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From Chalkboards to Chatbots: Why Education Must Play a Role in AI's Creation

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Abstract

The rapid advancement of artificial intelligence (AI) demands an equally transformative response from education, positioning it as a critical player in shaping the future of technology. This paper explores the essential role of education in AI development, focusing on STEM initiatives that foster both technical expertise and ethical awareness. By examining the historical trajectory of educational technology, the benefits of AI integration in STEM education, and the importance of interdisciplinary collaboration, this paper highlights how educators can guide the evolution of AI to align with societal values. Special attention is given to Artificial General Intelligence (AGI) as a fledgling intelligence, emphasizing the need for educators to serve as mentors in its responsible growth. Through proactive involvement, education can prepare students for an AI-driven future, foster innovation, and safeguard the ethical impact of AI on society.

Key Words: Artificial Intelligence (AI), Artificial General Intelligence (AGI), STEM Education, Education Technology, Responsible AI Development

Introduction

The course of human history has been determined time and again by the development of modern technology. As artificial intelligence, or AI, pervades every aspect of everyday life, reshaping industries and education alike, one must ask who is responsible for its development and what values are being programmed into AI? This question becomes even more urgent when leading experts in the field of AI development predict the emergence of Artificial General Intelligence, or AGI, within roughly the next five to twenty years (Levin & Maas, 2020). AGI is best defined

as a hypothetical, for now, type of AI that would be able to perform every conceivable cognitive task that a human could perform to the same standard, or better, than your average human (Bołtuć, 2020). While this is still in the realm of science fiction in its conceptualization, the conversation about AI and its evolution into AGI needs to start now.

AI has swiftly become a driving force across a multitude of fields including, healthcare where it was used to develop COVID-19 vaccines, to finance where AI models can be used to predict market trends, to education itself. Its capabilities are expanding at an unprecedented rate, enabling machines to analyze data, predict outcomes, and even make decisions. This rate of development has the potential to only increase in a cascade effect as AI models of today are used to develop the AI models of tomorrow (Levin & Maas, 2020). The development of AI & AGI affects not only how we work and learn but how we define what it means to be human in an increasingly automated world.

Historically, education has always adapted to meet the demands of technological advancements. Mostly recently this can be seen as teachers prepare students for a society where innovations like the internet and personal computers dominate. Schools introduced computer literacy and digital skills to equip students for a modern digital era, integrating these technologies into curricula (Kiryakova & Kozhuharova, 2024). Now, as we enter the age of AI, education once again must step forward to prepare students not only with technical skills but also with the ability to navigate complex ethical landscapes that are emerging as a result of AI development and use.

Some may feel that the integration of AI into daily life cannot be avoided, and therefore, students must engage with its unique ethical and societal challenges now, from privacy concerns to potential biases in decision-making systems. Those in the field of education have the opportunity to play a critical role in preparing students to understand and address these issues, fostering a generation that can build and use AI responsibly. Through teaching values, ethics, and critical thinking, educational institutions are in a prime position to shape both students' and AI's consciousness towards a future that is inclusive, fair, and mindful of societal impacts. As the frontier of Artificial General Intelligence (AGI) approaches, the need for education to serve as a guiding force in fostering ethical, responsible, and human-centered AI becomes even more pressing, as someday soon, students may be learning alongside a machine consciousness.

Historical Development of Educational Technology

In the early 20th century, technologies like film projectors, radios, and overhead projectors began to be used in classrooms to enhance learning (del Campo et al., 2012). These tools allowed educators to present information visually and audibly, expanding students' access to knowledge beyond textbooks while also providing a more engaging communal experience for the class. Though far more limited in interaction, these early technologies marked the start of integrating external technological resources into traditional teaching methods. With the introduction of personal computers in the 1980s and internet access in the 1990s, education underwent another major transformation (del Campo et al., 2012). Computers enabled more interactive, personalized learning experiences, and the internet connected students to vast digital libraries and online courses. Moving firmly into the age of communication, the field of education saw the

birth of e-learning, which made education accessible to a broader population and paved the way for online schools and digital classrooms.

In conjunction, the 2010s saw a surge in mobile technology and educational apps, making learning more flexible and accessible than ever before (Algoufi, 2016). Smartphones and tablets allowed students to learn anytime and anywhere, giving rise to microlearning and gamified educational content. To build upon this concept, a wave of EdTech startups emerged, creating platforms such as Khan Academy, Coursera, and Duolingo, which broadened the accessibility of quality education worldwide and highlighted the potential for technology to democratize learning.

