

ARTIFICIAL INTELLIGENCE IN EDUCATION: A REVIEW OF APPLICATIONS, BENEFITS, CHALLENGES, AND EQUITABLE INTEGRATION

Abstract

The adoption of artificial Intelligence (AI) in teaching, learning, assessment and educational administration is on the rise. This paper provides for a systematic literature review on the field of AI in Education to identify uses, promises and limitations to its implementation in education and conditions for equitable integration. The literature reviewed are from the years 2022 to 2025 and focus on recent systematic reviews and empirical studies in the area of Artificial Intelligence in Education (AIED), and important review studies that address the overall development of the AIED domain. The results indicate that AI can support aspects like personalized/adaptive learning, intelligent assessment, profiling/feedback and administration. While the literature has shown that there are several critical points about data privacy, algorithmic bias, academic honesty, digital dependence, teacher preparedness, infrastructure and inequitable access. Evidence is not always strong and varies at different levels of education, primary and secondary, across different subject areas, in various settings and with varying technology designs and implementation. The paper thus calls attention to the need for a humane and context-specific approach in which AI is associated with assistantship to teachers, the need for proper governance and teacher capacity building, as well as the focus on digital and socioeconomic inequalities, particularly in developing countries contexts.



Prof. Bhawani Shankar Sharma

Principal
University Commerce College
University of Rajasthan
Jaipur
bssharma303@gmail.com



Dr. Richa Singhal

Associate Professor
Department of Commerce
S.S. Jain Subodh P.G. College
Jaipur
singhal.richa78@gmail.com

Introduction

Artificial Intelligence (AI) is now more evident in today's educational landscape

and is impacting teaching, learning, evaluation, student support and educational management. There has been a significant increase in research

on Artificial Intelligence in Education (AIED) literature, especially following the development of generative Artificial Intelligence (AI) systems that are readily available. In a bibliometric analysis of 2,223 research articles, subsequent content analysis of 125 papers, Wang et al. (2024) categorize key application areas as adaptive learning and personalized tutoring, intelligent assessment and management, profiling and prediction, and emerging AI-powered educational products. With the advent of generative AI, the applications have expanded to encompass content creation, conversational support, feedback, and aid with learning activities. Garzón et al. (2025), in a systematic review of the peer-reviewed empirical literature, also find significant research trends in AI-in-education since 2022 and common themes of learning outcomes, personalization, motivation, and ethical and implementation issues. But the

proliferation of AI shouldn't be seen as a direct path to educational improvement. The evidence is influenced by variations in level of education, discipline, country, infrastructure, teacher readiness, pedagogical design, and the AI system being evaluated. For instance, a 2023 Best Colleges survey of 1,000 undergraduate and graduate students across the United States found that 43% of them had used ChatGPT or another AI tool; this represents one survey population and does not imply that all college students or educational systems are represented. In this context, the present paper summarizes the key areas of application and reported benefits of AI, analyzes contradictory and implementation related evidence and proposes a conceptual pathway towards equitable and sustainable integration, including a focus on the developing country's context.

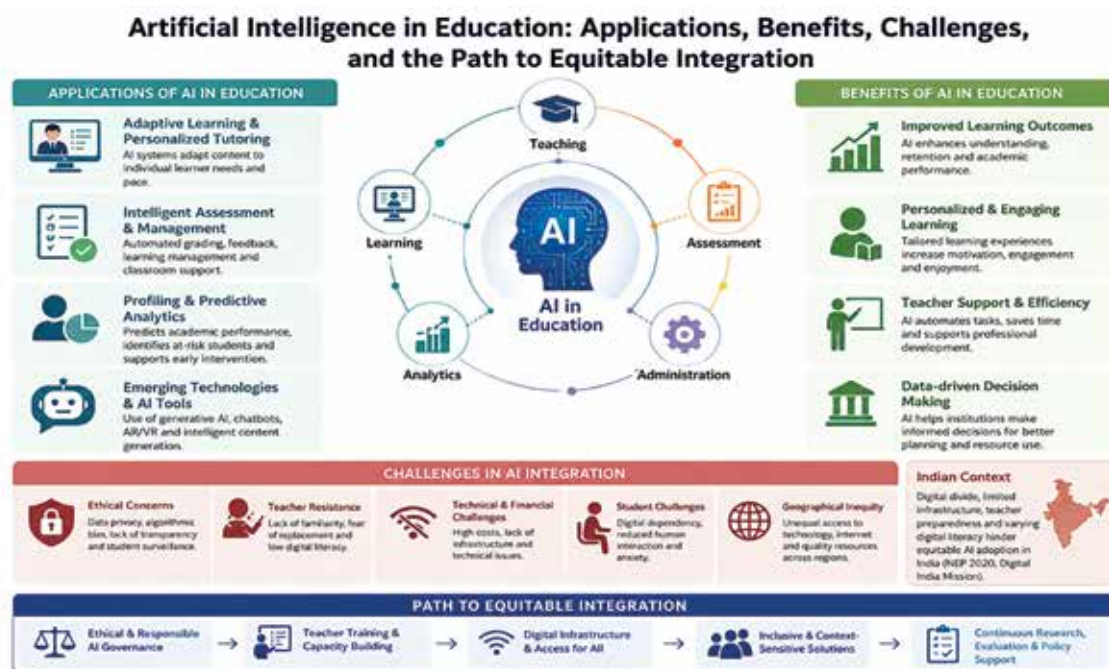


Figure 1: Artificial Intelligence in Education

Source: Author's conceptual synthesis based on Wang et al. (2024), Garzón et al. (2025), UNESCO (2023), Government of India (2020), and the reviewed literature.

Research Methodology

This paper is a structured narrative review, and does not purport to be fully systematic. The literature will mostly be limited to publications dealing with AI interventions in educational systems after 2022 and until 2025, including systematic reviews, empirical research, policy reports, and selected conceptual papers relevant to the AI use, educational outcomes, implementation issues, and equity. The keywords were:

“Artificial Intelligence in Education,” “Generative AI,” “AIED,” “Personalized Learning,” “Intelligent Tutoring Systems,” “Educational Technology” and “AI Applications in Education.” To provide transparency, information used for journal submission should include the number of records retrieved, the number of duplicate records removed, the number of records screened, the number of records assessed for full text, the reasons for exclusion, the final number of the studies that were included, but it also should include the number of databases used, the dates on which journals were searched, complete search strings, and where applicable.

AI Application In Education

Wang et al. (2024) performed a bibliometric analysis of 2223 research articles and a content analysis on the selected 125 articles. They classify AIED applications into four categories: Adaptive learning and personalized tutoring, intelligent assessment and management, profiling and prediction, and emerging products. With the help of adaptive learning and intelligent tutoring systems, learners can receive personalized feedback and learning materials according to their learning progress. Automated grading, automated writing evaluation, learning management support and classroom-management functions are examples of intelligent assessment and management applications. Education data is applied in profiling and prediction applications to find trends in academic achievement or possible dropout trends to target intervention. Recent uses include augmenting education with chatbots and other immersive technologies like augmented and virtual reality (Wang et al., 2024). These categories should not be read as mutually exclusive, nor equally effective. They gain their educational value on the basis of system design, data quality, pedagogical integration, teacher supervision, and learner and institutional characteristics.

Garzón et al. (2025) conducted a systematic review of 155 peer-reviewed empirical studies that were published from 2015 to 2025. The most frequently investigated type of AI was generative AI (30.3%), followed by conversational/natural language processing agents (19.4%) and machine learning models (14.2%). Language education (LE), information and communication technologies (ICT) and science education (SE) were some of the most

represented fields of study, with higher education (HE) being the most often studied educational level. Overall, the evidence suggests that there is a high level of research interest in the field of generative and conversational AI, with a focus on specific areas and educational contexts. This concentration imposes restrictions on the generalizability of the results to areas of research that have not been studied, areas of research, age group, and financial constraints of institutions.

The Benefits of Using AI In Education

The reviewed literature outlines a number of potential benefits of AI, and to the extent that benefits exist, their size and consistency are different across studies and contexts. Garzón et al. (2025) reported that learning gains occurred in 65.8% of empirical studies reviewed and personalized learning occurred in 26.5% of the articles reviewed. The numbers indicate the percentage of the studies reviewed that find a certain benefit; they do not imply a fixed percentage improvement in learning due to AI nor effect sizes. The previous manuscript reported a 62% increase in average test scores with adaptive learning, a 30% increase with AI overall and a 20% decrease in anxiety. We need to clarify that while this is a secondary statement from Wang et al. (2024), the figures are not from a meta-analytic estimate from Wang et al. themselves, but from a statement within the paper. Due to the lack of underlying evidence and context of effect sizes in the current manuscript, claims have been omitted instead of being shown as percentages to be generalized. A more reasonable conclusion is that there have been some positive learning outcomes with both adaptive and personalized AI systems in some contexts, and the level of evidence is dependent on study design, intervention, content, student population, and implementation.

At the personal level, Garzón et al. (2025) find motivation, autonomy, enjoyment, positive attitudes and engagement as the most frequent variables reported in the studies reviewed. The benefits for teachers include optimizing tasks, support in professional development and saving time with the automation of specific administrative tasks. But it is important to view these findings as trends in the literature reviewed and not as effects that can be found in all cases. The personalization

and suggestions from AI may prevent or reduce the involvement of a human or may be useful for engagement; however, the reliance on the AI or the lack of quality of human interaction may also have the opposite effect.

So the evidence suggests it's conditional rather than a point of view about AI inspired improvements in education. AI should be viewed as a pedagogical augment and not as a tool to replace teachers. Teacher judgement, feedback, dialogue, collaboration and understanding their context is important, particularly for complex learning and social and emotional development. There is also literature that shows that technology comes out in various results in accordance with their different applications. Hence, these are the factors to consider when institutions review AI to make an informed decision.

Limitations and Challenges

Ethical and governance issues are reported in literature as one of the key challenges in the adoption of responsible AI. Garzón et al. (2025) analyzed a variety of studies and reported that 14.8% of these studies raised an issue of ethics, including topics like data privacy, algorithmic bias, transparency and student surveillance. 12.3% of studies reported teacher resistance and other common issues were technical challenges, low digital literacy and implementation costs. These findings point to the fact that adoption does not necessarily fall in the category of technology-acquisition issues. Guidance within the institution must be provided around data governance, academic integrity, transparency and accountability and human oversight. Algorithmic systems may exhibit similar biases as the data on which they are trained and even as to their very design; automated decisions may be difficult for student and teacher to understand and contest. These risks are particularly relevant with respect to the use of AI for the purposes of evaluation, profiling, prediction or decision-making affecting educational opportunities.

The student-centred risks are that there is dependence on technology, reduced opportunities for self-led problem solving, anxiety with technology, lower levels of learning that occur from the technology being badly designed or used and less overall human interaction. Besides these technical challenges, elsewhere, Mukhamediev et al. (2022)

cite the following problems: non-interpretable or “black-box” decisions, lack of data, and lack of stability in the real world. Hence, it is not about good or bad AI but how, who, what, and how protected it is in education. Human supervision and transparency of institutional rules will be necessary to reduce the risk of the convenience of replacing the learning processes which students need to develop themselves.

Another key constraint of the evidence base is geographic concentration. Garzón et al. (2025) identified 155 studies, of which 44 were within mainland China (with Taiwan, USA, and Turkey also well represented). The comparatively small amount of evidence emanating from Latin America, Africa, and South Asia makes it difficult to extrapolate results in other linguistic, cultural, infrastructural, and socioeconomic contexts. This is especially true when it comes to assertions of equitable incorporation. A technology that is developed and evaluated in a high-income or highly digitized context may not yield similar results in contexts with limited internet, access to devices, teacher training, local language resources, and/or institutional capacity.

Equity needs to be seen as a precondition of implementation in the context of developing countries, such as India. While the National Education Policy (Government of India, 2020) is supportive of technology mediated learning, disparities in digital infrastructure, connectivity, teacher readiness, digital literacy and institutional readiness can affect access and use of AI. Linguistic differences, rural/urban disparities, cost, local institutional practices, and teacher readiness for assessing AI generated work need to be taken into account in the Indian context. Therefore, fair integration of AI in education requires a holistic approach that encompasses access to AI technologies, teacher training, governance transparency, inclusive design, and support for marginalized students.

Four interrelated needs illustrate the Indian situation: having a strong digital infrastructure, relevant teacher training, data and AI that are held accountable and needs-based supports for learners and institutions in socio-economically and geographically challenged settings. These requirements correspond with those raised in the international literature on the issue of equity in education at large, and with UNESCO's recommendations for human-centric,

safe, equitable and context-sensitive applications of generative AI in education. The analysis thus assumes the same infrastructure and training issues the same pathway since it does not have to be repeated along the equitable-integration pathway.

One of the most recurring themes in the literature is the great potential AI has in terms of efficiency, feedback and personalisation; evidence is of variable quality with a bias towards specific countries and contexts. This tension is provided as the relationship between the promise of technology and its transferability between context. This means the review distinguishes reported benefits and actual causal effects and it considers equity, teacher capacity, and governance and infrastructure as moderating rather than secondary conditions.

Conclusion

The findings presented in this paper suggest that AI can play a role in personalized learning, feedback, learning outcomes, motivation, assessment, and chosen administration. But across the board claims of the benefits of AI in education are not substantiated by the literature. The impact depends on the nature of the AI, the design of the education, the level of education, the subject area, the characteristics of the learner, the preparedness of the teacher and the institutional context. A conditional pathway for synthesis based on the review is therefore created, where learning value is more likely to be realised when AI capability is coupled with pedagogical purpose, with teacher oversight, teacher capacity, responsible governance and equitable access. On the other hand, differences in infrastructure and basic digital skills, as well as opaque algorithms, faulty implementation, and excessive reliance, could exacerbate or create new gaps in education. Figure 1 outlines this pathway by connecting applications of AI, in particular to potential benefits, risks that may thwart such gains, and enabling conditions in governance, teachers, accessibility, and contextual adaptations. The framework is not designed to be an empirically tested causal model, but rather the author's synthesis of the literature reviewed.

Future Research Directions

Future studies will need to transcend brief demonstrations of AI performance and evaluate continuous educational outcomes, using longitudinal

and comparative studies. Key areas of focus are critical thinking, creativity, academic integrity, student well-being, teacher workload, learning equity, and distributional impacts of AI between rural and urban schools. There should also be greater representation from South Asia, Africa, Latin America, and other under-researched contexts, and an analysis of the role of language, culture, socioeconomic status, disability, and infrastructure on AI outcomes. Comparative research at cross-disciplinary and cross-level levels can help to understand when AI can make a genuine contribution to pedagogy and when more traditional or human-centered methods are still better. Lastly, interdisciplinary efforts by teachers, computer scientists, psychologists, policy researchers and institutional leaders can assist in the development of evidence-based governance frameworks that can balance innovation with transparency, accountability, privacy, academic integrity and equity in education.

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