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11/11/2025

How Artificial Intelligence Has and Will Continue to Impact Education?

Research Methods Summary

This study examines how artificial intelligence (AI) has influenced education, focusing on how both students and teachers use these tools. The main research question guiding this project is: How has AI affected learning and teaching practices in modern education?

I selected this topic because AI has already become part of everyday educational life, yet its long-term effects remain unclear. My goal is to understand both the benefits and drawbacks of AI in schools, with attention to areas such as learning enhancement, academic integrity, and student development. My initial interest lay in how Generative AI (GenAI) has affected education, but I broadened the scope from GenAI to AI as a whole after realizing from my research how much the other forms of artificial intelligence can impact the future of education.

My research draws from peer-reviewed sources accessed through the ACM Digital Library and IEEE Xplore, which provide high-quality publications on technology and education. Sources were selected based on relevance, credibility, and publication date. I prioritized studies that offered empirical evidence or comprehensive analyses of AI's role in education because these types of sources provide more reliable insights than opinion-based discussions. Since the goal of this report is to understand the real impact of AI in educational settings, research grounded in measurable outcomes and systematic review was essential. Together, these materials form the foundation for understanding how AI is reshaping the learning experience.

How AI Aids Students

AI provides students with one of the most crucial forms of learning – active learning. Many contemporary theories related to teaching cite interaction and engagement with content to be one the most important factors in learning [2]. Large Language Models (LLMs) have already been used to guide medical students through practice medical procedures as well as provide post-op feedback [2]. By providing guidance through complicated tasks, AI allows students to begin engaging and interacting with the learned material earlier, almost like how training wheels allow individuals to begin riding bikes sooner. By engaging with course content early, students get a head start toward mastering it, promoting the active learning that AI is uniquely suited to support.

Also, by monitoring individual students as they complete tasks, LLMs may be able to provide personalized feedback, another key factor in learning. Chatbots and Intelligent Tutoring Systems (ITS) in particular have been developed to offer students personalized support. AI has been used to create ITS systems with the aim of providing some of the assistance typically offered by teaching assistants [1]. ITS systems typically represent a specialized concept for which there is dedicated literature, and these systems are designed to give students access to more detailed knowledge. Question-and-answer chatbots, a subset of ITS systems, use LLMs to attempt to provide students with in-depth answers [5] regarding course-related questions. Using chatbots or other ITS systems can offer students AI-based assistance that is available

24/7 and may be equipped to supply personalized guidance. Because chatbots keep track of past interactions, these ITS systems may be able to support the individual needs of each student based on their current understanding. It's important to note that for broader topics, GenAI systems such as ChatGPT are often used informally as chatbots by students. This can allow students to obtain personalized learning on a wide range of subjects, giving them the opportunity to learn independently and at their own pace.

Another important component of quality education is multimedia learning, which AI has the potential to help facilitate. Multimedia learning involves using multiple modes—video, audio, and text. In a meta-analysis comparing the effects of multimedia learning to a single-mode control group, researchers found, with 95% certainty, that multimedia approaches have a medium to large positive effect on student learning outcomes [3]. Because multimodal materials tend to enhance comprehension and retention, technologies that expand students' access to such materials contribute to stronger learning outcomes. Through the use of AI, students may be able to transform media from one mode to another. For instance, GenAI can generate audio or video from written text, or produce text from audio or video segments [3], giving students the ability to create a multimodal learning environment even when only one mode is initially available. Additionally, GenAI systems are being developed to provide video, image, audio, and textual analysis [3] that can support student comprehension across different types of media.

How AI Aids Educators

GenAI can provide teachers with a promising resource for creating and improving course content. Similar to students, teachers can potentially use GenAI's multimodal conversion capabilities to transform their materials into multiple modes of expression [3]. This may allow for quicker generation of supplemental content, reducing the amount of time teachers spend on these tasks. Apart from creating content, teachers may also use AI to reframe or reword the materials they already have while staying within the same mode. For instance, some educators report using ChatGPT to review class slides in an effort to improve clarity and ensure the slides accurately reflect their instructional goals.

Beyond supporting course material development, AI has the potential to assist teachers more directly by functioning as a supplemental teaching assistant. AI tools are being explored as ways to answer student questions and even assist with grading [5]. These systems could enhance the classroom experience for students and help teachers dedicate more time to higher-level instruction. For example, educators might use AI assistants to address routine or low-level questions, allowing teachers to focus more energy on complex inquiries that require detailed explanations [5]. Conversely, some ITS systems are trained on course-specific content and may eventually be capable of providing information that goes beyond what is covered in class, offering support in areas where instructors themselves may not have immediate answers.

ITS systems are also being developed to support both individual student and classroom-level analysis. Through such systems, teachers might gain insights into each student's knowledge, learning preferences, or performance trends. These capabilities could help predict which students may be at risk of struggling or failing a course [5], enabling instructors to intervene more effectively and tailor support to students' needs. AI is also being studied as a tool for understanding which lecture moments capture the most student attention. Visual analysis technologies may be used in the future to record and interpret students' reactions

or attentiveness during class [1], offering teachers feedback on which aspects of their instruction resonate most. Moreover, classroom analytics tools have the potential to assist with room utilization and occupancy calculations [1], providing educators with data that could improve classroom efficiency and offer insights into student attendance patterns.

The Downside(s) of AI in Education

Although AI is a powerful tool, it is far from perfect. LLMs such as ChatGPT are known to generate biased or false outputs [3]. Because AI systems learn from the data on which they are trained, the biases of the individuals who create that data can appear in the model's responses [1]. As a result, AI can reach inaccurate or misleading conclusions, which is one of its major limitations. In a survey of students who regularly use LLMs, about 38% reported occasionally encountering hallucinations, where the model produced false or logically incorrect information [2]. This potential for misinformation is especially concerning in educational settings, where young and highly impressionable learners may not yet have the skills to detect inaccuracies. Due to AI's tendency to produce biased or incorrect content, many worry about the long-term impact of integrating such tools into students' daily learning.

The rapid integration of AI into education has also raised a number of ethical concerns. First, critics point out that AI can fabricate information entirely, which worries many parents who do not want children absorbing false or misleading claims. Second, AI's involvement in education brings up data privacy concerns. Educational AI systems rely on data collection, specifically, students' academic records and behavioral patterns [3], which some people find incredibly intrusive. Such data collection can also lead to data leakage [3], where private student information is given out to those who should not have access to such information. Lastly, GenAI provides students with easy access to a powerful cheating tool. GenAIs such as ChatGPT are notorious for enabling plagiarism, which is defined as "the act of imitating or copying others' creation or idea without permission and presenting it as one's own" [3].

Other than the fact that plagiarism is morally wrong, it also places an added burden on teachers. Teachers now have to spend significant time determining which students produced their own work and which relied on GenAI to plagiarize [4, 5]. This task is already challenging, as anti-plagiarism tools are often ineffective at detecting AI-generated content [5]. It will likely remain difficult, given that GenAI tools continue to advance, and seemingly faster than anti-plagiarism tools. Ultimately, this means teachers must devote increasing amounts of time and effort to preventing and identifying academic dishonesty.

Plagiarism also stunts students' development of essential critical thinking skills. When students use GenAI to complete their assignments dishonestly, they deprive themselves of the opportunity to engage with the material and think independently. While using AI as a supplemental tool can support learning, over-reliance occurs when students let AI do the intellectual work for them instead of using it to enhance their own understanding. Students who turn to AI for easy shortcuts may benefit in the short term, but this reliance ultimately harms them in the long term by preventing them from building the skills they need. Repeated misuse of AI for academic tasks limits students' ability to develop critical thinking, creativity, teamwork, and communication skills [3]. Those who depend heavily on technology to do their work for them diminish their capacity to contribute unique human insights [4], ultimately undermining their autonomy. This pattern can lead to long-term academic and professional

disadvantages as students will lack the tools necessary to generate original work.

Conclusion

Artificial intelligence has already had a noticeable effect on education and its influence will only continue to grow. Based on the evidence, AI has the capacity to dramatically enhance learning by supporting active engagement, providing personalized feedback, and giving both students and teachers powerful tools that were previously unavailable in the classroom. When used responsibly, AI can expand access to high-quality instruction, reduce teachers' workloads, and help students interact with content in deeper and more meaningful ways.

However, the limitations and risks of AI cannot be ignored. Issues such as biased outputs, hallucinations, data privacy concerns, and the growing ease of academic dishonesty show that AI is far from flawless. In my view, the biggest danger is not the technology itself, but the lack of structure around how it is used. Without clear guidelines, students may misuse AI in ways that harm their learning, and schools may adopt tools without fully understanding their ethical implications.

Because of this, I believe the next steps should focus on regulated integration. Schools should create policies that define when and how AI can be used, and teachers should receive training on how to incorporate AI tools effectively while maintaining academic integrity. Likewise, students should be taught not just how to use AI, but how to question it. At the same time, developers of AI tools specifically made for schools should work closely with educators to build systems that prioritize accuracy, safety, and privacy.

AI will continue to shape the future of education whether schools prepare for it or not. The challenge moving forward is to use AI in a way that strengthens learning rather than replacing it. With careful planning and responsible implementation, AI can become a tool that greatly enhances education for future generations.

References

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