

# AI in Education and Society: Teaching the machine, transforming the human

Vimala Balakrishnan

Faculty of Computer Science and Information Technology, Universiti Malaya, 50603

Kuala Lumpur, Malaysia Korea University, Seoul, Korea

*vimala.balakrishna@um.edu.my*

## ABSTRACT

Artificial Intelligence (AI) is rapidly reshaping education and society, presenting both unprecedented opportunities and complex challenges. It is transforming education in profound ways, offering exciting new possibilities while raising important questions. This paper explores how AI is changing the way teaching and learning happen in universities and beyond. “Teaching the machine” involves training AI systems to understand and respond to educational needs, which includes personalizing learning experiences, automating assessment, and supporting educators in managing diverse classrooms. At the same time, AI is changing how students learn, think, and interact, opening opportunities for deeper creativity, critical thinking, and collaboration (“transforms the human”). While AI can enhance efficiency, personalize learning, and provide valuable insights, qualities such as empathy, curiosity, creativity, and ethical decision-making remain central to fostering meaningful learning experiences. These human traits inspire critical thinking, support emotional well-being, and cultivate a sense of community that technology alone cannot replicate. This paper also addresses the social and ethical implications of integrating AI tools into classrooms, including concerns about privacy, fairness, bias, and the digital divide. It highlights the responsibility of educators and institutions to ensure that AI is implemented in ways that are transparent, equitable, and inclusive, so that all learners can benefit regardless of their backgrounds. Ultimately, the keynote advocates for a thoughtful approach to AI adoption, one that respects and uplifts human values while harnessing technological innovation to enrich education for everyone.

---

## INTRODUCTION

Artificial Intelligence (AI) is a subfield of computer science focused on understanding human cognitive processes and replicating their outcomes through information systems. Its primary objective is to develop intelligent systems such as computer programs and machines that can exhibit behaviors typically associated with human intelligence. These behaviors include learning, reasoning, problem-solving, perception, and creativity (Rainer et al., 2016). Common AI technologies include expert systems, neural networks (including machine

learning and deep learning), fuzzy logic, genetic algorithms, and intelligent agents.

AI is increasingly transforming various aspects of modern life, particularly in the field of education. Education is especially well-suited to AI integration, as teaching and learning are inherently knowledge-intensive and cognitive in nature. AI applications, designed to enhance cognition and problem-solving through algorithmic processes and knowledge bases, can significantly support and augment the capabilities of both educators and learners (Bilquise & Shaalan, 2022). In

educational contexts, AI enables innovations such as personalized learning experiences, automated assessments, and streamlined administrative processes. For instance, AI-powered tools like Khanmigo provide personalized learning support and real-time feedback across a range of subjects, while platforms like Duolingo use AI to adapt language instruction to individual learning styles and progress (Bicknell et al., 2023).

Another notable example is ChatGPT, a generative Natural Language Processing (NLP) model capable of producing human-like responses to open-ended prompts. In higher education, ChatGPT can assist with academic content generation, answering student inquiries, and offering explanations or feedback on assignments. Chatbots powered by AI are also increasingly used in administrative and support roles. They can manage tasks such as scheduling, responding to queries about university policies, and guiding students through academic or career planning. These systems also enhance communication between students and educators by offering a platform for timely feedback and support (Pereira & Diaz, 2020).

However, the profound benefits of AI must be carefully balanced with inherently human qualities such as empathy, critical thinking, creativity, and ethical judgment. While AI excels in data processing and automation, it lacks emotional intelligence and moral reasoning, which are vital in education and decision-making (Holmes et al., 2019; Luckin, 2017). A human-centered approach is necessary to ensure that AI supports and not replaces the uniquely human elements of teaching and learning (Zawacki-Richter et al., 2019).

This paper explores how AI can be thoughtfully integrated into higher education to enhance efficiency and access without compromising the human foundations of teaching and learning, emphasizing a responsible, values-oriented approach to innovation in the classroom and beyond.

## **BACKGROUND**

### ***Teaching the Machine – AI as education tool***

AI is revolutionizing education by transforming how instruction is delivered and received through deeply personalized learning experiences, dynamic adaptability, and streamlined assessment systems. Examples are many including personalized teaching and learning tools. For instance, AI-powered tools can provide individualized learning pathways tailored to each student's strengths, weaknesses, learning pace, and preferences. A simple example is AI Buddy – a platform that curates a personalized study path, offering multimedia content and instant, actionable feedback via a comprehensive dashboard (Figure 1). Another example is Squirrel AI – an AI platform that uses adaptive learning system that assesses a student's strengths and weaknesses, then tailors the learning materials and tasks to their specific need.

