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Research Article

The Impact of Artificial Intelligence on the Education Landscape: A Systematic Literature Review

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Abstract

Artificial intelligence (AI), including generative models like ChatGPT, is rapidly transforming the global educational landscape. To synthesize the current state of this integration, this systematic literature review explores the pedagogical, ethical, and institutional impacts of AI across various educational sectors, including higher education, medical training, and language learning. Adhering to PRISMA guidelines, a systematic search of major academic databases yielded 130 peer-reviewed studies published between 2020 and 2024. Data were extracted and thematically synthesized through the lenses of sociotechnical systems, constructionist learning, and AI literacy. Findings indicate a duality in AI's impact: while AI facilitates highly adaptive, personalized learning and improves administrative efficiency, it simultaneously introduces severe ethical concerns regarding academic integrity, algorithmic bias, and over-reliance on AI-generated content. Furthermore, the review reveals a discrepancy in the literature, where survey-based studies report optimism, but assessment-focused research warns of degraded independent problem-solving skills. For AI to be effectively harnessed, educational institutions must move beyond mere technology adoption. Stakeholders must prioritize holistic assessment redesign, proactive data governance, and comprehensive teacher professional development focused on AI literacy. Future research should prioritize longitudinal studies and equity-centered frameworks to ensure AI serves as a pedagogical scaffold rather than a replacement for critical thought.

Keywords: Artificial Intelligence, AI Learning Tools, Education Ethics, Personalized Learning, Teacher Development.

1. Introduction

Artificial intelligence (AI) has become one of the most prevalent tools and platforms used in education nowadays. From automated teaching and tutoring systems to large language models like ChatGPT, AI tools are increasingly shaping teaching methods, learning experiences, and institutional structures at all levels of education. Though AI integration into education is still relatively new, researchers worldwide have conducted numerous theoretical and empirical studies on AI in education, its short-term benefits and potential long-term effects (Chen et al., 2020).

While there is sufficient literature on AI in education, many questions remain unanswered. Many research studies have been fairly vague about the long-term implications of AI in education or have examined AI integration only at a technical level, without considering other social or cultural factors that could affect its implementation (Al-Momani & Ramayah, 2024). This issue has also recently been found to hold in regional studies: Altakhaineh et al (2026) investigated inclusive education policies aimed at students with special needs in Jordan and the UAE regarding AI implementation. They concluded that while technological infrastructure is key to integration success, other factors, such as teacher training methods, data governance initiatives, and awareness of local educational and cultural environments, also play significant roles. Additionally, many AI tools have been rapidly developed and released over the past couple of years, such as ChatGPT, without many empirical studies to support their effective use in educational settings (Alasadi & Baiz, 2023). There is also no clear consensus among educational experts on how to use these tools effectively or on strategies for teaching students about them (Zhang et al., 2024). This also poses a problem for specific fields of education, such as medical education, where there is no agreed-upon framework on how AI should be used to teach students. Therefore, this systematic literature review was conducted to better understand current trends in AI in education literature.

The study approached this review from three interconnected perspectives on AI in education: sociotechnical systems theory, constructionist learning theory, and AI literacy. By synthesising research through each lens, this review considers AI not only as an engineering endeavour but also as a set of learning opportunities and as a driver of instructional, ethical, and systemic change.

2. Methodology

2.1 Review Protocol

The search methodology followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021). The study used academic search engines and databases relevant to the current research domains, namely AI and education. Databases searched: PubMed, IEEE Xplore, ACM Digital Library, Web of Science, Scopus, SpringerLink, ScienceDirect, arXiv, Google Scholar. ArXiv typically contains repositories of papers that have not been peer-reviewed or published yet but fall under the categories of AI and machine learning. Google Scholar was employed to search for additional records identified through backward and forward citation searching. Grey literature was excluded from the primary review corpus and was only considered if it met the inclusion criteria and contained adequate methodological information. As papers listed on arXiv are not always peer reviewed, they were grouped with and evaluated as preprints. Search terms included "AI", "artificial intelligence", "education", "educational landscape", and "learning environment". The study included empirical studies, conceptual papers, theories, and review or bibliometric articles that directly addressed AI in education and required methodological transparency. Review and bibliometric studies informed trends and gaps in the literature but were not considered primary evidence of intervention effectiveness. The study limited the search to papers published between January 2020 and December 2024. Articles published after December 2024 did not contribute to the systematic review body of articles, nor to the total count of 130 studies in PRISMA. Mentions of publications from 2025 or 2026 are provided for context only. They highlight developments that have arisen since the search period and were not included in the review's thematic synthesis, tables, figures, or study counts.