Recently, VR and AR technologies have also started to make inroads into education, offering immersive learning experiences that simulate real-world environments. These tools enable students to explore complex subjects, like anatomy, historical events, or landmark locations, in a hands-on, engaging way that traditional classroom settings cannot afford to provide (Kavanagh et al., 2017). By fostering experiential learning, VR and AR are reshaping educational possibilities, creating a bridge between theoretical knowledge and practical experience.

Lastly, in the most recent years, AI-driven educational tools have emerged which include adaptive learning platforms that tailor instruction to each student's needs and intelligent tutoring systems that can provide real-time feedback. This evolution in educational technology has transformed classrooms by supporting individualized learning paths and predictive analytics (Zhai et al., 2021). AI in education highlights the shift toward data-driven, personalized instruction, positioning technology not just as a supplement but as an active participant in the learning process. Through adaptive learning platforms, AI can assess a student's strengths, weaknesses, and learning pace, tailoring lessons and resources to optimize their educational journey where each generation of AI is better than the last at identifying and meeting the needs of the students that engage with it. Beyond personalization, AI-driven analytics offer educators more rapid insights into student performance trends and help identify areas where interventions are needed, enabling data-informed decision-making and more effective support for each learner (Zhai et al., 2021).

Benefits of AI Integration in STEM Education

AI empowers personalized learning experiences that adapt to each student's pace, strengths, and weaknesses, especially in complex STEM subjects. By using adaptive learning platforms, such as DreamBox or IXL Learning, students can work through challenging topics with customized resources and feedback, increasing their understanding and retention. This tailored approach helps students progress at their own pace, ultimately improving engagement and mastery in STEM fields, yet it is only the beginning of the possibilities that AI can provide. Today's adaptive learning platforms are still plagued by the base flaws found in traditional education, where the typical approach to successful learning is repetition. AI and its evolution, AGI, if developed with the intent of pushing education towards experiential learning, could be an invaluable tool in breaking the cycle of traditional forms of education.

An example of this in action are AI-powered simulations and virtual labs, such as PHET Interactive Simulations or Labster, which offer students the chance to explore complex STEM concepts in an interactive, hands-on way. For example, AI-driven science labs, such as the two listed above, can simulate real-world scenarios, like chemical reactions or physics experiments, without the need for costly physical materials. These immersive learning tools allow students to apply theoretical knowledge to practical problems, boosting critical thinking and reinforcing their understanding of core STEM concepts (Dai & Ke, 2022). Integrating AI into STEM education prepares students for a workforce increasingly driven by technology and automation and allows students to live up to the phrase, "Work smarter not harder." AI tools can provide instant feedback and assessments, helping students identify and correct mistakes in real time. This immediate feedback allows students to understand and address gaps in their knowledge before moving on to more advanced concepts, making learning more efficient (Dai & Ke, 2022). For educators, AI-driven assessments also reduce time spent on grading and tracking, allowing them to focus their attention on supporting individual student needs.

By engaging with AI tools at an early age, students will begin to develop an intuitive understanding of technology and be able to proficiently use it in multiple, dynamic settings. It is critical that educators are a key part of the development of AI to help steer these tools away from digital worksheets and towards a landscape of imaginative interactive AI tools. AI encourages students to explore cutting-edge content areas, sparking curiosity and a passion for innovation in STEM fields. With access to AI-powered tools, students can tackle complex, open-ended problems, from environmental issues to engineering challenges thus encouraging more classrooms to engage with problem-based learning with additional confidence and support (Fitria, 2021). This exposure to AI technology not only cultivates problem-solving skills but also inspires students to become creators and innovators in fields that are shaping the future.

As Artificial General Intelligence (AGI) develops, it has the potential to act as an advanced learning companion, capable of understanding and responding to individual student needs on a near-human level (Raddaoui & Raddaoui, 2024). Imagine if you will, a classroom of 30 students each with their own adult capable of answering questions and prompting inquiry. Unlike current AI, AGI would not only provide answers but could engage in complex, adaptive conversations with students, offering explanations, clarifications, and encouragement in real time. This could create an immersive, tutor-like experience, where AGI learns alongside students, guiding them through intricate STEM concepts and helping them develop critical thinking skills with nuanced feedback that is tailored to each learner. AGI has the potential to catalyze unprecedented collaboration between students and AI on advanced research projects, from quantum physics to environmental science. AGI could support students by suggesting hypotheses, interpreting complex datasets, and even generating new approaches to scientific problems, functioning as a true intellectual partner in exploration (Raddaoui & Raddaoui, 2024). This level of engagement could democratize access to cutting-edge research, empowering students to make meaningful contributions to STEM fields much earlier in their educational journeys and pushing the boundaries of what is possible in high school or university-level STEM learning.