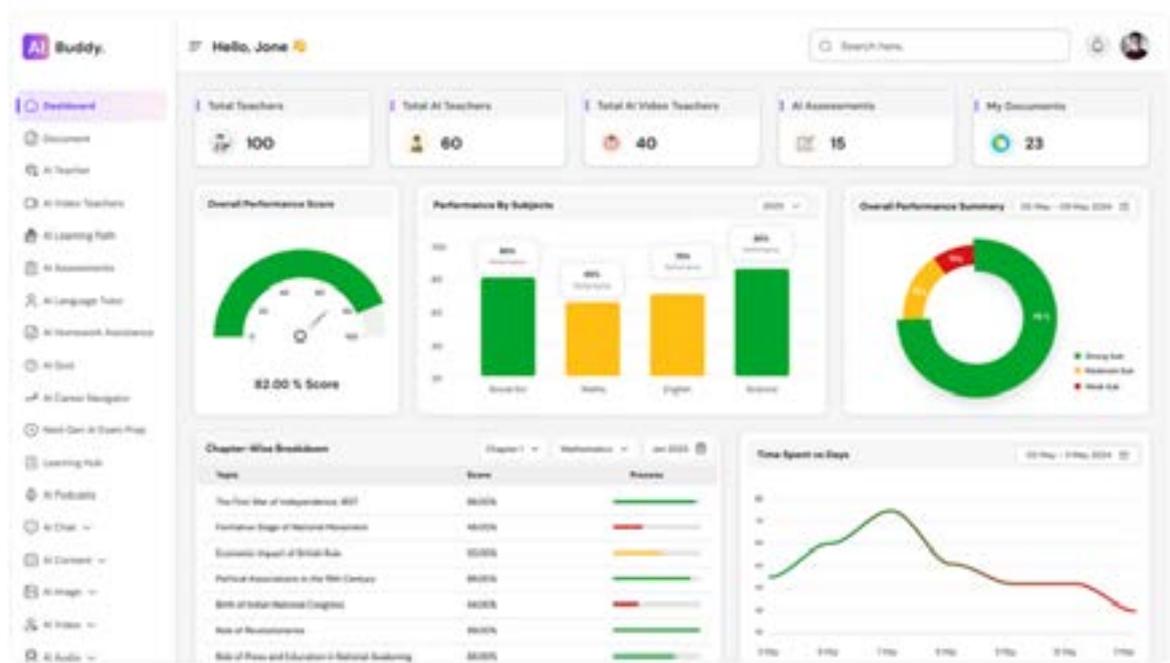


Figure 1. AI Buddy dashboard (<https://aibuddyapps.com/>)

Another possibility is the rise of Intelligent Tutoring Systems (ITS) - a computer system that imitates human tutors and aims to provide immediate and customized instruction or feedback to learners, often without human intervention (Arnau-González et al., 2023). ITSs are revolutionizing education by providing personalized learning for diverse students. These systems utilize artificial intelligence to analyze a student's current knowledge, learning pace and preferred learning style. ITS typically comprises four key components: domain or expert model containing the knowledge and skills to be taught, serving as the foundation for the system's instructional content; student model that tracks the learner's progress, identifying strengths and areas for improvement; tutoring or pedagogic model that determines the most effective teaching strategies based on data from the domain and student models and the user interface model that facilitates interaction between the student and the system (Mosa et al., 2018). Previous studies have shown students utilizing ITSs to perform better academically than those who did not (Karaci et al., 2018).

Automation of assessment and feedback can be accomplished using AI as well, and this can dramatically reduce teacher workload while enhancing feedback quality. Real-time assessment engines can adapt question difficulty, reinforce challenging topics, and offer multimedia hints or explanations, thus creating a continuous feedback loop for the learner. These AI-driven tools promise to revolutionize the way educators evaluate student performance and provide feedback, enhancing the learning experience and outcomes. One example is Gradescope – a tool that provides grades coding, math, and math-adjacent assignments with high accuracy and efficiency. A common tool that also focuses on interactive and engaging teaching and learning is Kahoot! that uses AI to create interactive quizzes and simulations that respond to student input, keeping learners motivated and involved.

