International Journal of the Whole Child
2023, VOL. 8, NO. 2

Tech Talk
Entering a New Frontier: AI in Education

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Abstract

Artificial Intelligence (AI) has become a normal part of life in many areas, including education. This article seeks to explain some background in AI, discuss how it can be used to improve teaching and learning, and how it can be used as a digital assistant. Particularly we explore how AI can be used to personalize and differentiate instructional plans, create and score assessments, provide feedback, incorporate intelligent tutoring systems, expedite administrative tasks, and

some uses of generative AI, as well discuss some of the risks and concerns associated with using artificial intelligence in education.

Introduction

Artificial Intelligence (AI) has become deeply embedded in our daily lives. Alexa and Siri (digital assistants), facial detection and recognition (e.g., on smartphones), email spam filtering, maps, and navigation (i.e. Google Maps and Waze), spelling auto-correct sentence restructuring (e.g., Grammarly), smart recommendation systems (e.g., on social media), chatbots (e.g., when ordering something online or seeking assistance), language learning apps (e.g., Duolingo), and e-payments and fraud detection are some common ways our society is engaging with AI daily (Holmes, Bialik, & Fadel, 2019; Reeves, 2023).

Ruiz and Fusco (2023) in the "Glossary of Artificial Terms for Educators" provide this definition of artificial intelligence, "AI is a branch of computer science. AI systems use hardware, algorithms, and data to create 'intelligence' to do things like make decisions, discover patterns, and perform some sort of action" (para. 1). In this setting, algorithms are considered the "brains" of AI as they provide the rules for the actions to be taken, or in the case of machine learning, discover the rules.

A popular and easily accessible form of AI, generative AI, uses large language models (LLMs), software or systems that have studied content on the web and are designed to learn patterns and make predictions based on that content, and natural language processing (NLP), the ability to understand text and spoken word, as part of artificial intelligence, to transform ideas into reality (Manzer, 2023; Mollick & Mollick, 2023). Many industries rely on these models in their use of AI. The agriculture industry uses AI to improve crop yields and track resource consumption. The construction sector uses it to predict budget and time requirements for projects. The healthcare industry capitalizes on AI to reduce human error, diagnose disease, and for drug development (Holmes, et al., 2019; Mendes, 2023). These technological advances in AI have become commonplace in the workforce as they have been developed to expedite decision-making, provide faster service, improve outcomes, and make life easier, and maybe even safer.

In addition to these fields, Artificial Intelligence is used in the field of education. Its uses have been researched in education for more than 80 years (Frontier, 2023) with the first AI, Logic Theorist, in 1956 at Dartmouth College. The precursor to AI began with B.F. Skinner's and Sidney Pressey's teaching machine (non-adaptive) and then Gordon Pask's Self-Adaptive Keyboard Instructor (SAKI) in the 1950s. Next, Computer-Aided Instruction (CAI) like PLATO (Programmed Logic for Automatic Teaching Operations) was developed in the 1960s, and then Jamie Carbonell's SCHOLAR (first intelligent tutoring system) (Arnold, 2000; Holmes, et al., 2019; Waters, 2015). Artificial Intelligence in Education (AIED) has exploded as evidenced by a myriad of applications, articles, and blog posts, as well as presentations at the 24th annual international conference on AIED in Tokyo, Japan on July 3-7, 2023 (AIED, 2023) and articles published in the *Journal of Artificial Intelligence in Education* (AIED Proceedings, 2023).

While AIED has been researched and utilized in education for many years, it has quietly entered the classroom and has only recently been recognized as a useful tool that is accessible to

educators and students. Now practitioners are recognizing that the integration of artificial intelligence into education can be a transformative force, revolutionizing the way educators teach and students learn.

Using AI to Improve Teaching and Learning

AI is demonstrating notable benefits for teachers' instructional practices. Educators can leverage AI for effective planning, execution, and evaluation of their teaching methods. AI aids in identifying students' needs, allowing teachers to tailor learning content and activities accordingly. During activities such as collaborative tasks, AI facilitates real-time monitoring and prompt feedback for teachers. Additionally, AI can be used to support educators' learning, keeping them up to date in their disciplines (Celik, et.al. 2022; Chen, 2023). There are also several ways AI may positively support and improve student learning when used to personalize and differentiate instruction.

AI for Personalized Learning and Differentiated Instruction

A significant challenge teachers face is accommodating the diverse needs, abilities, and interests of their students. Therefore, a significant advantage of AI in education is its ability to tailor learning experiences to individual student's needs because it can predict how people will learn (Meehir, 2023). Adaptive learning platforms utilize AI algorithms to assess students' strengths, weaknesses, and learning preferences, allowing them to progress through content at their own pace and truly personalize content, not heretofore possible (Frontier, 2023). It can also generate personalized learning materials such as worksheets, reading lists, and interactive exercises that align with each student's learning preference. For example, AI can help a teacher explain a complex concept by breaking down the concept, altering the lexile level of text, and suggesting different approaches. An example is iReady, an online math curriculum that differentiates and supports learners based on their current knowledge and skills (iReady, 2023). An example of altering lexile levels is the use of NewsELA. This online reading platform is customizable to meet the needs of individual students (NewsELA, 2023).

AI can also help a teacher build a bridge "between a skill and the student's interest" by making recommendations for strategies that would be helpful for the student. (Nieves 2023). AI can also be used to improve student outcomes by designing learning activities and assessments; and creating music, images, text, videos, and other innovative content (Manzer, 2023; Mollick & Mollick, 2023). An example of an AIED tool for personalized learning is ChoiceText. This fun, free online math and reading program responds to students' backgrounds and interests and customizes reading passages and comprehension questions (Dahlberg, 2023).

AI for Assessment

Part of differentiating instruction is differentiating assessment. AI can be used to create differentiated assessments by providing lower lexile levels in reading passages, simplifying verb tenses, and providing a glossary of terms. Tiered instruction and assessment questions, assignments, and rubrics can all be created using AI (Nieves, 2023; Spencer, 2023). Additionally, AI-powered assessment tools can gauge a student's proficiency and adapt the

difficulty level of questions in real time. This ensures that students are consistently challenged without becoming overwhelmed or bored, fostering a balanced learning curve (Nieves, 2023).

After instruction, AI-driven automated scoring systems can assist with grading assessments, ultimately streamlining teachers' workload and enabling them to focus on crucial aspects like timely intervention and assessment. AI has been used for automated essay scoring (AES) and computer adaptive testing (CAT) since the 1960s and has improved the efficiency and validity of assessment systems that use large volumes of data. It can also be used to check for plagiarism (Celik, et.al. 2022; Gardner, O'Leary, & Yuan, 2021; Jimenez & Boser, 2021). By analyzing students' performance data, AI can provide teachers with actionable insights into each student's progress, which enables teachers to identify areas where students are excelling and where they might need additional support.

Intelligent Tutoring Systems

When students need additional support, intelligent tutoring systems (ITS), a form of AI, can enhance student learning by providing real-time instruction and feedback that is better than conventional computer-assisted instruction and comparable to an effective human tutor (Sedlimeier, 2001). These systems leverage natural language processing and machine learning to offer students immediate feedback on their assignments and help them navigate complex topics. A study by VanLehn et al. (2005) found that students using an ITS in algebra showed significant learning gains compared to those using traditional methods, highlighting the potential of AI in addressing individual learning gaps.

AI can also provide feedback in the form of "feedback loops" that can be useful to help the teacher improve their instruction and how they adapt instruction for each student. The significance of feedback loops extends to immediate scenarios, such as honing a skill, as well as to broader situations involving comprehensive efforts and reflections, such as the conclusion of a project or a term paper presentation. Teachers can benefit from feedback loops by understanding how they are responding to students. They see patterns that are effective and others that are not (U.S. Department of Education, 2023).

