Can AI Universally Help Students and Teachers?: A Cross-Cultural Investigation of Perceptions of AI's Potential in Education

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Abstract

As Artificial Intelligence (AI) increasingly advances and permeates our lives, education has been one of the most disrupted sectors. With numerous AI educational tools developed to enhance education, much research has also been done to assess their efficacy, merits and limitations. Nevertheless, past research has shown a striking lack of investigation into educators' perspectives, which points to their limited representation in discourse about AI in education despite them being such pivotal stakeholders. Additionally, most past research studying public opinion on AI in education has been too general, with an evident lack of clarity in differentiating various types of AI used in each aspect of educators' job scope, resulting in vague generalised findings. Therefore, to fill these gaps, interviews have been conducted on 22 professional educators to learn about their opinions on AI tools used in education derived from both their own personal experiences and second-hand knowledge. A comprehensive analysis of their responses then reveals valuable insights about areas in education with high potential for AI assistance, inherent limitations of AI, the importance of human educators amidst rapid AI advancement, the varying suitability of applying AI in various educational contexts (subject areas, educational system and academic levels) and the importance of much greater personal involvement of educators in the development of AI tools to optimise their effectiveness in enhancing education.

Keywords: *Artificial Intelligence*, *Education*, *Educators' Perspectives*, *Teaching*, *Assessment*, *Cross-cultural Analysis*

INTRODUCTION

Artificial Intelligence (AI) can be broadly defined as the ability of machines to "perceive, recognize, learn, react, and solve problems'' as a simulation of human intelligence (Stryker & Kavlakoglu, 2024; Zhai et al., 2021). While there exists various more specific definitions of AI, this general non-computational definition has been chosen over the rest for three main reasons: 1. ease of layman understanding which is crucial both for discussions with educators who mostly are non-experts in AI and for greater accessibility of this research paper 2. its ability to encapsulate the wide-ranging levels of sophistication and capabilities of existing AI tools, and 3. the ever-changing nature of specific definitions of AI due to its rapid advancement (The Investopedia Team, 2025). AI is mostly applied to automate processes, with key applications today including machine learning used for recommendation engines, natural language processing used for speech recognition, and machine vision used for image recognition (Bista, 2019; Zhai et al., 2021).

AI has been increasingly infiltrating our lives in various fields, with evidently rapid advancement in education in the past decade (Zhang & Aslan, 2021). Especially during the Covid-19 pandemic, the need for remote learning has led to a sharp rise in demand for educational AI tools (Pantelimon et al., 2021). As demand increased over time, past research on the potential of AI in education has also grown increasingly prevalent. However, most research has focused on the efficacy of AI in enhancing student learning needs and opinions of the general public on its ethical and legal implications, with two main unaddressed gaps: 1. limited involvement and representation of educators' perspectives on AI in education, when their opinions and experiences are especially important as both experts of education and users of educational AI tools, and 2. limited clarity in differentiating the use of AI in each specific aspect of educators' job scope which gives rise to obscure research findings.

Objectives

Therefore, the main research topic has been broken down into the following four proposed research questions which this report aims to answer: 1) What are educators' understanding of and experiences with AI in education? 2) How can AI assist in each aspect of educators' job scope? 3) What are some challenges that educators foresee in using AI in education? 4) What role do educators play in education that is increasingly AI-driven?

Literature Review

Analysis of past research reveals various AI tools used to enhance different aspects of educators' job scope, including classroom teaching, assessment, invigilation, data management and other administrative tasks. In this research, the two areas which will be analysed are 1. Teaching and 2. Assessment. In the following section, prominent tools are discussed by category.

Teaching

Intelligent Tutoring Systems (ITSs) are a type of "adaptive educational technology that provides students with detailed, step-by-step feedback during complex problem-solving practice, while adapting instruction based on continuously-updated models of students' current state" (Holstein et al., 2017). ITSs are highly valued for their ability to improve student learning outcomes through personalised curriculum and feedback (Kochmar et al., 2020). However, large amounts of data are required to create accurate user profiles for effective personalisation, which raises privacy concerns (Habegger et al., 2017), but the risk ultimately depends on the type of data collected and how personal they are.

ITSs have become increasingly advanced. One prominent type is Conversational ITS (CITS), which simulates human teachers through teaching via natural language, making it more dynamic than traditional chatbots and thus more effective in enhancing learner experience, but also more time consuming to develop (Latham et al., 2012). Some ITSs are even able to analyse non-verbal behaviour using image processing and artificial neural networks (M. Holmes et al., 2018), with some applying theories of emotions together with facial expressions and brain waves analysis to understand affective behaviour of students to improve the quality of personalised feedback (de Oliveira et al., 2020).