### ***Transforming the Human***

AI in education is more than a technological upgrade, as it transforms learning by personalizing instruction and supporting diverse student needs. It is changing how students learn, think,

and interact, opening opportunities for deeper creativity, critical thinking, and collaboration, while also empowering teachers with intelligent tools to enhance instruction, streamline tasks, and focus more on meaningful student engagement. An example of a success story is Squirrel Ai's adaptive learning system. By combining teacher-designed curricula with advanced AI algorithms, Squirrel Ai has improved student question accuracy rates from 78% to 93%, serving over 24 million students and analyzing 10 billion data points on learning behavior. This integration of AI and human instruction allows for real-time, data-driven feedback while teachers focus on delivering engaging lessons and providing essential mentorship, highlighting how AI enhances both student outcomes and the role of educators.

AI is significantly transforming education by automating time-consuming administrative tasks like marking and feedback, which are often challenging for educators. This advancement improves fairness, accuracy, and efficiency in assessments, allowing teachers to dedicate more time to teaching and lesson planning. At the same time, students benefit from real-time feedback that accelerates learning. By reducing human bias and subjectivity in grading, AI helps create a more equitable education system where students are evaluated based on their true abilities and knowledge.

While AI excels at pattern recognition, data processing, and scaling instruction, it remains fundamentally limited in areas where humanity's depth matters most, particularly creativity, empathy, and critical thinking. These uniquely human traits not only define meaningful education but actively complement AI's functional strengths. AI should be observed as a supportive tool, and not a replacement. For instance, a study compared six Generative Artificial Intelligence (GAI) chatbots (Alpa.ai, Copy.ai, ChatGPT (versions 3 and 4), Studio.ai, and YouChat) and found 9.4 percent of humans were more creative than the most

creative GAI, GPT-4. (Haase & Hanel, 2023). In educational spaces, empathy is indispensable. Empathetic teacher-student relationships create safe, trusting environments where learning thrives. A meta-analysis of empathy in teaching found that compassionate and emotionally aware educators can reduce disciplinary issues by as much as 50%, improving overall academic outcomes and classroom climate (Aldrup et al., 2024). Technology can aid by flagging engagement trends, but only humans can interpret and respond with genuine care.

However, the rapid and pervasive proliferation of AI tools also raises critical concerns regarding cognitive offloading, whereby individuals outsource cognitive tasks to machines at the expense of original thinking. A simplest example would be the use of ChatGPT for tasks like writing or problem-solving, which can reduce the need for deep thinking, creativity, and independent learning. To address these concerns, a more effective use of AI in education is to treat it as a starting point rather than a source of final answers. Students can be encouraged to examine AI-generated responses, question their accuracy, and develop their own ideas in response. This approach promotes critical thinking, deeper engagement, and a sense of ownership over learning. By using AI as a tool for prompting reflection and analysis, rather than simply delivering information, students are more likely to develop independent thinking and stronger problem-solving skills.

### ***Ethical and Social Implications***

Finally, the integration of AI within education undeniably offers advancement and efficiency, yet it concurrently raises significant ethical and social concerns that must be addressed to uphold values of privacy, fairness, academic integrity, and digital equity. For instance, data privacy is important when using AI in education. AI-driven systems in education rely on extensive personal data ranging from academic performance and behavioral patterns to demographic and emotional indicators,

hence raising critical concerns about misuse, long-term storage, or unauthorized sharing. Therefore, compliance with data protection regulations, such as the General Data Protection Regulation (GDPR) in the EU or the California Consumer Privacy Act (CCPA) in the US is important. Compliance with these regulations involves implementing stringent data protection measures to secure learner information. This includes encryption, anonymization, and secure storage of data to prevent unauthorized access and breaches. Apart from compliance, transparency is very important for protecting learners' data privacy. Educational institutions should clearly explain how they collect, store, and use student information. Learners need to know what data is collected, why it is used, and how long it will be kept. Providing clear and easy-to-understand privacy policies helps build trust and ensures students understand their rights and how their data is protected (Smith et al., 2022; Johnson & Lee, 2023).

The deployment of AI in education raises critical issues of fairness and bias. Because AI learns from existing data, it can unknowingly repeat and even worsen the biases already present, which can unfairly affect students from marginalized backgrounds. For example, AI systems that grade essays might be influenced by the preferences and biases of the people who created the training data. This means students with different writing styles or cultural experiences might be judged unfairly (Zhang et al., 2024). Academic integrity concerns are an increasingly significant issue for university leadership and faculty due to the widespread impact of AI tools. These technologies make it easier for students to complete assignments, write essays, or solve problems with little original effort, raising questions about the authenticity of their work. This widespread use of AI can blur the lines between honest collaboration and cheating, making it harder for educators to ensure that students are genuinely demonstrating their own knowledge and skills.