AI as a Teacher's Assistant

In addition to being an excellent tool for teachers to support student learning, artificial intelligence can provide great benefits to educators when acting as a teacher's assistant. AI can aid in administrative tasks such as creating emails, memos, and proposals; time management and smart scheduling; and setting and tracking goals (Mollick & Mollick, 2023; Rampton, 2023).

AI tools used to curate information and created content are called generative AI. Generative AI, like ChatGPT, has found its way into the classroom. There are several generative AI tools, for example Anthropic Claude, Autodesk's Generative Design (for engineers), Bing AI, ChatGPT, Dall-E2 (for creating images and art), GitHub CoPilot (an AI programer), Google Bard (a conversational AI tool), Notion, Scribe, Speechify (text to speech read out loud), and Wordtune (Gonzales, 2023; Manzer, 2023; Mollick & Mollick, 2023). These tools can be used to assist with scheduling, class planning, and managing administrative work, allowing teachers to focus

more on teaching. Chatbots and virtual assistants can handle routine inquiries and administrative tasks, such as setting up parent-teacher meetings or managing classroom resources, creating emails to specifics such as parents and back-to-school planning.

In addition to AI acting as a tutor for students, AI can be used as a virtual assistant that is a resource to tutor teachers. Teachers can use AI as a professional development tool by using it to increase content knowledge and pedagogical content knowledge; stay up-to-date on technology; and for assistance in college coursework and preparing for additional licensure exams.

Risks and Concerns of Using AI

While artificial intelligence may offer an array of benefits and opportunities for educators, it is not without its risks. For example, potentially reinforcing bias; creating "hallucinations" due to limited training data; and risky security issues.

One concern is inherent bias. Because the training data used for generative AI is based on English text from Western culture, and these systems are created by humans, unconscious bias can enter machine learning models and become automated and perpetuated (Coley, et al., 2023; Marr, 2022). In turn, AI can reinforce existing biases and inequalities by not being reflective of the diversity in classrooms. These can be manifested in image creation tools, inappropriate facial recognition, and biased assessment of student performance (Blask, 2023; Chen, 2023; Coley, et al., 2023; Hardman, 2023; Marr, 2022).

Another concern is incorrect information, also known as hallucinations. In AI, hallucinations are information that is partially or entirely fabricated. Generative AI is programmed to provide plausible responses, even if they are incorrect. A query that is presented to a generative AI tool could be responded to an intelligent-sounding falsehood. This means that generative AI can be convincing liars (Coley, et al., 2023; Chen, 2023; Thorbecke, 2023).

Finally, with the rise of AI comes privacy and security concerns, particularly the misuse of personal information. Of note is what constitutes personal information (Office of the Victorian Commissioner of Information, 2018). Because AI systems collect and access large amounts of different data, there is a risk of personal information sharing, profiling, or even surveillance. Tracking students' online activity and making predictions about future activity as well as inferring private information, can lead to security issues (Cullican, 2023). Educators should proceed with caution in entering any identifiable student information into AI systems (Coley, et al., 2023; Yuskovych-Zhukovsk et al, 2021).

In Conclusion

The integration of Artificial Intelligence (AI) into education marks a significant and transformative shift in the way learning is facilitated and nurtured. As AI continues to evolve, its potential to revolutionize education remains vast. By aligning long-standing pedagogical aspirations with AI's emerging capabilities, educators can harness the power of technology to create truly engaging and effective learning experiences. The journey ahead necessitates a vigilant awareness of AI's limitations, ensuring that its implementation remains grounded in the

principles of effective education. The collaboration between educators, students, and AI is poised to shape the future of learning, enabling a more inclusive, adaptable, and engaging educational landscape. It's important to note that while AI has the potential to assist teachers in many ways, it should be seen as a tool to augment human expertise rather than replace it. Rather than focusing on the fear of using artificial intelligence, it is important for educators to use it in ways that can benefit teachers and students.

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