

The Opportunities of Artificial Intelligence in the Field of Education: An Examination of Obstacles and Resolutions

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Abstract

The integration of Artificial Intelligence (AI) in education has sparked transformative changes in traditional teaching methodologies, offering promising opportunities while presenting significant challenges. This study explores the impact of AI on the educational landscape, focusing on its potential benefits and the obstacles it poses. Through a comprehensive review of existing literature, this paper analyzes the implications of AI, particularly in the context of Maslow's hierarchy of needs, to understand its influence on student learning and educational outcomes. Key themes include the role of AI in personalized learning, administrative tasks automation, and the ethical considerations surrounding its implementation. By examining the challenges of AI in education and proposing strategies to address them, this study aims to contribute to a deeper understanding of the evolving relationship between technology and education.

Keywords: Personalized Learning, AI Ethics, Student Outcomes

Introduction

The emergence of Artificial Intelligence (AI) has triggered a profound transformation across various domains of human activity, education being no exception. The integration of AI technologies, including machine learning algorithms and natural language processing, has

ushered in a new era of personalized and adaptive learning environments. Educators worldwide are increasingly enthusiastic about leveraging AI to revolutionize traditional teaching methodologies. However, amidst this wave of innovation, it is imperative to critically examine the challenges inherent in this paradigm shift.

Dating back nearly half a century, the roots of AI in education can be traced to pioneering efforts such as the development of the first Intelligent Tutoring System (ITS) “SCHOLAR” by Carbonell for geography learning. Subsequent decades have witnessed incremental advancements in AI research for educational applications, with a particular focus on Intelligent Tutoring Systems (ITS), robotics, and chatbots catering to learners at all levels. The proliferation of information technologies over the past decade has facilitated access to vast and dynamic datasets, enabling educational psychologists to glean valuable insights from platforms such as social media, Massive Open Online Courses (MOOCs), and Learning Management Systems (LMS). (Daniel, 2015).

The transformative potential of AI in education lies in its ability to address the diverse needs of learners through personalised and adaptive learning experiences. Drawing inspiration from Maslow’s theory of needs hierarchy, which emphasizes the importance of fulfilling basic needs before higher-order needs can be addressed, AI can play a pivotal role in tailoring educational experiences to individual student preferences and learning styles. By leveraging machine learning algorithms and natural language processing, AI platforms can dynamically respond to the evolving needs of learners, offering valuable insights gleaned from teacher experiences and student interactions.

However, the integration of AI in education is not without its challenges. Ethical considerations surrounding data privacy, algorithmic biases, and the risk of exacerbating existing inequalities loom large. Safeguarding student privacy and ensuring equitable access to AI-powered educational resources are paramount concerns that must be addressed through robust policies and regulations. Moreover, the delicate balance between leveraging AI for efficiency gains and preserving the human touch in education remains a pressing issue. While AI can streamline administrative tasks and enhance learning outcomes, it must complement rather than replace human educators, fostering meaningful interactions and personalized support for students.

Through a synthesis of existing research and theoretical frameworks, this study endeavors to shed light on the opportunities and challenges inherent in the intersection of AI and education. By offering insights into the implications of AI on student learning and educational practices, we aim to inform ongoing discussions and guide future initiatives aimed at harnessing the full potential of AI to transform education for the better.

Possibilities and Application

The contemporary education system continues to evolve to address its inherent shortcomings and maximize its effectiveness. One such avenue of improvement is the integration of Artificial Intelligence (AI) into education. While AI is still in its nascent stages, its potential applications are virtually limitless. One immediate benefit is the significant reduction of administrative burdens within educational institutions. Tasks such as student admissions, fee processing, and inquiries can be automated using AI, thereby freeing up staff members to focus on more meaningful endeavors.

The debate surrounding the one-size-fits-all approach to education underscores the need for personalized learning experiences. With each student possessing unique needs and learning styles, traditional teaching methods often fall short. Herein lies the immense potential of AI, which can track and monitor students' performance, concentration levels, and personality traits to tailor learning experiences accordingly. While AI adoption in countries like India may be limited currently, other nations have successfully implemented AI to create personalized learning systems that cater to individual student needs.