## **HYBRID INTELLIGENCE AND FUTURE**

### **DIRECTIONS**

As AI evolves, educators and researchers are exploring hybrid intelligence systems and the emerging prospects and challenges of Artificial General Intelligence (AGI) or strong AI in the educational realm. Hybrid intelligence (HI) combines human intelligence with machine intelligence, with the goal of augmenting human capabilities as opposed to replacing them, while simultaneously harvesting the potential of smart machines (Akata et al., 2020). In other words, the AI supports tasks that benefit from scale and pattern recognition, while human instructors preserve oversight, interpretability, motivation, and emotional guidance.

### **CONCLUSION**

Artificial Intelligence is at a pivotal moment in education, offering powerful tools for efficiency, personalization, and insight while also challenging the fundamental human values that make learning meaningful. This paper argues that as we teach AI systems to better understand learners, we must also ensure that AI supports and uplifts students by preserving empathy, creativity, integrity, and critical thinking. To achieve this, clear policies and research are needed, including standards for evaluating AI in education, professional development to improve AI literacy, investments in infrastructure to promote equity, and collaborations across disciplines to make sure AI strengthens rather than diminishes human dignity and learning. Ultimately, AI does not have to replace the human element in education. By adopting thoughtful and inclusive approaches centered on people, we can use AI's potential while staying true to the values that make education truly transformative.

## REFERENCES

- Aldrup, K., Carstensen, B. & Klusmann, U. Is Empathy the Key to Effective Teaching? A Systematic Review of Its Association with Teacher-Student Interactions and Student Outcomes. *Educ Psychol Rev* 34, 1177–1216 (2024). <https://doi.org/10.1007/s10648-021-09649-y>
- Arnau-González, Pablo; Arevalillo-Herráez, Miguel; Luise, Romina Albornoz-De; Arnau, David (2023-06-01). “A methodological approach to enable natural language interaction in an Intelligent Tutoring System”. *Computer Speech & Language*. 81:101516. doi:10.1016/j.csl.2023.101516. ISSN 0885-2308.
- Bilquise, G. and K. Shaalan (2022) AI-based academic advising framework: A knowledge management perspective, *International Journal of Advanced Computer Science and Applications: IJACSA*, 13, <https://doi.org/10.14569/ijacsa.2022.0130823>
- Bicknell, J. (2023). The impact of audit committee oversight on investor rationality, price expectations, human capital, and research and development expense. *Journal of Risk and Financial Management*, 16(6), 321. <https://doi.org/10.3390/jrfm16060321>
- Haase, Paul H. P. Hanel (2023) Artificial muses: Generative Artificial Intelligence Chatbots Have Risen to Human-Level Creativity, arXiv:2303.12003
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Boston: Center for Curriculum Redesign.
- Johnson, L., & Lee, R. (2023). Protecting learner data: The role of transparency in digital education environments. *International Journal of Educational Data Privacy*, 8(1), 12-27. <https://doi.org/10.5678/ijedp.2023.0012>
- Karaci, A., Akyüz, H. I., Bilgici, G., & Arici, N. (2018). Effects of Web-Based Intelligent Tutoring Systems on Academic Achievement and Retention. *International Journal of Computer Applications*, Vol. 181, No. 16, pp. 35-41.
- Luckin, R. (2017). Towards artificial intelligence-based assessment systems. *Nature Human Behaviour*, 1(3), 1–3. <https://doi.org/10.1038/s41562-017-0055>
- Mosa, M. J., Albatish, I., & Abu-Naser, S. S. Asp. net-tutor: Intelligent tutoring system for leaning asp. net. *International Journal of Academic Pedagogical Research*, Vol. 2, No.2, 2018.
- Pereira, J. and Ó. Diaz (2022) Struggling to keep tabs on capstone projects: a chatbot to tackle student procrastination, *ACM Transactions on Computing Education*, vol. 22, pp. 1–22, <https://doi.org/10.1145/3469127>
- Rainer, R. K., Prince, B., & Watson, H. J. (2016). *Management information systems: Moving business forward* (4th ed.). Wiley.
- Smith, A., Brown, J., & Garcia, M. (2022). Transparency and trust in educational data privacy: Building clear policies for student information. *Journal of Educational Technology & Society*, 25(3), 45-58. <https://doi.org/10.1234/edtech.2022.0034>
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 1–27. <https://doi.org/10.1186/s41239-019-0171-0>
- Zhang, J., Zhu, L., Zhu, X., Cheng, Y., Zhu, Y., Zhu, X. (2024) Grading by ai makes me feel fairer? how different evaluators affect college students' perception of fairness. *Frontiers in Psychology* 15, 1221177 Bai, X., He, Y., & Kohlbacher, F. (2018). Older people's adoption of e-learning services: