Artificial Intelligence in the Classroom: Opportunities, Tools, and Ethical Challenges

AIML430 Team 1: Green Team HR

1. Introduction

Artificial Intelligence in education refers to the use of AI technologies such as machine learning, natural language processing, and intelligent tutoring systems within teaching and learning settings. Its role has grown rapidly over the last decade, extending across primary, secondary, tertiary and corporate training environments. New technologies, such as automated grading systems to AI-driven tutoring and analytics, is reshaping the learning process and environment.

The purpose of our review is to explore both the potential and the challenges of AI in education. We will look at the tools currently used, such as tutoring systems, chatbots, plagiarism detection, and AI assessment while discussing the benefits, such as personalized learning, instant feedback, and workload reduction for teachers. We will also critically examine the limitations and ethical concerns, such as bias, privacy, and the impact on teacher-student relationships.

So why AI in education? AI has been positioned as a solution to pressing challenges, such as, supporting remote learning and distance education, expanding equal access to learning opportunities, providing personalised pathways tailored to students abilities and learning styles, and enhancing efficiency through the automation of repetitive tasks like grading. Our discussion will be informed by and evaluated based on seven recent studies which highlight the range of papers we consider to be vital to address. We will be discussing recent tools, systematic reviews/studies, ethical challenges and development and application advances. These works provide the foundation for understanding how AI tools are shaping education, the benefits and opportunities they bring, and the risks and ethical concerns that must be addressed.

2. AI Tools in Education

2.1 AI for Students

AI in education provides several applications to aid in students' progress. These technologies directly influence how students learn, practice and receive feedback. Intelligent tutoring systems [4, 6] offer tailored guidance to every student, while AI-assisted apps [5, 6] offer quick solutions to common challenges. Immersive environments such as AI-simulation [5, 6] and games extend learning to encourage student engagement and understanding. Chatbots connected to schools offer 24/7 support for frequently asked questions and instant feedback, releasing teachers from out-of-office hours. At the same time, more controversial applications such as fully AI generated assignments and essays raise concerns about misuse and academic integrity.

Intelligent tutoring systems such as ADAPT [5] provide functional instructions by analysing students progress and tailoring exercises to their needs. Ensuring all students are equally challenged. These systems are particularly effective in maths and programming where they build confidence and engagement.

Lightweight mobile applications such as PhotoMath [6] are able to assist outside of the classroom. PhotoMath is able to provide step-by-step assistance with math problems from a simple image. SayHi [6] on the other hand is used for translations for language learning. While

these apps increase accessibility they also raise concerns around students over-reliance, reducing their core understanding of the topics.

Interactive simulations and game-based learning environments use AI to adapt scenarios to student performance. They are widely applied in fields such as aviation, neuroscience [6] and programming [5]. AI simulation offers practice in realistic virtual settings, supporting skill development and mitigating real-life risk. These tools enhance engagement by offering immersive, hands-on experiences that traditional teaching methods may not provide [4, 5].

These tools collectively demonstrate how AI is reshaping the student experience. They highlight the potential of personalised, accessible and engaging content. These tools already exist with the majority freely available online, meaning students can, and do, adopt them independently. The key challenge therefore lies not in access but integration, [4] how can schools and educators adapt these tools to maximise benefit while minimising risks of overreliance.

2.2 AI for Teachers

Incorporating AI into the classroom can help not only students, but teachers as well. Helping teachers lower their workload [4], while also increasing output quality and efficiency, can take mental stress off teachers and really improve the students' education overall. There are many different ways AI can be looked at to help out teachers in the classroom.

The paper “State of the art and practice in AI in education” [5] explores how tools such as AI powered plagiarism detection can be used to detect academic dishonesty, tools like this already exist such as turnitin. These tools are fairly common use already, being a part of everyday classroom life. Tools like turnitin or grammarly plagiarism checker are commonly used.

The article also expands and explains how AI can be used for the “Smart Curation of Learning Materials” [6] which is using AI to scan for high quality, relevant teaching resources online. Finding classroom materials can be a very time consuming task for teachers. Tools like X5GON are being used for research in this area, as well as commercial tools Teacher Advisor and Clever Owl.

