may exacerbate educational disparities, leaving behind students who do not have access to suitable devices or the internet.

Finally, there is the concern that the adoption of AI devalues the role of the teacher in the teaching-learning process. While AI can be a valuable tool to support teaching work, it is critical that the teacher remains the primary mediator in the educational process.

As Morin (2009) emphasizes, education should not be fragmented or reduced to algorithms; it should promote an integral and complex understanding of the world. In this sense, AI should be seen as a resource to enhance the work of the teacher, and not as a replacement.



2.6 INFRASTRUCTURE AND PUBLIC POLICIES FOR AI IN EDUCATION

Technological infrastructure in public schools is one of the main factors limiting the effective adoption of AI in education. Lack of adequate equipment, quality internet connection and technical support are barriers that make it difficult to implement these technologies in a comprehensive and equitable manner.

According to Vicari (2018), most Brazilian schools still lack basic resources to integrate technological innovations, which makes full adoption of AI unfeasible.

In this context, public policies play a crucial role in creating an enabling environment for the implementation of AI in schools. As Almeida e Silva (2023) argues, it is necessary for the government to invest in technological infrastructure, ensuring that all schools, regardless of their geographic location or socioeconomic condition, have access to the tools necessary to incorporate AI into the teaching-learning process. In addition, public policies should promote teacher training so that teachers are able to use these technologies effectively and ethically (Barros *et al.*, 2024).

2.7 CONTINUED TEACHER TRAINING FOR AI

Continued teacher training is an essential element for the successful integration of AI into education. Most teachers, especially in public schools, have not yet received adequate training to use emerging technologies in their pedagogical practices (Carvalho, 2023). This creates a significant gap between the potential of AI and its practical application in the classroom.

To overcome this challenge, it is necessary to redesign the teacher training curricula, incorporating digital and technological skills as an integral part of future teacher education (Tedesco, 2015). Braga and Costa (2023) argue that training programs should go beyond simple technical training and also address the pedagogical and ethical implications of AI use, promoting a critical reflection on how these tools can be used in a balanced way.

Continued training, as Dias and Moraes (2023) point out, should be an ongoing process, accompanying technological innovations and offering constant support to teachers. This includes not only the development of technological skills, but also the creation of spaces for dialog and exchange of experiences among teachers, so that they can share challenges and solutions in the use of AI.



3 METHODOLOGY

This research follows a qualitative approach, carried out in three public elementary and high schools located in the municipality of Barão de Cocais, Minas Gerais. The main objective was to investigate the use of Artificial Intelligence (AI) by teachers at these institutions, examining the impact of these tools on the teaching-learning process, as well as identifying the main challenges and benefits perceived by incorporating these technologies into pedagogical practices. The choice of a qualitative approach, as advocated by Creswell (2014), allows for a deep and detailed understanding of social phenomena in specific contexts, offering valuable insights into participants' experiences and perceptions.

The data collection was carried out through semi-structured interviews with the teachers of the three selected schools. According to Flick (2009), this type of interview makes it possible to explore in depth the experiences and perceptions of the participants, maintaining flexibility so that new emerging issues are addressed throughout the conversation. The participants were intentionally selected, as suggested by Patton (2002), considering their direct involvement with high school education and the use of technological tools, in order to ensure a sample aligned with the research objectives.

Data analysis followed the content analysis technique, which, according to Bardin (2011), allows one to identify patterns and recurring themes from the systematic organization of the data. The interviews were transcribed and categorized based on previously established topics such as the level of AI adoption, infrastructure challenges, teacher training, and perceived impacts on student learning. This approach facilitates the identification of structural barriers and opportunities provided by AI in the educational context.

In addition to the interviews, field observations were conducted in the three schools, as recommended by Lüdke and André (2013), to understand the daily use of technologies in the school environment and how teachers integrate these resources into their pedagogical practices. The observations served to contextualize the lecturers' talks and to offer a broader vision of the technological reality of the institutions investigated.

Finally, the triangulation of data - derived from interviews, observations and documentary analysis - followed the principles described by Denzin (2006), guaranteeing methodological rigor and greater reliability of the results. This procedure allowed to verify the consistency between the data sources and to identify divergences in the teachers' responses, providing a more comprehensive and detailed understanding of the dynamics and challenges associated with the implementation of AI in public education in Barão de Cocais.



