Harnessing AI to Transform Education: A Literature Review of Recent Publications

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Abstract

The literature agrees that artificial intelligence (AI) has been a disruptive force in society. It also suggests that AI, and particularly generative AI (GenAI), is reshaping the educational landscape by introducing innovative solutions to enhance learning experiences. This rapid review examines AI's transformative role in education, emphasising its influence on learning outcomes, teaching practices, and the broader educational ecosystem. AI adoption in education has ushered in personalised learning tailored to individual student needs. AI-driven adaptive learning systems analyse performance data to create customised learning paths, delivering content at an appropriate pace and level of understanding. This individualised approach boosts both engagement and academic achievement. Moreover, AI, and particularly GenAI, has the capacity to revolutionise teaching methodologies by equipping educators with tools to streamline administrative tasks and refine instructional strategies. AI-powered tools can automate grading, design constructivist and constructionist interactive lessons, and offer real-time feedback, enabling teachers to focus on fostering critical thinking and deeper learning in students. The assessment process is also undergoing significant changes, moving beyond traditional exams to dynamic, AI-enabled evaluations. These tools analyse student responses instantly, providing immediate feedback and insights into learning progress and comprehension. In addition to enhancing learning and teaching, AI optimises administrative processes, such as enrolment, scheduling, and resource management. By automating these functions, AI enables more efficient institutional management. However, challenges remain, including issues surrounding data privacy, algorithmic bias, and the need for teacher training to effectively integrate AI tools. Addressing these concerns is vital to harnessing AI's full potential and ensuring equitable access to quality education. In conclusion, AI is revolutionising education by enhancing learning experiences, transforming pedagogical practices, and streamlining administration. As AI technology, and particularly generative AI, advances, its impact on education will continue to expand, offering new opportunities to improve learning outcomes and prepare students for success in an increasingly digital world.

Keywords: *Artificial Intelligence (AI), Generative AI (GenAI), education transformation, learner-centred pedagogies, transformative pedagogical practices, constructivism and constructionism, benefits and challenges of AI in education.*

Introduction

Scholars in education agree that Artificial Intelligence in Education (henceforth, AIED), and more notably, Generative AI (henceforth, GenAI), is having a profound impact on the teaching and learning process (see, for example, [1], [2] and [3]). They also agree that the impact of this technology will increase, however, even though AIEd will never replace academics or teachers [4], [5], [6], it will enhance their work if used well. Educators and researchers in the education field must be well trained within this rapidly growing field aware [7], [8], [9] and, consequently, be prepared for immediate and future changes in educational institutions [10], [11] and pedagogies [12], [13], [14]. Scholars emphasise that AI has the potential to enhance educational practices, assist educators, and offer more tailored learning experiences for students . Indeed, major tech companies and institutions like Amazon, Google, Facebook, and Microsoft have spent millions on AIEd research and development [15]. The literature also notes that AIEd has existed for over three decades, but the majority of educators, at all educational levels, including elementary and secondary schooling [16], [17], [18],

adult education [19], and Higher Education (HE) institutions, are still uncertain about how, currently, to effectively scale the pedagogical advantages of AIEd and its potential to enhance the teaching and learning experience [20], [21], [22].

This **rapid, non-exhaustive but** systematic literature review seeks to contribute to the ongoing discourse on the implementation of effective and secure AIED by examining it through the lenses of **constructivism** and **constructionism**. These theoretical frameworks offer valuable insights into how learners build knowledge and engage with technology in meaningful ways. By grounding the analysis in these models, the review highlights how AIED can be designed and applied to support active, learner-centred education while addressing ethical, pedagogical, and practical concerns related to its integration in educational settings.

The literature reviewed emphasises the numerous benefits of AI in education, such as the opportunity for students to investigate AI technology, personalised assistance, and improved learning experiences. Furthermore, advantages such as enhanced learning and enhanced information accessibility are identified. Nevertheless, ethical considerations and biases in AI models are also highlighted. GenAI enhances student engagement by offering personalised responses, prompt feedback, and rapid access to information, resulting in enhanced learning outcomes and the growth of critical thinking abilities. Ethical considerations and safeguards, including user education, privacy protection, human supervision, and stated guidelines, are essential for responsible use. The integration of ChatGPT transforms the role of educators from content delivery to assistance and guidance, thereby fostering personalised and differentiated learning. Educators have to consider ethical considerations while monitoring student usage in order to facilitate this transformation. Educational institutions can increase student engagement, learning outcomes, and the responsible use of AI in education by addressing challenges, establishing ethical guidelines, and leveraging the strengths of GenAI. This will prepare students for future challenges.

Why Constructivism and Constructionism?

