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Embracing Doubt: Critical Thinking in the Age of Artificial Intelligence in Education

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Abstract: This study explores how artificial intelligence (AI) can support and challenge the development of critical thinking skills in educational settings. Through the analysis of various AI tools and their applications, the research identifies methods to enhance critical thinking, provides immediate feedback, and addresses potential challenges such as data privacy and over-reliance on AI. The study proposes a practical guide for teachers, offering strategies for balanced AI integration that fosters critical thinking and encourages doubt. The significance lies in preparing students for modern challenges by promoting independent and critical thought while leveraging AI capabilities.

Keywords: artificial intelligence, critical thinking, doubt, education, ethical use of AI, personalized learning.

Introduction

Recent studies have shown that AI enables the creation of personalized learning plans that adapt to individual student needs and learning paces, thus addressing diverse learning styles and promoting deeper understanding (Holmes et al., 2019). AI tools can provide immediate feedback on assignments and assessments, which is essential for developing critical thinking and embracing doubt (Chen & Xie, 2020). Additionally, AI-powered interactive tools, such as simulations and virtual tutors, engage students in problem-solving activities that require critical thinking and the ability to question assumptions (Luckin et al., 2016). However, the literature also highlights several challenges. There is a risk of over-reliance on AI, potentially diminishing students' independent thinking skills. Data privacy concerns are significant, as AI systems often require extensive data collection. Effective use of AI in classrooms also necessitates proper teacher training, which is currently lacking in many educational institutions (European Commission, 2024). Education thus faces the challenge of how to harness the advantages of AI and prepare students for new knowledge shaped by today's economy and society, which demand complex skills that are increasingly difficult to automate, as they require higher cognitive abilities such as creativity and critical thinking (Vincent-Lancrin & van der Viles, 2020).

In the contemporary era of rapid technological advancement, where artificial intelligence (AI) plays an increasingly significant role, critical thinking is becoming a crucial skill for learners of all ages. The ability to analyze, evaluate, and interpret information is more important than ever, as we are faced with vast amounts of data and information that must be understood and correctly applied. Critical thinking enables individuals to make thoughtful decisions and effectively confront the challenges of the modern world (Darwin et al., 2023).

Today, the internet is a key source of information that students frequently use for learning. However, we are increasingly encountering false, incomplete, and sometimes fabricated information. The problem arises when students receive and use such information in their learning. Consequently, students' knowledge is at real risk of becoming incomplete or even incorrect. To avoid such situations, it is essential to teach students to critically assess the sources and information they obtain from the internet (Zemljak & Kerneža, 2023).

Moreover, it is important for students to learn the value of doubt and the willingness to ask questions, despite the risks involved. It is not about teachers trying to 'convert' students, but rather maintaining the integrity of the student as a curious, questioning, and investigative individual. Teachers play a crucial role in fostering care and commitment among students. Education can help identify and analyze how and why indifference can occur. Through education, ideas and ideals should become significant for students, which, although it complicates their lives, also gives the educational experience a sense of excitement and promise (Roberts, 2017).

Students will not doubt if the teacher presents all answers as definitive (Haber, 2020). Collaboration between AI and humans in learning and research will bring significant benefits to individuals and society, as long as critical thinking skills and academic integrity remain top priorities (Rusandi et al., 2023). Finally, it is essential to highlight the limitations and offer a balanced view of the future of education, advocating for a balanced approach that leverages AI capabilities without compromising the development of independent and critical thinking in students (Wu, 2024).

Purpose of the Article

Research results indicate a gap in teaching critical thinking skills, especially in the use of innovative methods and new technologies. They also emphasize the need for further research to explore new

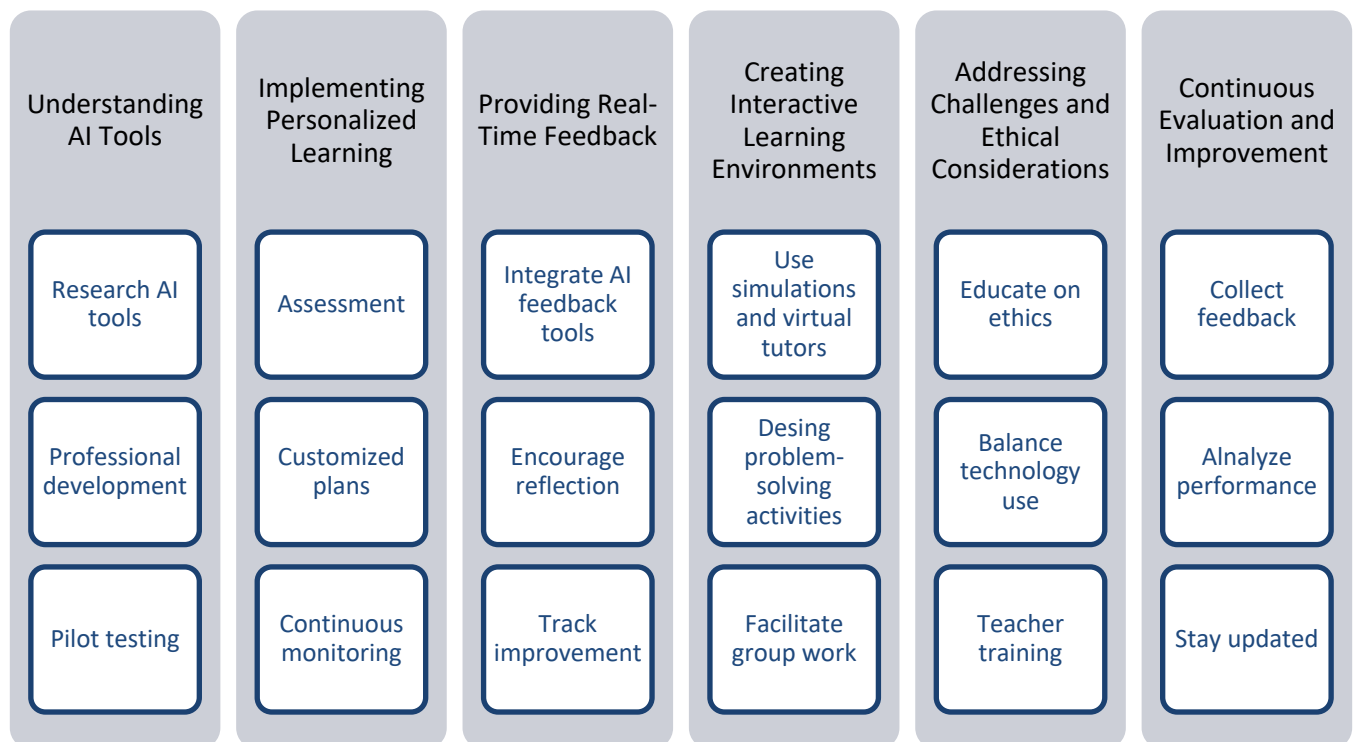
approaches to teaching these skills (Alsaleh, 2020). The purpose of this article is to explore how AI can support and challenge the development of critical thinking skills, particularly the role of doubt, in educational settings. It aims to identify methods by which AI tools can enhance critical thinking, evaluate potential challenges, and propose strategies for balanced AI integration in education. The ultimate goal is to create a basis for a practical guide for teachers to effectively integrate AI into their classrooms, fostering critical thinking and encouraging doubt among students.