4 RESULTS AND DISCUSSIONS

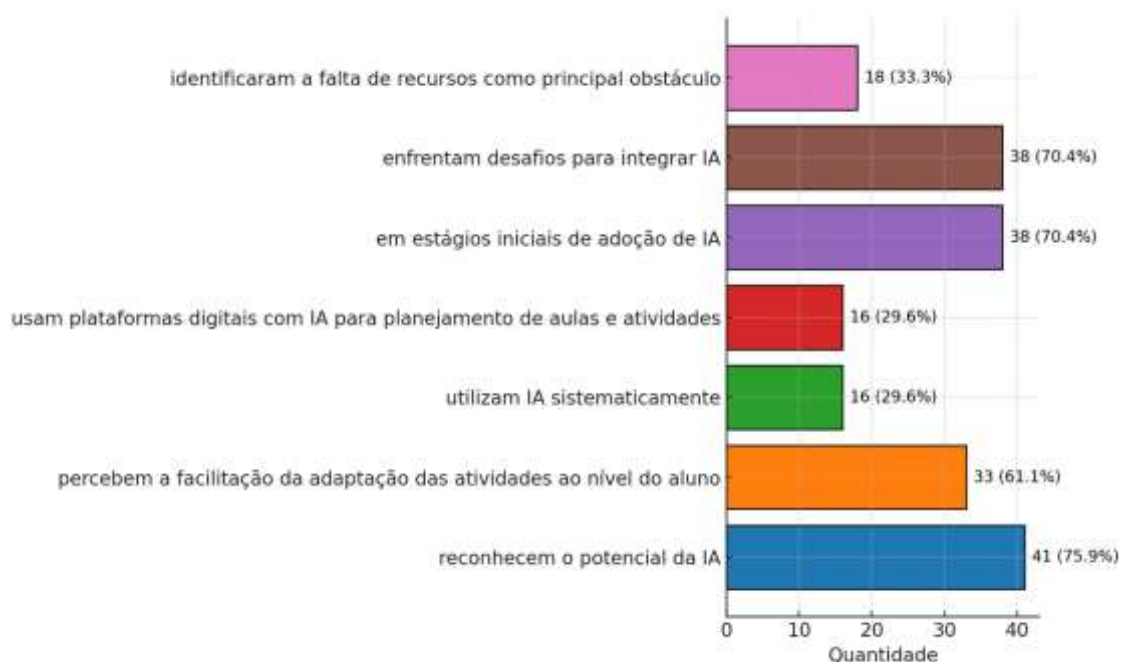
The results of this research, carried out with 54 teachers in three public high schools of Barão de Cocais, revealed mixed perceptions about the use of Artificial Intelligence (AI) in the school environment. The interviews and observations conducted indicated four main themes: adaptation and use of AI in pedagogical practices, infrastructure challenges, teacher training and perception of impacts on learning.

4.1 ADAPTATION AND USE OF AI IN PEDAGOGICAL PRACTICES

Figure 1 illustrates the percentage of AI use in schools. Most of the teachers interviewed, 41 out of 54 (76%), professors, recognized that Artificial Intelligence has great potential, especially when applied to the personalization of teaching and the automation of administrative tasks, such as automatic correction of exercises and the continuous monitoring of students' progress. Of the 54 interviewees, 33 (61%) realized that AI could facilitate the adaptation of activities to each student's level of learning, which would increase the engagement and efficiency of the teaching process. However, only 16 teachers (30%) reported systematically using these tools in their school day-to-day.

Figure 1

Use of AI in Pedagogical Practices.





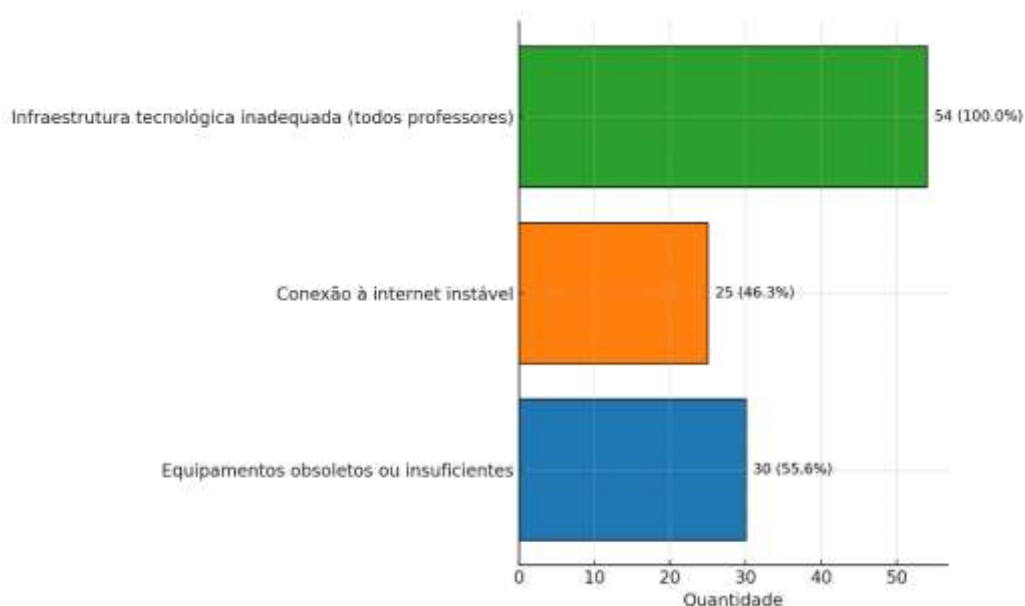
Among the 16 teachers who use AI, the most cited application was the use of digital platforms with automatic learning algorithms for planning classes and creating personalized activities for different profiles of students. They reported that AI helps monitor students' performance and identify their difficulties faster and more accurately. However, despite these advances, 38 teachers (70%) are still in the early stages of adopting these technologies and face challenges in integrating them into their traditional methodologies. The main obstacle identified by 18 teachers (86%) was the lack of adequate resources, in addition to the complexity involved in learning and integrating new technological tools into school life.