Constructivism and constructionism are two influential learning theories that inform educational practices, particularly in technology-enhanced environments [23]. Constructivism, rooted in the work of John Dewey [24], Lev Vygotsky [25], Jerome Bruner [26], [27], [28] and Jean Piaget [29], emphasises that learners build knowledge through their own experiences and by connecting new information to what they already know [30]. In this model, the teacher acts as a facilitator who supports inquiry, problem-solving, and critical thinking [31]. Although Dewey [32] did not explicitly employ the term "constructivism," he emphasized that:

"Knowledge is a construction, not a copy. It is an outcome of interaction between the individual and the environment."

Constructionism, developed by Seymour Papert [33], [34] - a student and collaborator of Jean Piaget at MIT - extends these ideas by suggesting that learners understand concepts more deeply when they create tangible, shareable artefacts such as digital projects or models [35]. In his own words, Papert argues that:

"Constructionism—the N word as opposed to the V word—shares constructivism's view of learning as 'building knowledge structures' through progressive internalisation of actions... It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sandcastle on the beach or a theory of the universe. Part of what's important about that idea is that it gives a concrete experience to abstract ideas, and thus makes them more accessible." [36]

It thereby promotes a learning-by-making approach, where meaningful and authentic learning occurs through active creation and reflection in tasks with other students and the teacher. Together, these two theories offer a strong foundation for designing learner-centred, engaging, and effective collaborative educational experiences—particularly relevant in the context of AIEd.

Methodology

This paper draws on peer-reviewed articles, conference proceedings, and systematic reviews, through a non-exhaustive analysis as suggested by Fernandez [37]. The reviewed work was published between January 2020 and March 2025. Two multi-disciplinary databases were used - the University of Malta's *Hydi* (short for Hybrid Discovery) search portal which includes research databases, such as, EBSCO, Web of Science and ProQuest, and, obviously, Google and Google Scholar which indexes published scholarly literature. They were queried using keywords such as "Artificial Intelligence (AI) in education" and "Generative AI in teaching and learning." A total of 164 publications were identified, with 82 selected for in-depth analysis mainly based on relevance (some of these papers appear in the reference list).

This research paper provides a literature review that examines the effects of incorporating GenAI into education. The study examines four primary research questions: the benefits and challenges of ChatGPT, its impact on student engagement and learning outcomes, ethical considerations and safeguards, and the effects on educators and teachers, based on an analysis – through constructivist and constructionist lenses - of scientific research articles published between 2022 and 2025.

Generative AI (GenAI) in Education

GenAI refers to artificial intelligence systems capable of producing diverse forms of novel content—including text, code, data, images, music, voice, and video—typically in response to user-provided instructions, commonly referred to as prompts. The quality of GenAI-generated output is often sufficiently high that it becomes difficult to discern from content produced by humans [38].

The literature reviewed agreed that GenAI has transformative constructivist and constructionist pedagogic strengths by fostering active knowledge construction, creativity, and learner agency [39], [40], [41]. Specifically, GenAI supports active knowledge construction by enabling learners to engage with content in interactive and meaningful ways. It fosters creativity by allowing students to generate original ideas, solutions, and representations using AI tools. Furthermore, GenAI enhances learner agency by giving individuals greater control over their learning processes, encouraging self-directed exploration, decision-making, and personalised learning experiences. Notwithstanding these developments, a paradigm shift in educational thinking and practice - particularly within traditional schooling - is essential for generative AI to be effective. Such a shift should align with constructivist and constructionist models and GenAI, should be leveraged not merely as a tool for efficiency, but as a dynamic partner in inquiry-based learning, supporting creativity, critical thinking, and the development of higher-order cognitive skills. Without such pedagogical alignment, there is a risk that GenAI will reinforce the passive consumption of information - what Paulo Freire [42], [43], [44] would call 'banking' - rather than empower learners to construct and apply knowledge meaningfully, and democratically. Thereby, if integrated within these pedagogical frameworks rather than traditional educational models, including behaviourist ones, GenAI, holds the potential to support 'liberatory' teaching and learning practices wherein teachers and students are engaged in dialogue and, hence, true learning.

Concerns about GPT in Education

However, the literature is replete with concerns regarding academic integrity, plagiarism, misinformation, bias, hallucinations (that is, the generation of false and nonsensical information), inaccuracies and accountability for student learning [45], over-reliance on the use of GenAI by students [46], [47], [48], [49] and procrastination [50]. These limitations warrant careful consideration. Moreover, the technology also entails the risk of abuse. Some risks stem from the tool's technical limitations, while others arise from how it is used—whether deliberately or inadvertently—in ways that undermine learning [51] and, particularly, assessment [52].

Indeed, Noam Chomsky [53] a public intellectual known for his work in modern linguistics, is a critical opposer of the use of AI in educational settings and argued, in an interview:

I don't think it [ChatGPT] has anything to do with education, except undermining it. ChatGPT is basically high-tech plagiarism…and a way of avoiding learning"

As contended by various studies the excessive use of ChatGPT can have harmful effects on students' personal and academic outcomes. Indeed, not all scholars are happy with its evolution and use in educational systems [54]. GenAI, particularly ChatGPT, is highly considered to be a threat to academic integrity, especially in higher education, where end-of-course essay assessments remain prevalent. Indeed, many investigators note that GenAI can be used to circumvent assessment approaches within the HE sector, compromising the quality of the learning process [55], [56], [57]. Indeed, scholars insist on the use of formative rather than summative assessment tasks to reduce this risk.

Discussion

This literature review has explored the transformative, yet complex, role of Artificial Intelligence (AI), particularly Generative AI (GenAI), in reshaping the educational landscape. The corpus of literature, published over 5 years, consistently indicated that AI presents a dual capacity: an immense potential to enhance learning experiences and pedagogical practices, alongside significant challenges that necessitate careful consideration and proactive strategies. The lenses of constructivism and constructionism have proven invaluable in navigating this duality, offering a pedagogical compass for harnessing AI's strengths while mitigating its risks.

A key insight emerging from the reviewed literature is that the effective integration of AI in education is not merely a technological upgrade but demands a fundamental paradigm shift in pedagogical thinking and classroom practice. As highlighted, GenAI tools can foster active knowledge construction, creativity, and learner agency, aligning powerfully with constructivist principles where learners build understanding through experience and interaction, and constructionist ideals where this understanding is solidified through the creation of tangible artefacts [58]. The potential for personalised learning paths, AI-driven adaptive systems delivering content at appropriate paces, and tools that automate administrative tasks, thereby freeing educators to focus on deeper learning and critical thinking, are significant advantages. AI-enabled dynamic assessments also promise a move away from traditional summative evaluations that are prevalent at all education levels, offering real-time feedback that supports the learning process itself – a core tenet of formative, constructivist-aligned assessment.

However, this optimistic view is tempered by legitimate concerns. The risk of GenAI reinforcing passive consumption of information—the "banking" model critiqued by Freire [59] is substantial if these tools are implemented without a robust pedagogical framework. Issues surrounding academic integrity, such as plagiarism facilitated by tools like ChatGPT, are at the forefront of educators' anxieties. Furthermore, given the prevalence of misinformation, algorithmic bias, and the so-called "hallucinations" in AI-generated content underscores the critical need for students to develop advanced critical thinking and digital literacy skills to evaluate and use these tools responsibly. This review confirms that these are not just technical limitations but pedagogical challenges that require new forms of teaching and learning.

The role of the educator is thus undergoing a profound transformation. Although the profession is not at stake, the teacher must move beyond mere content delivery. Educators are increasingly positioned as facilitators of learning, curators of resources, ethical guides, and designers of learning experiences that thoughtfully integrate AI. This necessitates comprehensive teacher training and ongoing professional development, focusing not just on the technical operation of AI tools but on the pedagogical strategies to leverage them effectively and ethically within constructivist and constructionist paradigms.

The ethical considerations - data privacy, algorithmic bias, and equitable access - are paramount. Without addressing these, the promise of AI to democratize education could instead exacerbate existing inequalities. Therefore, the development of clear ethical guidelines, safeguards, and institutional policies, as emphasized in the literature, is not an afterthought but a prerequisite for responsible AI adoption.

This review, while limited through its rapid and non-exhaustive methodology, focused on recent work published from 2020 to 2025, capturing the accelerated developments in GenAI. Future research should continue to track these rapid advancements, particularly longitudinal studies examining the

long-term impacts of AI integration on student learning outcomes, critical thinking development, and the evolving skill sets required for both students and educators in an AI-ubiquitous world.

Conclusion

Artificial Intelligence, and most notably Generative AI, is undeniably revolutionizing education, offering unprecedented opportunities to personalize learning, enhance engagement, transform teaching practices, and streamline administrative processes. This literature review, framed through the pedagogical lenses of constructivism and constructionism, concludes that the true potential of AI in education lies not in the technology itself, but in its thoughtful and ethically-grounded integration into learning environments that prioritize active knowledge construction, learner agency, and critical inquiry. In other words, *it should help not take over* the teacher's professionalism and his or her pedagogic choices and behaviour.

The path forward requires a concerted effort to embrace the constructivist and constructionist strengths of AI – enabling students to become active creators and critical consumers of knowledge, rather than passive recipients. This necessitates a significant paradigm shift, robust teacher training, and the development of curricula that explicitly address AI literacy and ethics. While the challenges related to academic integrity, misinformation, bias, and equitable access are substantial, they are not insurmountable. By proactively addressing these concerns, establishing clear ethical guidelines, and fostering a culture of responsible AI use, educational institutions can navigate the complexities and harness AI's transformative power.

Ultimately, the journey of integrating AI into education is ongoing, progressing at an incremental pace. As AI technology continues to evolve, so too must our pedagogical approaches and ethical frameworks. The goal is not simply to adopt new tools, but to leverage them in ways that genuinely enhance learning outcomes, foster critical thinking, and prepare students for a future where AI is an integral part of their personal and professional lives. By committing to a learner-centered, ethically responsible, and pedagogically sound approach, the educational community can ensure that AI serves as a powerful force for positive transformation.

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