2.2 Data Extraction and Synthesis

Data extraction was followed by a coding sheet designed to record elements of the study context, including education level, artificial intelligence technology, study design, sample, theoretical framework, research outcomes, limitations, and implications. Synthesis was thematic. Studies were coded according to the review's dimensions. Then they analysed four analytic themes that cut across studies: (1) pedagogical affordances, (2) learner outcomes, (3) ethical and equity risks, and (4) institutional implementation challenges. Instead of presenting syntheses of individual studies, the review focuses on convergences and divergences in findings, methodological limitations, and gaps in extant literature.

2.3 Inclusion and Exclusion Criteria

Articles were included if they: 1) concerned AI in education, 2) were published in English from January 2020 to December 2024, and 3) presented empirical, theoretical/conceptual, review, or bibliometric evidence with sufficient transparency in approach. Peer-reviewed journal articles made up the bulk of the review body. arXiv preprints that were identified through search were included if they directly addressed the review questions, had sufficient methodological transparency, and were clearly labelled as non-reviewed evidence when presented in synthesis. Articles were excluded if they: 1) only peripherally addressed AI or education, 2) were opinion pieces/editorials, 3) did not report methods, or 4) duplicated the results of another article.

2.4 Study Selection Process

The initial search yielded 855 records. After duplicate and clearly irrelevant records were removed, 646 records were screened based on title and abstract. Four hundred thirty-seven records were excluded because they did not pertain directly to AI used in education, fell clearly outside of the scope of this review, or did not appear to provide content relevant to the research questions. The full-text articles for the remaining 209 records were located and retrieved, and each was assessed for eligibility. Each article was assessed against the study's inclusion criteria and the quality/relevance appraisal criteria described above. At full-text eligibility assessment, the study excluded 79 articles because they lacked methodological transparency, used artificial intelligence tangentially to education, provided duplicated evidence from another included article, or presented insufficient findings to inform thematic synthesis. This resulted in 130 including studies, bringing parity between the PRISMA calculations and Figure (1). Figure (1) shows the PRISMA flow diagram.