The Role of Education in Responsible AI Development

Educators need to carefully consider their responsibility in shaping future AI developers and their innovations by fostering the critical thinking, creativity, and problem-solving outcomes that teachers would hope to find in effective and impactful AI technologies. By integrating critical thinking and creativity into AI development, through the exploration of issues such as academic progress, analysis, and feedback, as well as bias and responsibility, educational technology developers can equip future AI tools to focus on student development while maintaining transparency and ethical standards. This level of interdisciplinary cooperation will be essential to the development of the proposed AGI educational tools, helping to establish a strong foundation for creating responsible and effective AGI systems in the future. Additionally, this foundation helps students approach AI with a sense of responsibility and trust knowing the tools they were using were designed specifically with education in mind as opposed to the tools of today which are designed for the masses.

A responsible approach to AI development benefits from input across diverse fields, as opposed to being developed solely by programmers and engineers. The development of AI/AGI will require collaboration among not just computer scientists and engineers, but also ethicists, philosophers, psychologists, educators, and other experts who can contribute to the nuanced understanding of intelligence and consciousness. Education is uniquely positioned to foster interdisciplinary collaboration due to the very nature of education itself being interdisciplinary. Courses that combine STEM with social sciences, humanities, and law encourage students to think critically about the social contexts and potential consequences of AI (Ali et al., 2021). This cross-disciplinary education helps future AI professionals approach development with a well-rounded perspective, considering scholastic achievement, human rights, cultural impacts, and the ethical dimensions of the very technology they are creating. Furthermore, educators can involve their students in these conversations, which in turn, will provide valuable hands-on experience with the developmental process and ensure their voices are heard in the conversation as well. By preparing students to engage in these complex, multi-faceted conversations, educators will help ensure that AGI is developed in a way that is ethical, inclusive, and aligned with the values of a diverse global society (Ali et al., 2021).

Therefore, educators must be actively involved in the creation of AI, as it offers a unique opportunity to shape technologies that align with human-centered values and prepare developers and students alike for an increasingly AI-driven world. By participating in AI development, educational institutions can ensure that future AI systems are not only innovative and effective but also equitable and responsible. In return, education benefits from enhanced curricula that integrate cutting-edge technologies, providing students with hands-on experience and a deeper understanding of the tools shaping their future. As the development of Artificial General Intelligence (AGI) progresses, educators' involvement will be crucial in ensuring that AGI is developed in a way that aligns with societal needs, and more specifically, academic needs, where the vision of virtual teacher assistants for every student could be realized. This knowledge, when applied to the dream of empowering AGI educational assistants, will help ensure that AGI is developed with a focus on the collective good, minimizing risks while maximizing its benefits for all of humanity.

Lastly, just as educators nurture the growth of their students, they should be actively involved in the development of AGI, which can be viewed as a fledgling intelligence that requires careful guidance and ethical mentorship. Like students, AGI will evolve, learn, and adapt over time, making it essential for educators to help shape its development with an understanding of both its potential and its limitations (Bołtuć, 2020). By leveraging their expertise in teaching, educators can ensure that AGI's growth is aligned with human values, fairness, and accountability, fostering a balanced approach that prioritizes academic, social, and ethical considerations throughout its evolution.

Conclusion

While it may still seem like science fiction, there may come a day when every student has their own personalized AI assistant tailored to their unique learning style, strengths, and interests—a technology that could revolutionize education. This vision may be closer to reality than many can imagine, with rapid advancements in AI paving the way for tools that not only adapt to students' needs but also foster creativity, critical thinking, and problem-solving skills. Such AI assistants could act as mentors, collaborators, and lifelong learning companions, bridging gaps in access to quality education and empowering students to reach their full potential. However, realizing this vision requires intentional, ethical development guided by educators, researchers, and policymakers to ensure these tools are equitable, transparent, and aligned with the values of a diverse global society. Educators' proactive involvement will be the cornerstone of creating AI that transforms learning into an inclusive and empowering experience for all.

AI Disclosure Statement

It would be remiss to write about AI without actively utilizing its tools. To ensure transparency and maintain the highest ethical standards, the following AI tools were employed in the creation of this article: ChatGPT was used to draft an initial outline, while both ChatGPT and Google Gemini served as editorial assistants. ResearchRabbit was utilized to identify additional supporting articles, and Zotero was employed for organizing and managing citations. These tools demonstrate the collaborative potential of AI in academic writing while underscoring the importance of ethical and responsible usage.

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