There are slightly more controversial uses as well, such as using AI for grading or marking, which could increase fairness and consistency [7] when marking, but people are still sceptical of how trust-worthy the system would be. Although somewhat controversial, auto grading has been around for a while, in many different forms, such as automatic grading of multiple choice tests to save the teachers time. But as AI gets better and better, grading will likely be automised, and the scope of the applications will get broader, such as even suggesting new ideas to students rather than solely offering corrections [6] or even giving the teacher an overview and insight into overall class performance. [4]

A perhaps more controversial usage is classroom monitoring [6], where AI is used in different ways to monitor students or teachers, such as monitoring where students go on campus via their ID cards, all the way to watching eye movements to avoid going off task/avoid cheating. There is also the possibility of facial tracking for students [2] to give teachers insight into the behaviours of students, possibly making it faster for teachers to take action if behavioural issues are present [2]. There are some products, such as headbands made by BrainCo [6] that can ‘monitor’ student attention. The practice of classroom monitoring is controversial as there is little evidence it will improve the education of students [6] and can be seen as a violation of privacy.

There are also more speculative applications of AI, such as AI teaching assistants [6], where AI would act as an assistant to teachers, rather than replacing their roles, maybe through managing calendars or recommending lesson plans, but since this is such a speculative area, there isn't a set goal or task for these applications. Tools such as Graide [6] assist the teacher by offering ideas/phrases the teacher has previously used.

There are also some applications of AI that take on bigger jobs, like AI powered admissions [6], a controversial practice both in academic institutions and in recruiting, where AI assesses applicants rather than a human.

3. Benefits of AI in Education

AI technologies offer a wide range of benefits in education, enhancing experiences for both students and teachers. Personalised learning systems and intelligent tutoring approaches can provide students with interactive content instead of relying solely on textbooks [2], which can improve test scores compared to traditional methods [2] as it allows a more custom learning style catered towards each student's needs [1]. Moving away from conventional teaching methods by incorporating AI, helps to identify and fill the gaps in student knowledge [2], support distance learning which is especially useful during situations like COVID [2] and promote equal opportunities across different student backgrounds [4] and improve overall student engagement [4].

Automated assessment systems are another key benefit, offering reduced teacher workload and accelerating grading processes [2]. Incorporating these systems on large scale online platforms, such as Coursera, EdX, and Gradescope [2], would provide availability and instant feedback to students [4] wanting to access course modules both at school and home promoting continuous learning. These would also provide teaching benefits, as these systems would provide insights and metrics into overall class performance [4], reduce bias and improve precision in grading, while maintaining consistency [7]. This also facilitates early identification of at-risk students through predictive features [7], promoting inclusivity and providing direct remediation [1]. This overall results in both better student performance and teaching engagement [7] through use of engaging AI systems and immersive learning environments promotes class enthusiasm and creativity [1].

Facial recognition systems and predictive analytics provide insights into students' behaviours [2], which helps teachers take timely action such as intervening when a student is at risk of failing a course [2].

When it comes to tutoring approaches, AI adds a lot of value. In example-based approaches, tools like NavEx provide students with personalized navigation through examples tailored to their level. At the same time, ADAPT systematically diagnoses errors and connects feedback to the student's underlying strategy [5]. In simulation-based approaches, AI makes abstract programming concepts clearer by simulating code execution step-by-step, making invisible processes, such as variable updates or operator precedence, visible and easy to follow [5]. These systems also correct mistakes immediately when students' solutions don't match expected results, and allow them to observe and modify code [5] interactively. The benefits that immediate feedback enables through multiple submissions, helps promote engagement and customised learning paths for a student through automated clarification and remediation [7]. However, construction of intuitive answers and not promoting superficial learning through trial

and error processes to get the ‘correct result’ needs to be established with student learning approaches [7].

Dialogue-based approaches make learning more interactive and personalized [5]. They help detect misunderstandings in real time and support “learning by explanation,” where students explain their thinking while responding to guided questions [5], helping establish and develop reasoning and critical thinking skills [1].