However, adoption of ITSs is still highly limited as most systems are designed by companies to fulfil *students'* learning needs while undervaluing *teachers'* needs, with analytics provided often not in line with what teachers deem useful for enhancing performance (Matsumura et al., 2020; Nye, 2014). Additionally, an extensive experiment conducted on middle school mathematics teachers focused on understanding teachers' needs in ITS-driven classrooms reveals major current limitations with ITSs. While automated personalisation aligns with teachers' desire for greater capacity to provide their students with one-on-one support, it also results in difficulty closely tracking all students' activities. The tendency of ITSs to focus on mastery learning or internalisation of concepts while overlooking thought processes also fails to fulfil teachers' need for understanding students' lines of thought, which provide more actionable insights on improving their capabilities (Holstein et al., 2017). Other research similarly advocates for greater incorporation of metacognitive reflection in ITSs (Wu & Looi, 2010).

Furthermore, in the aforementioned experiment, digital devices without software for blocking unrelated websites and applications created high potential for misuse, and self-paced learning resulted in difficulty in tracking student growth over time, thus hindering grading with objective justification. Both these issues demanded teachers to implement corrective mechanisms such as constant classroom patrolling and their own grading systems, which can be time consuming and thus counterproductive to the purpose of most ITSs in improving teacher efficiency. Ultimately, rigidity of the ITSs rendered it obsolete in the face of a major curriculum revamp, resulting in the discontinuation of its use (Holstein et al., 2017). These findings synergise to reveal a strong need for more flexible ITSs achieved through greater customisability and comprehension ability for higher order thinking, with both students' and teachers' needs at the forefront.

Assessment

Marking written work is a responsibility of educators that is highly time consuming yet crucial for enhancing students' learning. To increase convenience, AI-driven Automated Writing Evaluation (AWE) systems have been developed to quickly assess writing and assign scores, with some even using natural language processing (NLP) to provide prompt feedback with high resemblance to that of human teachers to help students quickly learn and improve (Matsumura et al., 2020). While most AWE systems have been able to assess syntax and grammar, those with greater flexibility in rubrics, scalability and ability to assess semantics have only recently been explored, with limited success when fed with new data (Shetty et al., 2020). Reflecting on their experiences using a specific AWE system in a research, educators revealed a desire for greater ability to monitor students' progress and greater involvement in the marking process – a sort of collaboration with AI in providing human feedback to corroborate AI-generated feedback (Matsumura et al., 2020), possibly suggesting their desire to retain their autonomy as educators and to benefit from such AI systems as tools that boost their effectiveness rather than replace them entirely.

METHOD

To answer the four proposed research questions, qualitative data has been gathered through interviews with 22 professionals in education and educational technology, who shared their first-hand experiences and second-hand knowledge about AI used in various areas of education and their opinions on their merits and limitations.

Professional educators were selected from a wide range of subject areas including mathematics, natural sciences, social sciences, language arts, fine arts and physical education. They were also ensured to be of diverse races and age groups, and to have had experiences with different education systems in order to cover a broad range of perspectives that would yield insights on the potential of AI in education which are as comprehensive as possible.

For interviewees who were comfortable, audio recordings of their interviews were obtained and transcribed using online AI transcription tools Rev and Otter.ai, followed by another manual check for greater precision. For other interviewees who were uncomfortable with being recorded, notes were hand-typed during interviews, then deciphered into clearer language afterwards. Data collected was summarised and thematically analysed with reference to the literature review to glean valuable insights, which were then organised to form a systematic response to the four proposed research questions.

The interview format has been chosen because much research on the potential of AI in education has been done using quantitative data collected through Likert scales for speed and efficiency, which are accompanied by inherent flaws such as the subjectivity of each numerical value on such scales and limited access to the rationale behind responses which diminishes the validity of such data. Therefore, the approach of qualitative data gathered through interviews has been taken to thoroughly understand each person's opinions and reasoning behind them. This is especially apt for a topic like AI which is still unfamiliar to most people, as it facilitated two-way communication for continuous clarification of understanding and mutual learning.

Educators were the stakeholders exclusively chosen for interviews to fulfil the ultimate aim of this research: to increase representation of educators' perspectives in discourse about the potential of AI in education now heavily dominated by AI companies, computer scientists, programmers and researchers. As providers of education with specialised understanding of educational needs and ultimately the users of various educational AI tools developed, educators own perspectives which are invaluable to the development of effective educational AI technology.

Rather than being a completely realistic technical assessment of the potential of AI in education which is outside the scope of this study, this research focuses more on educators' subjective opinions formed from a combination of their views on existing educational AI tools and their imagination for their future potential based on the assumption that AI can eventually reach the "self-aware" stage in the established four primary types of AI (Marr, 2021).

RESULTS AND DISCUSSION

General Understanding and First-hand Experiences with AI

When asked to define AI, most educators were stunned, with one quickly stating, “Not that I, I have a very good understanding” among others who had similar immediate reactions. A variety of vague responses were given, with most sharing common ideas of AI being “the highest level of technology” capable of “mimicking the human brains” in terms of “processing”, “spotting patterns” and possibly even “making decisions” using “algorithms” and “machine learning”. One Physics teacher was comfortable with currently considering “just if then statements” AI and one English teacher interestingly considered most technology to be discussed too rudimentary to be called AI because to him, “AI needs a brain” – the ability to create, think and operate completely independently from humans. A few teachers asked for examples of AI for reference. These responses clearly illustrate both the limited familiarity with AI among secondary and tertiary level educators and the lack of a clear unanimous consensus on what the term “AI” entails, which easily limits the depth and productivity of discourse (Sloane, 2018).

To reconcile these divergent understandings, a Social Sciences teacher raised the importance of highlighting that “there's different levels to [AI]”, making clear in discussions that AI is an umbrella concept and specifying the level of AI in question instead of conversing about “AI” generally. A promising system of classification which can be used divides AI tools into four main types: reactive, limited memory, theory of mind, and self-aware (Marr, 2021).

Notably, first-hand experience using AI in education is extremely limited. Many educators revealed that they are “still dependent very much on the kind of Google Classroom formula” considering the Google Suite the most advanced technology they currently use in their education, with a handful having no prior experience with educational AI technology at all, as subsequently explained by diverse factors. Most commonly, educators shared their struggles with time pressure – “we are just trying to get certain things done”, “trying to just get ready for the next class” – so pragmatism needs to be prioritised over experimenting with new tools that often require a lot of time invested into inputting massive amounts of data before sufficient intelligence is developed for application which also comes with uncertain success rates, a trade-off which many educators understandably do not want to risk. Another key factor is limited support from educational institutions and the government in AI adoption, as “the school did not buy AI tools” which are usually very costly. Lack of awareness also plays a part. Additionally, one pointed out that most tools are “not user friendly enough”, translating to inconvenience which defeats the common purpose of using AI to improve efficiency in education. Some educators do not use AI simply because they find the help of simple technology already sufficient in accomplishing their goals, such as “videos” and “animations” used by a Biology teacher who shares that they are sufficient for creating simulations of microscopic concepts to boost her students’ understanding. Notably, a Thai professor teaching Information Systems Management shared, “Thai people are not trying to do advanced programming, they enjoy [simpler things]” and to create advanced AI, you “need a really big team… in Thai culture, we are not that type [to] get used to that kind of big team,” illustrating cultural forces potentially hindering AI from disrupting education, a state which would take cultural paradigm shifts to change.

All these factors point towards a need for a top-down approach in popularising AI in education – whether or not that is a desirable outcome will be discussed later – whereby governments and school administrative boards make concrete efforts to create more accommodative environments for AI adoption through more enticing incentives, stronger support systems, greater flexibility for teachers to explore new pedagogical methods, and more vibrant cultures of innovation and collaboration.

Educators’ Views on AI Tools Used in Each Aspect of Their Job Scope

Teaching

Many educators hope to see AI assist with “personalisation” (also called “differentiation” and “individualisation”) of teaching, to create unique learning experiences targeted at fulfilling the needs of each individual student and maximise their potential (Kochmar et al., 2020). Educators of various

subjects hope to see personalisation in diverse forms, but all share a common goal of helping students master crucial fundamental concepts in their respective subjects.

A secondary school English teacher shared that in classes like his composed of students with wide-ranging levels of proficiency in English, educators "don't have the time to really go back and into the basics" as it would mean holding many advanced students back from reaching their full potential. Therefore, in this case, AI could come in to create personalised lessons on fundamentals of the language targeted at unique weaknesses of each student, to help strengthen their foundation and provide teachers with more time to focus on teaching advanced critical thinking and argumentation skills in class. Similarly, a PE teacher wishes for an "AI technology using a camera to capture a person's movement…a practice moment. Single person, multi camera…different angles captured and then immediate feedback [on] your response time, your speed, your angle", an AI tool that personalises the teaching of basic moves in each sport to free up time for coaches to focus on gameplay which requires more advanced human understanding and explanation.

Many educators value the potential of AI-driven chatbots as a convenient avenue for students to clarify their unique doubts. Among them, a Biology teacher shares, "it would be very helpful if we have a bot that can remember every single A level question from the past until now and then can actually explain the question to the person and answer all their questions, then we don't have to keep checking our messages and responding through the same questions", illustrating her hope for AI to help save time from answering relatively simple repetitive questions, to free up more time for addressing more advanced questions or improving lessons.

Among many educators, an Art teacher wants AI to provide diagnostics on how each student learns to personalise his own teaching approach to suit them better. He hopes AI could "compensate for my own teacherly humanly flaws" as educators "work with certain biases, old conventions and prejudices" which often cause them to "make certain assumptions about the way [students] learn". Educators recognise that students have unique learning needs and that fulfilling these needs through personalisation would lead to each individual's potential being better maximised. However, time constraints and rigidity of traditional curriculums limit them from achieving such personalisation. With evaluative information on students' performance provided by AI, educators would have more time to "come out with corrective lessons" and "teach in ways that can help students improve" more effectively, through more targeted teaching methods.

These diverse examples illustrate the existence of unique areas of improvement in each subject area, unique angles from which AI has the potential to enhance educational experiences. This clearly highlights the importance of much greater personal involvement of educators in conversations about AI in education and the developmental process of educational AI tools, to thoroughly understand and effectively fulfil their unique needs which often vary according to the nature of their subject, their institution or their education system (Matsumura et al., 2020). Yet, this does not mean that AI companies have no clearly predictable role in education. While educators teaching different subjects hope for different forms of assistance by AI in improving teaching, their responses can all be traced back to a common greater purpose: to have AI assist with repetitive rudimentary tasks to "take the load off the teachers" and enable them "to focus on the important things in education" such as "gameplay", "working with the individuals" and "differentiation" – notably, non-repetitive, more advanced tasks.

Nevertheless, that conversation is mostly theoretical. At the current level of advancement in AI, there are clear limitations preventing AI from taking over teaching completely. An Economics teacher shared her past experience with a chatbot which her department created to answer "very simple questions, like just concept based" drawing from a "database of responses". Quickly, the department discontinued its usage due to the chatbot's inflexibility: "[Students] want more direct and immediate answers instead of being redirected, and the chatbot may ask for many different kinds of answers and prompts before getting the answers that students want." This corroborates past research which has discovered system flexibility to be a key consideration for many educators in deciding whether to adopt AI tools (Holstein et al., 2017). *If not sufficiently advanced*, AI tools used might be counterproductive because they are able to fulfil tasks or satisfy needs in a much less targeted, efficient or "personalised" way than human beings. Thus, currently, the most efficient

approach is likely a collaborative effort between AI and educators. For instance, schools could implement well-developed AI-driven chatbots which students can first turn to for answers as a first step; if they are still unclear, as a second step, these chatbots could connect them to educators who would play the role of clarifying ideas requiring more advanced understanding.

Major pitfalls also lie in the fact that using AI to create highly advanced personalised learning experiences requires massive amounts of data, according to an Information Systems Management professor, which inevitably translates to significant amounts of time needed to input initial data when that same time could be used for improving lessons or one-to-one consultations with students instead. Arguably, this could be a case of making a short term trade-off for a long term benefit: possibly it "takes a lot more effort to start off using the platform and then maybe the yield gets better." More data also means higher risks of data loss and privacy invasion, which will be elaborated on later.

Additionally, a few teachers saw the potential of AI in creating more immersive learning experiences that enhance understanding. For instance, a Geography teacher envisioned the metaverse providing immersive remote learning experiences where his "students could have a virtual kind of encounter with people in that country who would tell them about food and culture and that could take them into something more immersive and it would be their option to enter that." In contrast, a professor would prefer for his students to be "hands-on" and actually "go around the world to get the experience" with current technology that makes it possible. He also shares that having education take place largely in the metaverse is "not really possible yet" with his knowledge of the current level of advancement of AI, together with his experiences as a "gameplayer" through which he learnt that Virtual Reality equipment is "still heavy, not comfy", easily causing motion sickness and other undesirable health consequences.

Assessment

Beyond teaching, another important part of education which takes up a lot of educators' time is assessment (Matsumura et al., 2020). Nearly all educators expressed very strong enthusiasm for AI's assistance in marking because it is "very tedious", as one English teacher shares. They believed Automated Writing Evaluation (AWE) systems would "save a lot of manual labour", alleviating the burden of mundane repetitive tasks from their already highly stretched schedules to free up more time for more important tasks such as teaching and improving lessons.

While most teachers were confident about AI's potential to mark simple right or wrong answers, short structured questions and possibly basic calculation questions, they were more sceptical about AI's ability to mark longer, more advanced responses. For instance, many humanities educators gave similar responses to "it's gonna be pretty much impossible" for AWE systems to mark essays because it is an "art form" characterised by "flow of arguments…logic", "creativity and style", factors which leave them feeling "not sure how that can be really accounted for by artificial intelligence". Interestingly, this led to many humanities educators sharing common concerns that AWE systems could "subdue creativity" among students because they likely "need to have some kind of template of what a good essay's going to be" when "quite often, the best essays that I come across are ones that have things that I wouldn't even think about." This is certainly a valid argument due to the inevitably limited possibilities of correct answers given the gargantuan amount of qualitative data currently needed to train the ability to detect nuances in AI, which could be a major drawback of heavy AI reliance in assessment.

While the ability of AWE systems to assess syntactics or linguistic conventions is relatively widespread now, an Information Systems Management professor verified that in the most advanced AWE systems existing currently, AI's comprehension ability stops at the "semantics" or meaning level, even though that is also not fully developed yet (Shetty et al., 2020). Not only does this illustrate AI's strong potential for effectively assessing the meaning of expressed ideas, it also importantly highlights the widespread underestimation of AI's potential among educators due to their highly limited awareness about it, a potential addition to the list of reasons they shared for limited AI adoption in education. However, he pointed out that AWE systems have certainly not reached the "pragmatic" level yet, meaning that "more indirect" "hidden meanings and human emotions conveyed

through irony, sarcasm, metaphors", among other literary devices, and nuanced ideas like "our intention, our goal" will likely remain undetectable by AI in the foreseeable future.

Thus, it is currently best to treat AWE systems as "complimentary to our efforts", to constantly conduct "human revision", and to use these software mainly for low risk assessments such as "extra practices" "as a kind of quick way to get a piece of feedback", to improve efficiency in formative assessment done for feedback rather than raising unprecedented issues in high-risk summative assessments done for major educational decisions. This is also because if partially developed AWE systems are allowed to run independently, as a Physics teacher pointed out, "You get to the point where instead of writing an essay to learn or to apply critical thinking, you're writing an essay to hack the AI marking algorithm. And once students figure that out, I'm sure every student will start writing their essays in the same way," which could clearly be detrimental to both academic integrity and students' development.

Many teachers greatly value AI's ability to remove effects of human bias on marking, increasing objectivity, accuracy and fairness in assessment, after admitting to inherent biases they struggle to eliminate when marking, with many teachers sharing permutations of "we are human…if we see the name of the student, we might be biased." However, some educators feel that AWE systems could be "more useful for things like…maybe exams or entrance exams…where there's a lot at stake…[an] objective answer that is unbiased is definitely worthwhile". Interestingly, a few Thai educators think AWE systems will be less beneficial for internal assessments, as "sometimes bias is in the student's favour" and highly objective marking "would probably hurt students more than it would help" because "if we remove the bias, I think you would see marks possibly be lower and lower students marks be even lower rather than the teachers kind of helping them out." Evidently, educators in Singapore can appreciate the potential of AI in removing bias more than those in Thailand, which is reflective of each country's unique criteria of success or educational priorities, which shape their different understanding of "helping students" – In Thailand, it very often means assisting students in getting higher grades, while in Singapore, it mostly means supporting students in improving their ability for standardised exams. This also means that some cultures could be more receptive to the implementation of AWE systems, and selling points should be strategically selected to appeal to specific societal contexts for effective marketing.

Nevertheless, even with the assumption that AWE systems can advance to match up to humans' level of pragmatic understanding, some educators were still held back from allowing AWE systems to completely take over marking due to various factors. One Literature teacher shares, "Marking students' essays is not only about us giving them a grade, it's also about understanding the student and having that kind of relationship with the student. That back and forth that constantly happens…that relationship is extremely important," corroborating the importance of human interactions in education, which aligns with what numerous teachers have raised as a major factor limiting AI's ability to completely take over education. With AWE systems, "you can lose track of the rhythm of where they are in terms of what they're trying to do", so educators play a crucial role in maintaining supervision over most of students' educational experience, to get a holistic understanding of them and how they can best improve, especially nowadays when many education systems advocate for holistic development.

Thus, automated marking is an avenue in which AI disruption will greatly benefit educators, but the current effectiveness of AWE systems could vary with the nature of subjects, with more objective, straightforward, and logical subjects being more suited for AWE systems to mark while more subjective, open-ended subjects being less apt. However, the most sustainable way forward is to balance the roles of human teachers and AI in assessment, to leverage on the objectivity of AI tools while humans keep them in check and maintain the human connection with students (Matsumura et al., 2020).

Other Concerns with AI in Education

Data Loss

However, one major risk that is difficult to eliminate from AI adoption is data loss. With large amounts of data in the hands of AI companies instead of being privately owned, "we are vulnerable

to that company…either deleting things or being hacked or having bad business practices." This is extensively corroborated by past research done on the risk of data and privacy loss associated with personalisation technology (Habegger et al., 2017; W. Holmes et al., 2022). One Physics and Astronomy teacher learnt this first-hand through his experience with an AI-run Intelligent Tutoring System that came with a textbook collection published by a certain company, which required teachers to spend a lot of time creating lessons and questions in the system, inputting initial data for the system to operate on. A year later, the company tripled the price because they already had the school hooked with all the information that they now own, ultimately resulting in both data and financial loss. The teacher then expanded this concern to "the pattern now of trying to lease everything" by big tech companies like Google, which as profit-oriented firms, would likely take actions to maximise their profit even if it means infringing on consumers' privacy. Therefore, while this risk is "different for every person and how much data you have on those systems," it is certainly important to heed this teacher's advice: "I think that the current generation will have some growing pains when all of a sudden you lose things that you thought you owned."

Black Box

Another major concern linked with any AI usage is the "Black Box" problem. As an Art teacher put it, it is "this fear that AI could one day become something that's harder and harder for the layperson to understand and when it comes to that point the foundation of its use would be not really understanding but trust in that technology", a highly prevalent fear with many implications (Hocquet, 2017). One of them is what an Information Systems Management professor calls a "filter bubble' that leaves us "separate in our own worlds", a sort of epistemic injustice where people have unequal access to knowledge, so they understand the same things differently and people in power are able to exploit this knowledge inequality for personal gains (Samuels, 2012). This Black Box could also lead to systemic biases being formed and entrenched. While AI might appear to remove human bias through taking over humans' job of processing information, it is important to remember that the information is initially fed by humans. Therefore, if humans input discriminatory data, we would get discriminatory machines, or worse, "bad machines that we take as neutral or good machines that we don't understand so we just think it is," which is a very realistic case considering the prevalence of real world examples such as AI tools used in the United States for surveillance and crime prediction that strikingly exhibit racist tendencies, shares a Philosophy teacher (Cumming-Bruce, 2020). Thus, human checks done on AI machines are indispensable, and widespread education about AI among the general public, especially educators, is crucial for ensuring conscious usage to avoid potential exploitation of its objective facade.

Inequality

Most teachers believe that adopting more AI in education would initially worsen inequality because "it's going to be the rich schools that have this implemented, the schools that have enough students", so already privileged students will receive even more opportunities while others are "abandoned", similar to how most students in underdeveloped areas were left behind during the pandemic. As one Science teacher puts it, "AI could give you the same education as somebody from a rural school, but only if they have the means to access that technology." However, with more widespread access to AI, there could be cost savings due to lower manpower needs: "let's say you have a school that has 50 teachers, you may have some of those subjects which could be taken online or in a different setting, and you wouldn't need a person on site to teach that class", which could translate to more access to quality educational AI tools in remote areas with insufficient human resources, increasing educational equality (Walia, 2023). Nevertheless, even widespread access to AI might not be sufficient; the effectiveness of AI in education likely "depends on the strength of the overall educational system", with "basic levels of literacy" and "confidence of operating with digital platforms," among other factors, being imperative for students and teachers to know how to use these AI tools effectively in the first place. Therefore, public and private efforts in developing both education and AI must come hand in hand for future generations to make the most out of AI in education.

Human Empathy

While it might seem that greater educational fairness can be established through AI's superior ability to maintain objectivity compared to humans, without human empathy, AI is unlikely to be sufficiently capable of "understanding special situations, making exceptions, understanding feelings" to "make decisions based on exceptional circumstances," as supported by past research which considers empathy as an in principle limitation of AI (Montemayor et al., 2021). A Physics teacher provided a striking example of a student who has depression. A human teacher would be able to use their discretion to be more empathetic towards the student when they submit homework late or give them marks for homework that is partially completed, while AI requires prior programming in order to achieve that. A complete takeover of education by AI is thus a near impossibility, "unless the AI has a switch that we can switch on depression mode for this student to be lenient" when necessary.

Additionally, while rapid advancement of AI might raise fears over unemployment, together with the many limitations of AI discussed earlier which clearly illustrate the need for human intervention in AI usage, human empathy is likely the most important reason for mass retrenchment of educators being an unlikely possibility. In discourse about the potential of AI in education, people often overlook the various roles of educators beyond teaching. As one English teacher shares, "I think one of the reasons why they call teaching a vocation is because it's not just about academics…It's also very much about the human relations with the students especially." This is corroborated by many teachers, with a Chemistry teacher pointing out that "human touch is very important…teachers don't play just an imparting of knowledge kind of role…we take on many roles, part of which also is mentoring students or giving them support emotionally" and an Economics teacher remarking, "this profession of teaching still requires a lot of human touch…only humans can actually do that rapport". To many educators across subject areas, supporting students in their psychological development through personal human interactions is an often overlooked yet pivotal aspect of their career which they feel is very challenging for AI to take over. This is potentially one of the strongest arguments against the risk of mass unemployment in the face of rapid AI advancement. As eloquently summarised by a professor in AI, "Humans are a species of survival" – We will find ways to do "other things…change our skill" through taking on new jobs being created, to ensure that we are able to "live among AI".

CONCLUSION

Currently, many educators have a limited understanding of what AI is and its different levels of sophistication, together with limited first-hand experience with using AI in education. Mostly, this limited awareness results from not having the opportunity to learn and experiment with AI due to time constraints, limited flexibility, and the lack of incentives in traditional curriculums. This is not only detrimental to the status quo; many educators voiced their limited ability to imagine future uses due to this limited awareness, with sentiments such as "It's not only until you try that you will know how to improve the system." and "It's very hard to imagine what is not yet in existence…It's that you don't know what you don't know." clearly illustrating the need for much stronger efforts by higher authorities such as governments and school leaders to provide the catalyst needed to kickstart the movement for greater AI adoption among educators such as through providing education about fundamentals of AI for teachers, giving financial incentives, and fostering more innovative and collaborative work cultures.

Through the evaluation of various AI tools developed for assisting in teaching and assessment, numerous clear merits have been discovered that prove AI's potential in enhancing education, with differing levels of effectiveness for different contexts, such as different age groups, educational systems, and subject fields. At the core of it, AI has immense potential in helping to alleviate the burden of administrative tasks that educators are required to do, when their passion lies in pedagogy. Among almost all teachers who voiced the same passion, a Social Studies teacher shares: "The joy of teaching is content creation."; With AI, this passion can blossom in its purest form.

Nevertheless, together with these benefits come limitations that are difficult to eliminate given both the current state of AI and the importance of the role human educators play in student development. Thus, from understanding educators' perspectives, the argument for augmentation

over automation prevalent in AI discourse seems to hold true, to make the best of both worlds through the cooperation of AI and human educators, to leverage on the former's potential for accuracy and objectivity and the latter's empathy.

Nevertheless, given how rapidly AI is evolving, self-aware AI is a distant possibility, so it is exciting to see what the future holds for both teachers and students. As one English teacher puts it in our conversation about AI potentially subduing creativity: "AI is not just about what the AI imposes, because what the AI imposes on us, it's first dictated by the parameters that have been imposed on the AI by humans", so "if the people who are building the algorithms and key in the possibilities of the answers were creative enough in the first place, they might actually be able to create some space for students to have a variation of answers as well". Ultimately, humans are the ones creating these AI machines, so our own human creativity is really the limit for how far AI can go.

Finally, this research reveals the countless forms "learning" takes shape in education: beyond the learning that students experience, learning is also a major part of the educational experience for teachers. From learning about students to "adapt my teaching to cover the areas that you're not good at or the areas that need improvement" to learning about new educational technology "[helping to] expand my skills and my repertoire as a teacher…[to help] me with not being burnt out…to keep my volume stimulated and try different things out", learning is a pivotal part of teachers' career. In this era of rapid continuous change, open-mindedness to learning is one of the most crucial values educators should cultivate for education to progress in the fastest and most sustainable way possible. One English teacher shared: "I don't see it in my teaching career…But I'm not gonna stop learning." Imagine a world where millions of teachers share this attitude; the possibilities are endless.

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REFERENCES

Bista, N. (2019). *Artificial Intelligence Techniques*. EDUCBA. https://www.educba.com/artificial-intelligence-techniques/

Cumming-Bruce, N. (2020, November 27). *U.N. Panel: Digital Technology in Policing Can Reinforce Racial Bias*. The New York Times. https://www.nytimes.com/2020/11/26/us/un-panel-technology-in-policing-can-reinforce-racial-bias.html

de Oliveira, W. C., Gottardo, E., & Pimentel, A. R. (2020). Changes of Affective States in Intelligent Tutoring System to Improve Feedbacks Through Low-Cost and Open Electroencephalogram and Facial Expression. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial*

Intelligence and Lecture Notes in Bioinformatics), *12149 LNCS*, 56–62. https://doi.org/10.1007/978-3-030-49663-0_8

Habegger, B., Hasan, O., Brunie, L., Bennani, N., Damiani, E., Habegger, B., Hasan, O., Brunie, L., Bennani, N., Kosch, H., Habegger, B., Hasan, O., Brunie, L., Bennani, N., Kosch, H., & Damiani, E. (2017). *Personalization vs . Privacy in Big Data Analysis To cite this version : Personalization vs . Privacy in Big Data Analysis*.

Hocquet, P. (2017, October 1). *Trust, and don't verify: the AI black box problem*. Medium. https://medium.com/@PhilippeHocquet/trust-and-dont-verify-the-ai-black-blox-problem-442c2b15e79e

Holmes, M., Latham, A., Crockett, K., & O'Shea, J. D. (2018). Near Real-Time Comprehension Classification with Artificial Neural Networks: Decoding e-Learner Non-Verbal Behavior. *IEEE Transactions on Learning Technologies*, *11*(1), 5–12. https://doi.org/10.1109/TLT.2017.2754497

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in Education: Towards a Community-Wide Framework. *International Journal of Artificial Intelligence in Education*, *32*(3), 504–526. https://doi.org/10.1007/S40593-021-00239-1/FIGURES/1

Holstein, K., McLaren, B. M., & Aleven, V. (2017). Intelligent tutors as teachers' aides: Exploring teacher needs for real-time analytics in blended classrooms. *ACM International Conference Proceeding Series*, 257–266. https://doi.org/10.1145/3027385.3027451

Kochmar, E., Vu, D. Do, Belfer, R., Gupta, V., Serban, I. V., & Pineau, J. (2020). Automated Personalized Feedback Improves Learning Gains in An Intelligent Tutoring System. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *12164 LNAI*(MI), 140–146. https://doi.org/10.1007/978-3-030-52240-7_26

Latham, A., Crockett, K., McLean, D., & Edmonds, B. (2012). A conversational intelligent tutoring system to automatically predict learning styles. *Computers & Education*, *59*(1), 95–109. https://doi.org/10.1016/J.COMPEDU.2011.11.001

Marr, B. (2021, July 2). *Understanding the 4 Types of Artificial intelligence*. Bernard Marr & Co. https://bernardmarr.com/understanding-the-4-types-of-artificial-intelligence/

Matsumura, L. C., Wang, E., Correnti, R., & Litman, D. (2020, July 22). *What do teachers want to see in automated writing evaluation systems?* ESchool News. https://www.eschoolnews.com/classroom-innovations/2020/07/22/what-do-teachers-want-to-see-in-automated-writing-evaluation-systems/?all

Montemayor, C., Halpern, J., & Fairweather, A. (2021). In principle obstacles for empathic AI: why we can't replace human empathy in healthcare. *AI & Society*, *37*, 1353–1359. https://doi.org/10.1007/S00146-021-01230-Z/METRICS

Nye, B. D. (2014). Barriers to ITS Adoption: A systematic mapping study. *12th International Conference on Intelligent Tutoring Systems*, *8474 LNCS*, 583–590. https://doi.org/10.1007/978-3-319-07221-0_74

Pantelimon, F. V., Bologa, R., Toma, A., & Posedaru, B. S. (2021). The evolution of ai-driven educational systems during the covid-19 pandemic. *Sustainability (Switzerland)*, *13*(23). https://doi.org/10.3390/su132313501

Samuels, M. G. (2012). Review: The Filter Bubble: What the Internet is Hiding from You by Eli Pariser. *InterActions: UCLA Journal of Education and Information Studies*, *8*(2). https://doi.org/10.5070/D482011835

Shetty, P., Yadav, K., & Kunder, P. (2020). Automated Essay Grading System using NLP Techniques. *International Journal of Engineering and Advanced Technology*, *9*(5), 1033–1042. https://doi.org/10.35940/IJEAT.E9880.069520

Sloane, M. (2018, July 16). *Making artificial intelligence socially just: why the current focus on ethics is not enough*. Artificial Intelligence and the Internet of Things: UK Policy Opportunities and Challenges; University of Westminster Press. https://doi.org/10.16997/BOOK25/

Stryker, C., & Kavlakoglu, E. (2024). *What Is Artificial Intelligence (AI)? | IBM*. IBM. https://www.ibm.com/think/topics/artificial-intelligence

The Investopedia Team. (2025). *Artificial Intelligence (AI): What It Is, How It Works, Types, and Uses*. Investopedia. https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp

Walia, P. (2023, October 10). *How can AI/ML be Leveraged in Solving Educational Inequality? - Turn the Bus*. Turn the Bus. https://www.turnthebus.org/blog/how-can-aiml-be-leveraged-in-solving-educational-inequality

Wu, L., & Looi, C. K. (2010). Agent Prompts: Scaffolding Students for Productive Reflection in an Intelligent Learning Environment. *Educational Technology & Society*, *15*(1), 426–428. https://doi.org/10.1007/978-3-642-13437-1_92

Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J.-B., Yuan, J., & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, *2021*(1), 1–18. https://doi.org/10.1155/2021/8812542

Zhang, K., & Aslan, A. B. (2021). AI technologies for education: Recent research & future directions. *Computers and Education: Artificial Intelligence*, *2*, 100025. https://doi.org/10.1016/j.caeai.2021.100025