4.2 INFRASTRUCTURE CHALLENGES

Figure 2 presents the answers on infrastructure conditions in schools. All 54 teachers interviewed (100%) pointed to inadequate technological infrastructure as a critical barrier to the implementation of AI in the public schools of Barão de Cocais. The lack of high-quality internet connection and the scarcity of equipment such as computers, tablets and smartphones have been identified as factors hindering the full adoption of AI tools. In some schools, 36 teachers (67%) reported that the internet connection is so unstable that it does not allow continued use of AI-based educational platforms. This severely restricts both students' and teachers' access to these innovative technological resources.

Figure 2

Infrastructure conditions in schools.





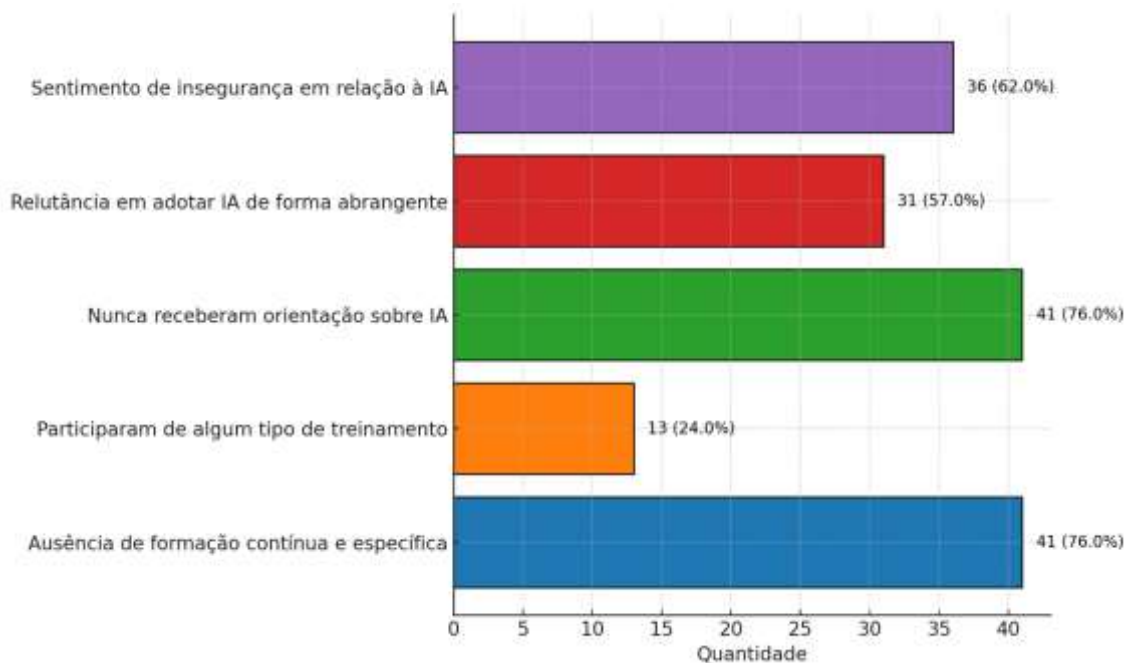
In addition, 47 teachers (87%) stated that the equipment available in schools is obsolete or insufficient to meet the needs of the entire school community. Teachers reported that they need to improvise using their own personal devices or adapting traditional methods due to the technological limitation available. These structural challenges result in a significant disparity in opportunities for students from different backgrounds, widening educational inequalities.

4.3 TEACHER TRAINING

Figure 3 presents the answers on teacher training and training. Another limiting factor highlighted by 41 teachers (76%) was the absence of continuous and specific training for the use of emerging technologies, such as AI. These faculty members have reported that they feel unprepared to use these tools effectively, resulting in limited or superficial adoption of AI technologies. Only 13 teachers (24%) reported having participated in some type of training aimed at the use of AI in pedagogical contexts, while the other 41 teachers (76%) never received guidance on how to integrate these tools efficiently into traditional teaching practices.

Figure 3

Teacher Training and Training.



Without this training, 31 faculty members (57%) were reluctant to adopt AI more broadly, and those trying to integrate AI into their practices reported difficulties in developing



a cohesive pedagogical approach that harnesses the full potential of technology. This lack of training also contributes to a widespread feeling of insecurity, cited by 36 teachers (62%), which directly affects their confidence in the use of AI in the educational environment.

4.4 PERCEIVED IMPACTS ON LEARNING

Figure 4 presents the responses on the impacts of AI. The 16 teachers already using AI-based tools (29%) noted a positive impact on student engagement, especially among those with learning difficulties. All 6 reported that AI's ability to customize activities and adapt the pace of teaching to students' specific needs was one of the main benefits observed. According to these professors, this personalization not only improves the performance of students with difficulties, but also increases their interest and participation in educational activities.

Figure 4

Perceptions of the Impacts of AI.



However, 23 teachers (43%) expressed concerns about the impacts of AI on the pedagogical process. The main concern, reported by 36 professors (62%), is that the excessive dependence on technology may devalue the role of the professor, jeopardizing the development of socio-emotional skills and critical thinking in the students. In addition, 16 teachers (29%) mentioned that AI, by automating certain tasks, could lead teachers to focus excessively on



technical and bureaucratic aspects, to the detriment of promoting creativity and social interaction.

Another point highlighted by 26 professors (48%) was the concern with equity. While AI can personalize teaching, they fear that students with limited access to technology will be even further away from their peers who have better infrastructure. Such inequality in access to technology could exacerbate existing educational disparities, especially among schools in more vulnerable regions.

The results presented confirm the existing literature on the challenges of adopting AI in the educational context, especially in areas with limited infrastructure. According to Selwyn (2019), the lack of resources and teacher training are frequent barriers to technological implementation, which corroborates the perceptions of Baron de Cocais' teachers. Although AI is recognized for its potential in personalizing teaching (Holmes *et al.*, 2019), the low level of teacher training limits its effective adoption, as also noted by Rogers (2003) in his theory of diffusion of innovations.

Discussion of the results further highlights that while AI can improve the quality of teaching by allowing a personalized approach, its implementation cannot occur without significant investments in technology infrastructure and ongoing teacher training, as suggested by Williamson (2017). The limitations identified in this study, such as the lack of stable internet and technological devices, are consistent with the challenges pointed out by Vicari (2018) in the context of Brazilian public schools.

Among the limitations of this research, the fact that the study was conducted in only three public schools in a specific region of Minas Gerais, which may limit the generalization of the results to other regions of Brazil, is noteworthy. In addition, the focus on teacher perceptions leaves gaps on the vision of students and school managers, who are also important actors in the adoption of new educational technologies.

For future research, it is recommended to expand the study to include different regions and types of schools, as well as to explore more deeply the experiences of students and managers. It would also be relevant to investigate how different models of continuing education can influence the adoption of AI and other emerging technologies in Brazilian public education.

5 CONCLUSION

This study sought to investigate the impact of the use of Artificial Intelligence (AI) in the public high schools of Barão de Cocais, focusing on the perception of teachers and the



barriers faced. The results showed that although AI is seen as a promising tool, mainly for the personalization of teaching and task automation, its implementation faces serious challenges, such as a lack of specific training for teachers and inadequate infrastructure in schools.

The findings confirm that although 61% of teachers recognize the potential of AI to adapt teaching to students' individual needs, only a small proportion (30%) use it systematically. The lack of technological resources, reported by all interviewees, as well as the absence of continuous and specific training, were limiting factors for the wider adoption of these tools.

In practical terms, the research highlighted the importance of public policies that promote access to adequate infrastructure and the training of teachers for the effective use of AI in pedagogical practices. This will not only allow for greater digital inclusion in public schools, but will also favor the creation of a more adaptable teaching environment responsive to students' needs.

Therefore, the study contributes to the field of research by providing a detailed analysis on the opportunities and limitations of AI in Brazilian public education. Furthermore, it suggests that for AI to reach its full potential in education, it is essential that investments in technology are accompanied by teacher training initiatives that can ensure that these tools are used consciously and efficiently in the teaching-learning process.

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