Program analysis-based approaches help students develop debugging skills by requiring them to predict the behavior of the code. These tools identify reasoning errors [5] and support a deeper understanding of how programs actually work [5].

Feedback-based systems ensure that the feedback given is relevant to what the student was trying to do, not just surface-level errors [5]. They support wide-ranging error diagnosis [5], adapt to new mistakes using machine learning [5], and help students understand the root of their mistakes, not just how to fix them [5]. Lastly, collaboration-based approaches promote problem-solving in groups, which has been shown to lead to better outcomes overall [5]. AI in these systems also ensures more balanced participation by preventing students from staying passive, and guides group discussions to keep them productive [5]. These tools model both the group and the individuals to make learning more adaptive and effective [5].

4. Limitations, Misuses and Ethical Concerns

The integration of AI in education offers many potential benefits, but it also raises important limitations and ethical concerns. Although more than 80 AI ethics frameworks exist, very few specifically address education, often overlooking deeper educational principles such as pedagogy, autonomy, and agency [6]. The Council of Europe has stated that it may threaten fundamental rights, including human dignity, autonomy, non-discrimination, data protection, and transparency [6].

One of the major issues that comes with AI in education is the privacy violations [2, 6]. In order to successfully use many of the AI tools discussed, there needs to be a huge amount of personal data collected, often without proper consent. Moreover, when asked for consent, many students and teachers might lack the technical skills to fully understand what they are consenting to. Furthermore, personalised learning tools require very personal data, which teachers cannot share with third parties without risking being fired [4].

Surveillance and autonomy are also ethical dilemmas that come with AI usage in classrooms [2]. This is because it reduces students’ willingness to share ideas and to participate in class. It can limit students when it comes to making their own choices and decisions [2]. It also blurs the boundary between the surveillance that comes with teaching responsibilities and intrusive monitoring [2].

Moreover, ethical concerns regarding bias and discrimination also arise [2, 4]. AI systems carry existing social and racial biases, which can be inherited into tools such as grading systems, making them biased and unfair to certain students [2]. Furthermore, taking into account that it requires teachers years of training to be able to assist students with disabilities, there should be more literature on how AI models accommodate those with disabilities [4].

Another limitation is the high cost of AI tools, along with the challenge of adapting to them and the training required for both students and teachers [4]. As a result, wealthier schools are more

likely to gain access, while schools with tighter budgets risk being left behind [4]. Moreover, integrating AI into teaching workflows will inadvertently also change the role of a teacher, resulting in fear of displacement or reduction of teaching authority [1]. This also results in the reconceptualisation of this ‘career’ as well as the misconception of their role in a classroom [1]. Challenges with this also include students' attitude to these changes, as to some extent students as “digital citizens will be able to leverage AI to improve learning outcomes” [1]. However a risk of this is students failing to use AI appropriately for their learning, resulting in negative connotations and attitudes towards the tools they are using [1].

Studies on the effectiveness of tools in ‘AI in education and learning’ (AIED) are limited, biased or narrowly focused as stated in [6]. Studies related to AIED tools are often conducted by the developers themselves, use small samples or focus on short term test gains. There are very few independent, large-scale studies. Most also ignore long term impacts on attention, memory, and brain development, particularly in younger students. This raises ethical concerns about using AI tools widely without fully understanding their effects on students [6].

AI is often presented as a quick fix to major educational problems, especially in areas with teacher shortages [6]. However, these ‘fixes’ can mask deeper issues such as poor teacher recruitment, inadequate infrastructure, or underfunding. Often, AI is introduced by people whose interests don’t align with local needs, raising concerns about who truly benefits.

AI also struggles with subtlety and context in student work [3]. Creative or unconventional responses may be misjudged, especially in subjects that rely on interpretation or critical thinking. This can lead to unfair or inaccurate grading. This issue was also covered in [7], which mentions how grading systems can discourage creative thinking by rewarding predictable answers, promoting superficial learning [7]. Other issues include answer leaks, less social interaction between teachers and students as well as inadequate personalised feedback for struggling students [7]. If not reviewed by a human, AI systems may provide overly generous or inaccurate marks on low-quality work [3], which can prevent teachers from recognising when a student needs help.