Moreover, AI can alleviate students' burdensome tasks, such as language learning, content curation, and assignment assistance. Despite concerns about AI stifling creativity, its effective utilization can actually free up more time for students to engage in creative endeavors by handling repetitive tasks efficiently. By delegating mundane tasks to AI, students can focus on more meaningful aspects of their education, fostering creativity rather than hindering it.

Additionally, the integration of AI into education can facilitate more meaningful interactions between teachers and students. While human intervention remains crucial in fostering emotional connections and empathy, AI can assist with administrative tasks, allowing teachers more time for one-on-one interactions and counseling. Furthermore, AI can streamline the examination process by providing personalized

practice tests for students and aiding teachers in creating unbiased question papers.

Furthermore, advancements in technology and AI have led to the proliferation of self-learning programs, making education more accessible to individuals worldwide. Remote learning programs enable students, including working professionals, to access educational resources from anywhere, thereby bridging gaps in accessibility. This is particularly significant in countries like India, where student-to-teacher ratios are often low, making remote learning initiatives immensely beneficial.

AI in education promises to revolutionize learning by automating tasks, personalizing experiences, and increasing accessibility. However, privacy, equity, and responsible use remain concerns. Through collaboration and careful planning, AI has the potential to empower both educators and students (Cardona et al., 2023; Tamang, 2020). AI systems like Intelligent Tutoring Systems can personalize learning by adapting to individual needs and offering immediate feedback. Additionally, AI can automate tasks like grading and scheduling, freeing up educators' time for more interactive learning experiences. This technology also has the potential to remove geographical barriers by facilitating online learning, making education more accessible globally. While AI offers exciting possibilities, ethical considerations like privacy and equitable access need careful attention. It's crucial to remember that AI is a tool, and its effectiveness relies on responsible development and implementation

Apart from the above, AI has an excellent potential for boosting student involvement which is another important feature of learning. The theoretical framework expects AI to use interactivity, gamification techniques, as well dynamic content that would keep on catching students' attention. The new real-world applications include AI learning platforms that use gamification as an additional feature, thereby making education not only interesting but also fun (Rozier, 2012). According to Long and Siemens (2011), learning analytics is a crucial tool for optimising educational settings. The integration of machine learning and AI techniques enhances the potential for development in learning analytics (Zawacki-Richter et al., 2019). This allows for the analysis of data streams necessary for handling big data and improving the efficiency of education through teaching strategy management. These capabilities are facilitated by dominant tools like the Kibana software analytical

system, which is integrated with other open resources. Consequently, there has been a significant increase in interest towards research on big data and AI education (Johnson, L., Smith, R., Willis, H., Levine, A., and Haywood, 2011) (S. A. Cummins, 2017). In contrast, studies focusing on psychological field theory and modelling (Harlow & Oswald, 2016) have maintained their popularity, as defended by H. Yarkoni and Westfall. The incorporation of big data and AI in learning psychology has unveiled a groundbreaking modern strategy to doing educational research. This technique may provide insights into paradigmatic shifts in understanding, analysing, and optimising realistic events. This trend focuses on the transformative effect the AI technologies can have in reinventing how to meet education needs. Further, the evolution of computer technology which started in mid 1900's and was used to adopt C6I/L to integrate computers into education led on other developments. Along with the technological advancements, we have an introduction of AI in education that has served to highlight multiple benefits including improved efficiency; larger scope for inclusive learning across wider geographical boundaries and time zones; individualized approach towards promoting quality education; better content delivery process among others as well highlighted by Jeff Altschuler who also happened backed Steve Jobs. New AI transformation's introduction perpetually creates new scales of education, learning and management in numerous cases. The use of AI has evolved out from traditional supercomputer understanding range to the field starting and more towards what could be seen as embedded systems

Moreover, AI can significantly contribute to enhancing learner autonomy, particularly in higher education. By playing a pivotal role in creating personalized educational paradigms, AI can contribute to the development of advanced distance learning programs, intelligent tutoring platforms, and online applications. Illustratively, initiatives like SYAWAM (Study Webs of Active Learning for Young Aspiring Minds) in India exemplify the incorporation of AI to make education accessible to all. Survey data from Kolkata students further indicates a growing inclination towards self-reliant learning and a noticeable shift towards leveraging online resources (Tamang, 2020). The integration of artificial intelligence (AI) into robots or computers has revolutionised the realm of children's education. Although collaborative robots are not fully autonomous, they are capable of learning basic tasks from their instructors and adjusting to the specific abilities of each pupil. Originally, web-based education was conceived as an additional

component to enhance current resources. However, it has evolved to include intelligent learning systems that analyse the interactions between tutors and students in order to enhance the user experience. The growing interest in integrating AI applications into various education systems is evident from the rising number of published papers on “AI” and “Education” since 2010. However, there has been a significant surge in publications between 2015 and 2019, accounting for approximately 70% of indexed publications. Investigators are consistently utilising advanced AI approaches such as deep learning and data mining to address complex challenges, while also adapting teaching methodologies to meet the individual needs of students. As AI technologies advance, they are being used more and more in educational settings, leading to significant improvements in student learning. The advancement of Intelligent Tutoring Systems (ITS) has significantly contributed to the integration of intelligence applications in education. These systems utilise sophisticated algorithms to give personalised education in a distinctive manner, while also facilitating an interactive learning environment. The features include immediate feedback, personalised content based on the learner’s performance, and incorporation of gamification aspects. ITS application is implemented at several levels in the education sector, including K12 and higher education. It has become significantly important in language training, as well as in instruction for individuals with special needs. Given the growing integration of technology and education, these systems are crucial in providing personalised learning experiences that enhance student engagement. Additionally, it enhances overall learning outcomes. However, despite the considerable benefits provided by ICTs in education, there are several obstacles to consider. These include a limited opportunity for human contact and interaction, which primarily affects a specific group of individuals who have access to it. Additionally, there is the challenge of the digital divide, along with concerns around privacy. Addressing these problems is crucial to ensure responsible and efficient utilisation of ITS applications.

Challenges and Risks of AI in Learning Systems

Since the inception of the Universal Turing Machine in 1936 by Alan Turing, a British logician and computer pioneer, artificial intelligence (AI) has made significant progress, evolving and advancing over the years. Presently, AI has become deeply intertwined with human activities, with some reports suggesting its potential to elevate

humanity to new heights. Research indicates that approximately 11% of Indians utilizing AI in their organizations are specifically engaged in teaching and learning (Mureşan, 2023), highlighting a significant stride in AI's application. Studies also reveal that AI possesses self-learning capabilities, akin to the cognitive abilities of the human mind (Evstratov & Guchenkov, 2020), making it an integral part of human endeavors. It simplifies complex tasks and saves time, contributing to its widespread adoption.

However, AI has limitations. It operates through algorithms that enable robots to mimic human behavior, but lacks human rationality and ethical reasoning. While AI may become very intelligent, human intelligence for complex problems and moral decisions remains irreplaceable. The education sector is embracing AI, with stakeholders like educational institutions and governments investing in its potential. This shift offers new solutions to longstanding challenges, but requires adaptation to avoid falling behind. Initially met with skepticism, tools like Chat-GPT are now used in education, with institutions even offering workshops on their usage. These tools can automate tasks like student interaction and grading, streamlining processes. It's important to remember that AI is not mystical but a product of human-created algorithms. While powerful, AI can lack true understanding and context, raising ethical concerns about information accuracy in education. As AI evolves, addressing these concerns and harnessing its potential responsibly is crucial.

Ethical Concerns

AI introduces novel challenges to the educational sector, particularly regarding data privacy and security. For instance, students utilizing AI-generated tools may inadvertently claim ownership of work plagiarized from others. This not only raises ethical issues related to academic dishonesty but also undermines the development of genuine knowledge and competencies. Moreover, AI systems, reliant on data analysis, can perpetuate biases inherent in the input data, potentially leading to the dissemination of misleading information and swaying users' cognitive processes away from objective reality. Additionally, AI algorithms that personalize content based on user behavior and preferences may compromise privacy by collecting vast amounts of user data, raising concerns about data protection and privacy (Kim, 2023).

Lack of Human Creativity

Human creativity, often driven by emotions and intuition, poses a challenge for AI systems. While emotions enrich information, AI struggles to replicate human creativity due to its reliance on predetermined patterns and data inputs. Consequently, AI-generated outputs often lack emotional intelligence, hindering their ability to evoke authentic human emotions or experiences. This limitation underscores the importance of human involvement in creative endeavors, as AI falls short in comprehending abstract concepts and contexts associated with emotional content (Cardona et al., 2023).

Inequities and Divisions

The integration of AI technologies in education has the potential to exacerbate existing inequalities and divisions, particularly in marginalized communities. While AI offers numerous opportunities, it also acts as a disruptive force that may exclude disadvantaged groups from accessing AI-powered education. In developing countries, the lack of essential infrastructure contributes to a digital divide, hindering the utilization of data-driven insights for informed decision-making. This disparity underscores the need for equitable access to AI-powered educational resources to mitigate inequalities in educational outcomes (Francesc et al., n.d.).

Lack of Awareness of AI-powered Education

There exists a disparity in understanding and adoption of AI-powered education, particularly among older generations with limited exposure to technology. Maximizing the benefits of AI in education requires a comprehensive understanding of its capabilities and implications. However, many individuals, especially the elderly demographic, exhibit reluctance to adopt state-of-the-art technologies. Therefore, there is a need for educational institutions to provide training and support to educators to effectively leverage AI in teaching and learning. Additionally, empowering educators with the authority to regulate academic programs and integrate AI-based tools can enhance the educational experience and address previously unattainable tasks, such as fostering human qualities like mentoring and emotional support (Francesc et al., n.d.).

Integrating Maslow's Theory of Needs Hierarchy with AI in Education

In recent years, the integration of artificial intelligence (AI) into education has been met with both excitement and apprehension. As educators and policymakers navigate this technological landscape, it becomes imperative to consider how AI can address fundamental human needs within the educational context. Maslow's Theory of Needs Hierarchy provides a comprehensive framework for understanding human motivation and behavior, offering insights into how AI technologies can contribute to fulfilling these needs in educational settings. This paper aims to explore the intersections between Maslow's theory and the integration of AI in education, elucidating how AI can enhance the educational experience by catering to various needs across Maslow's hierarchy (Alam, 2021).

Maslow's Theory of Needs Hierarchy

Maslow's theory posits that human needs are organized in a hierarchical structure, with lower-level needs taking precedence over higher-level needs. The hierarchy consists of five levels: physiological needs, safety needs, love and belongingness needs, esteem needs, and self-actualization needs. At the base of the hierarchy are physiological needs such as food, water, and shelter, followed by safety needs related to physical and emotional security. Love and belongingness needs encompasses social connections and supportive relationships, while esteem needs involve feelings of accomplishment and recognition. Finally, self-actualization needs represent the desire for personal growth and fulfillment (Simons, Irwin, & Drinnien, 1987).

AI in Education and Maslow's Hierarchy

Physiological Needs

AI technologies play a crucial role in addressing physiological needs by ensuring access to educational resources and opportunities. Through online learning platforms and AI-powered tutoring systems, students can access educational materials and support regardless of their physical location or circumstances. Additionally, AI can personalize learning experiences to meet the unique needs of students, including those with disabilities or special requirements.

Safety Needs

Safety needs in education are met through AI technologies that create secure learning environments and provide emotional support for students. AI-powered tools can detect signs of distress or discomfort in students' interactions, enabling educators to intervene and offer assistance promptly. Moreover, AI can facilitate safety measures in online learning environments, such as monitoring for inappropriate content or cyberbullying (McLeod, 2024).

Love and Belongingness Needs

AI fosters a sense of belonging and community among students by facilitating collaboration and social interaction. Through AI-driven discussion forums, group projects, and virtual study groups, students can connect with peers and build supportive relationships. AI-powered tutoring systems also offer personalized guidance and mentorship, strengthening the bond between students and educators.

Esteem Needs

AI technologies contribute to fulfilling esteem needs by providing feedback and recognition for students' achievements. AI-powered assessment tools offer timely feedback on academic performance, helping students build confidence and self-esteem. Additionally, AI can personalize learning pathways based on students' strengths and interests, empowering them to pursue areas of study where they excel.

Self-Actualization Needs

The integration of AI in education facilitates self-actualization by providing opportunities for creativity, exploration, and personal growth. AI-powered learning platforms adapt to students' learning styles and preferences, allowing them to explore diverse topics and pursue individual interests. By empowering students to take ownership of their learning journey, AI technologies support their pursuit of self-actualization (McLeod, 2024).

Maslow's Theory of Needs Hierarchy offers valuable insights into how AI technologies can address fundamental human needs in education. By integrating AI into educational settings, we can enhance the learning experience by catering to the diverse needs of students and educators across Maslow's hierarchy. Moving forward, it is essential to continue exploring the synergies between AI and human needs, ensuring that technology serves as a catalyst for positive educational outcomes and

personal growth (Zhai et al., 2021). Through thoughtful integration and application, AI has the potential to revolutionize education and empower learners to reach their full potential.

Approaches for Overcoming Challenges

Incorporating AI tools into educational institutions represents a significant shift in the educational landscape, yet it also presents a set of challenges. Overcoming these obstacles requires collaborative efforts among policymakers, educators, administrators, and the technology sector.

Addressing Privacy and Security Concerns

Maintaining privacy and security is paramount when integrating AI tools into educational settings, particularly concerning student data. Schools must implement robust procedures and collaborate with AI developers to ensure compliance with data protection standards. Transparent communication with parents and students regarding data usage policies is essential for building trust. Providing comprehensive training on ethical considerations and practical implementation strategies can help students navigate AI-driven education while safeguarding their privacy. Schools should prioritize obtaining informed consent from students and families before collecting and using their data (Akgun & Greenhow, 2022).

Balancing Technology with Human Interaction

While AI has the potential to enhance specific aspects of education, it should complement human interaction and creativity rather than replace them entirely. The connection between learners and instructors is crucial in the education system. Improving learner-teacher interaction, including communication and support, positively influences students' happiness and learning outcomes. The relationship between learners and teachers significantly impacts students' self-esteem, motivation to learn, and problem-solving confidence, aspects that cannot be fulfilled by AI tools (Seo et al., 2021). Schools must strike a balance between utilizing AI tools for efficiency while preserving the essential role of teachers in fostering critical thinking, creativity, and social-emotional skills.

Ensuring Accessibility and Infrastructure

Developing countries encounter challenges in implementing AI facilities in educational institutions due to insufficient technological

infrastructure, including outdated equipment and limited internet access. These barriers result in unequal access to education (Cardona et al., 2023). To achieve widespread accessibility, it is crucial to address obstacles such as high costs associated with AI tools and the need for basic technological infrastructure. By overcoming these challenges and leveraging AI-powered educational technology solutions, schools can enhance the quality and availability of education for all students.

Educator Training and Professional Development

In the evolving landscape of education, educators are no longer expected to be the sole bearers of knowledge, but rather facilitators of learning who guide students in navigating and synthesizing information while fostering critical thinking skills. However, a significant challenge arises in ensuring that educators possess the necessary skills and knowledge to effectively integrate AI tools into their teaching practices. Institutions must invest in comprehensive training programs that cover both pedagogical strategies and technical aspects of utilizing AI tools, aiming to optimize their impact on student learning (Roll & Wylie, 2016).

To address this challenge, educational institutions should collaborate with technology specialists and organizations specializing in educational AI. By forming partnerships with experts who possess in-depth knowledge of AI systems, institutions can access valuable guidance, support, and resources to navigate the complexities of integration. These partnerships can facilitate the development of tailored training programs that address the specific needs and challenges faced by educators in incorporating AI tools into their teaching practices.

Furthermore, ongoing professional development opportunities should be provided to educators to ensure that they stay abreast of advancements in AI technology and pedagogical best practices. This may include workshops, seminars, and online courses focused on AI integration, data analysis, and personalized learning approaches. By fostering a culture of continuous learning and professional growth, institutions can empower educators to effectively leverage AI tools to enhance student learning outcomes and prepare students for success in an increasingly digital world (Cardona et al., 2023).

Conclusion

In conclusion, a paradigm shift offers numerous opportunities to improve learning and accessibility. AI empowers educators with

personalised learning and streamlined processes, benefiting teachers and students. AI-powered tools also support learners with disabilities, providing features like audio descriptions and text-to-speech. However, ethical concerns like data privacy and bias need careful consideration. Researchers and educators must collaborate to ensure responsible AI use in education. Ultimately, harnessing AI's potential while acknowledging limitations and addressing ethical concerns is crucial to preparing the current generation for the future and empowering human intelligence responsibly.

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