Research Results

The objectives of this practical guide are to familiarize teachers with various AI tools available for educational purposes, helping them understand the capabilities and limitations of different tools through research, professional development, and pilot testing. Another objective is to implement personalized learning plans tailored to individual student needs by using AI diagnostic tools to assess learning styles and paces, and developing customized plans that promote critical analysis and deeper understanding. Enhancing student learning through immediate feedback is also a key objective, achieved by integrating AI feedback tools, encouraging reflection, and tracking improvement. The guide aims to create dynamic, problem-solving learning environments using AI-powered simulations and virtual tutors, designing activities that foster a questioning mindset and facilitating collaborative group work. Addressing ethical considerations and challenges associated with AI use is crucial, focusing on educating students about data privacy, balancing technology with traditional methods, and ensuring comprehensive teacher training. Finally, the guide emphasizes the importance of continuously evaluating and improving AI integration by collecting feedback, analyzing student performance, and staying updated with the latest research and advancements in AI in education. By achieving these objectives, presented at Figure 1, teachers can effectively foster critical thinking and encourage doubt among students, leveraging AI to enhance educational outcomes without compromising independent thinking skills.

Figure 1

Objectives and Action Steps for Integrating Artificial Intelligence in Education



Source: author's own development.

By following these detailed action steps, teachers can effectively integrate AI into their classrooms to foster critical thinking and embrace doubt. These steps provide a clear path for teachers to navigate the complexities of AI integration, from familiarizing themselves with various AI tools to implementing personalized learning plans and providing real-time feedback. Creating interactive learning environments and addressing ethical considerations are essential to ensuring that AI is used responsibly and effectively. Continuous evaluation and improvement of AI tools and teaching strategies will help maintain the balance between leveraging AI capabilities and developing students' independent thinking skills. By adhering to these action steps, educators can create a dynamic and engaging learning experience that prepares students for the challenges of the modern world.

Conclusions

In conclusion, this practical guide underscores the critical importance of integrating AI to foster critical thinking and embrace doubt in educational settings. Recent studies, such as those by Holmes et al. (2019), highlight AI's ability to create personalized learning plans that adapt to individual student needs, promoting deeper understanding and addressing diverse learning styles. Chen and Xie (2020) emphasize the value of AI tools in providing immediate feedback, essential for developing critical thinking and embracing doubt. Additionally, research by Luckin et al. (2016) demonstrates how AI-powered interactive tools engage students in problem-solving activities, requiring them to question assumptions and think critically.

However, the literature also points out significant challenges, including the risk of over-reliance on AI, which can diminish students' independent thinking skills, and substantial data privacy concerns due to the extensive data collection required by AI systems (European Commission, 2024). Addressing these challenges necessitates comprehensive teacher training, which is currently lacking in many educational institutions. This guide provides actionable steps for teachers to navigate these complexities, ensuring a balanced approach that leverages AI capabilities while promoting critical thinking, doubt, and independent thought.

Education must prepare students for the complexities of today's economy and society, which demand higher cognitive skills such as creativity and critical thinking (Vincent-Lancrin & van der Viles, 2020). In an era where the internet is a primary information source, teaching students to critically assess sources and information is paramount (Zemljak & Kerneža, 2023). The value of doubt and the willingness to ask questions are essential for maintaining the integrity of students as curious and investigative individuals (Roberts, 2017). Collaboration between AI and humans in learning and research offers significant benefits, provided that critical thinking skills and academic integrity remain top priorities (Rusandi et al., 2023).

By following the practical steps outlined in this guide, teachers can create a dynamic and engaging learning experience that prepares students to confront modern challenges thoughtfully and effectively. Further research should explore the long-term impacts of AI on critical thinking and doubt in education, focusing on evaluating specific AI tools, understanding ethical implications, and developing best practices for teacher training. This ongoing research will help educators stay at the forefront of educational innovation, ensuring they can harness the power of AI to benefit all learners while maintaining a balanced approach that fosters independent and critical thinking skills.

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