There is also the issue of AI colonialism discussed in [6]. Many AI educational tools are developed by companies in the Global North, these tools are then imposed on the Global South. These tools are not adapted to the local cultures, languages or teaching practices in these regions. This can lead to power imbalances and the suppression of local practices. It can also lead to linguistic or cultural mismatches, for example models trained in American English not working as effectively in other language contexts [6].

Companies involved in AI for education are shifting the focus from learning, to profit [6]. As tools become more widespread there are concerns regarding data ownership. There is also the threat that companies may use student behaviour for business intelligence. Another issue is that many of these AI educational tools are black boxed (no visibility into functionality or impact). Teachers and students can’t see how these tools work or why they make decisions. This lack of transparency could drive a standardisation of knowledge and therefore limit innovation [6].

5. Conclusion & Future Directions

The integration of Artificial Intelligence (AI) into education offers huge benefits and presents a transformative opportunity, reshaping how students learn, teachers teach, and how education establishments manage learning processes for their students. AI tools such as feedback-based tutoring [4, 5], automatic marking [3, 7], plagiarism detection, and predictive analytics systems

provide enhancements to traditional workflows as well as provide motivation, engagement and inclusion for students [1]. Promoting AI integration of human factors such as emotions, engagement and creativity into tools provides a more adaptive and broader learning environment [1]. The reviewed papers provide a general overview of the field from its practical applications and integration into this practice, however they do also provide clear and identifiable risks.

Challenges and ethical concerns such as algorithmic bias, data privacy violation and student surveillance [2], as well risks such as over-reliance on automation and loss of human connection [1] in the classroom remain critical challenges to address. Furthermore, multiple studies warn that poorly designed systems can lead to superficial learning through trial and error rather than deep comprehension [7]. Findings such as ChatGPT's use in marking show it to be a promising supplementary tool, however it still requires human oversight for quality assurance and borderline cases [3].

The general conclusion across the studies is that AI should be a tool that supports the teachers in education rather than replacement. If AI is integrated into the classroom, the role of the teacher must be clearly defined. This helps remediate common stigma around AI, such as fear of displacement, reduction of authority and preventing the reconceptualisation of the teacher career pathway. The primary focus should be on easing the teacher workload which allows them to spend more time to mentor and provide inspiration. This approach should limit the challenge of hindering the development of deep learning and critical thinking skills [1]. Teachers' knowledge of AI should extend beyond basic tool usage where they have a deep understanding of how the algorithm works and where the bias can appear [2], which can be achieved by having training programs for teachers.

There is also a need for stronger ethical frameworks specific to education as the papers [2, 4] mentioned fairness and transparency being key concerns.There should be a difference between the applications of AI tools between higher and early education. For example, the priority for students in early education is to improve their critical thinking and hand-on motor skills without an over-reliance on AI while the older students in higher education can make their own choices about AI usage. Technology should not hinder the foundational development of younger students therefore any integration of AI tools should come with training about the proper and ethical use.

Further research is needed to validate the actual effectiveness of AI tools in Education [7]. Further development is also needed to address the known drawbacks of the systems such as creating feedback designs and using dynamic problems generation to limit cheating [7]. Furthermore, research could explore more collaborative learning models to support group learning and social interactions [5]. Development also should be done collaboratively, both with AI developers and professionals from the education industry, to ensure that these tools are being developed in a way that both students and teachers can understand the benefits they provide [1]. Most current AIED systems are designed with a narrow view of education only focusing on the "qualification" function like acquiring testable knowledge while ignoring the equally vital functions of "socialisation" and "subjectification" that help students develop social interactions and autonomy [6].

Ultimately, the role of AI in education should be supportive, not substitutive. When implemented thoughtfully and ethically, AI can act as a powerful tool for human teaching, but it shouldn't be designed to replace the role of what teachers provide to their students. Qualities that educators provide, such as fostering mentorship, critical thinking and social interaction are skills that are

developed at a young age. Development of AI tools should be having these ideas in mind, and applications should be able to work alongside this, they should not be a solution for it.

6. References

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