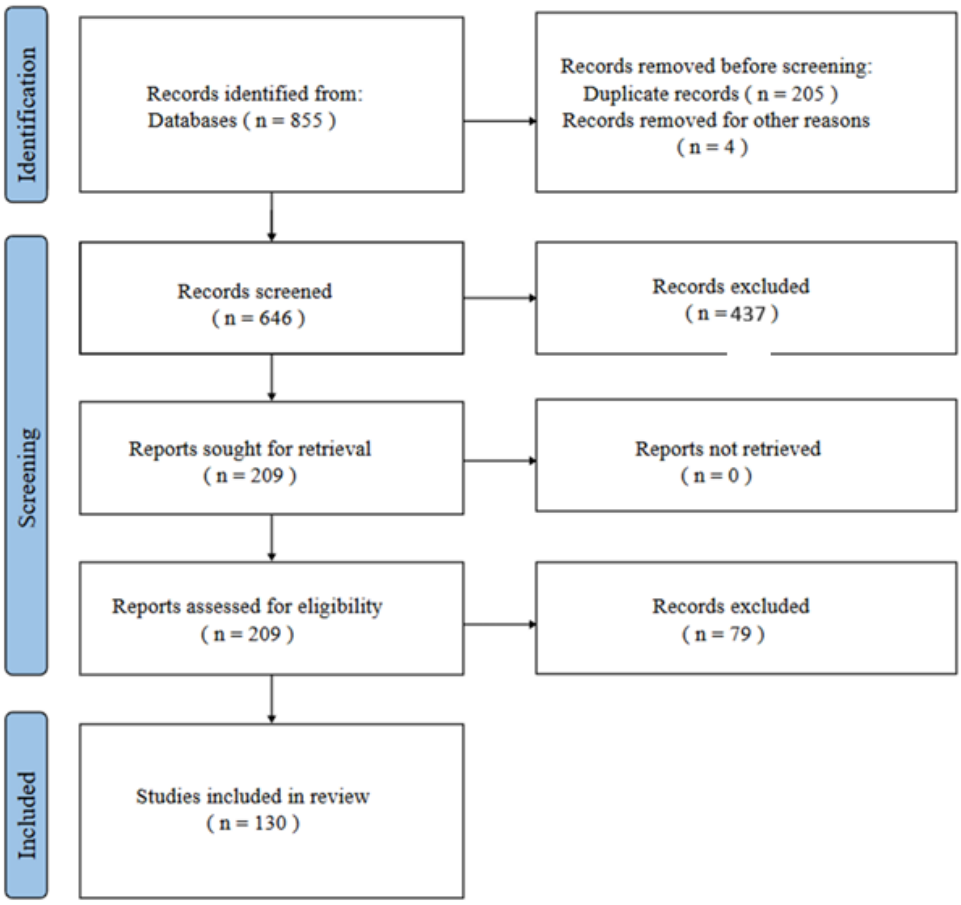

Figure (1): PRISMA flowchart of the study selection process

2.5 Quality and Relevance Appraisal

Full-text screening of successful studies was again assessed for quality and relevance to support transparency of the review process before inclusion in thematic synthesis. Since the studies identified in this review comprised empirical studies, theoretical/conceptual papers, reviews, and bibliometric analyses, studies were appraised using a fit-for-purpose appraisal strategy rather than an experimental risk-of-bias tool. This appraisal process included assessing all studies against five criteria: (1) explicit focus on AI in education, (2) description of educational context and participant group, (3) transparency of research design/methodology or analytical approach, (4) clarity of findings/implications, and (5) addressing one or more of the themes outlined in this review. All studies that did not explicitly discuss AI or ED, that lacked methodological transparency, duplicated included studies, or presented unsupported opinion as opposed to research-informed evidence were excluded from the review. All 130 final studies were therefore selected based on meeting the initial inclusion criteria and providing sufficient information regarding relevance to this review and transparency of methods or approach.

3. Results

Overall, the literature across higher education sectors suggests that usefulness beliefs, clarity of institutional policies and user trust are drivers of AI adoption. In contrast, research does not consistently support the claim that AI use improves learning outcomes beyond convenience.

Literature based on surveys reports more positive perceptions of AI, while experimental and assessment-focused research warns of over-dependency, academic integrity violations, and decreases in independent problem-solving. These patterns are further illustrated in Figure (2), which presents the research trends in the domain of the effect of AI on the educational landscape.

Research Trends

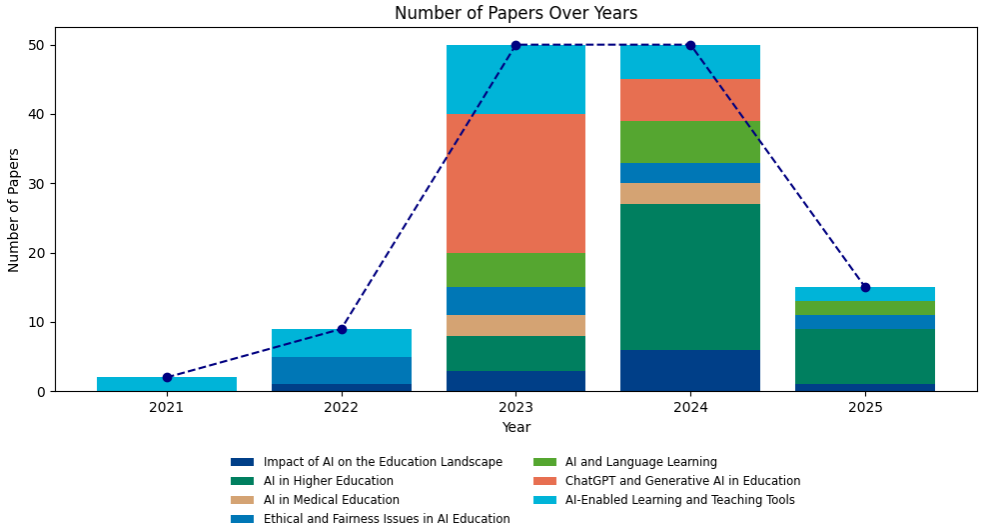

Figure (2): Research trends in the domain of the effect of AI on the education landscape

The Transformative Impact of AI on Education

AI has impacted how instructors teach, how students learn, and how schools operate. As presented in Table (1), the study groups the included papers into three categories that represent three dimensions along which AI has influenced education.

Table (1): Taxonomy of AI's Impact on Education

Dimension	Sub-Dimension	Focus Area	Sources
AI-Driven Transformation	General Impact	Broad transformation of education in an AI environment	(Bushuyev et al., 2024), (Khatun et al., 2024), (Yıldız, 2024)
	Higher Education	Redefining higher education paradigms	(Saaida, 2023)
	Post-Pandemic Adaptation	Revitalizing education post-pandemic	(Othman et al., 2023)
AI in Teaching & Learning	Teaching Resources	AI tools and resources for education	(Druga et al., 2022)
	Pedagogical Shifts	Changes in teaching and learning methods	(Tang, 2024), (Ramirez & Esparrell, 2024)
	Generative AI & ChatGPT	Speculative futures of AI in education	(Bozkurt et al., 2023)
AI & Disruption	Adaptation Strategies	Reshaping IT and educational paradigms	(Ozer et al., 2024)
	Opportunities & Challenges	AI-driven changes in higher education	(Saaida, 2023)

Table (2) presents the classification of the selected articles into four categories based on research themes.

Table (2): Taxonomy of AI Applications in Higher Education

Dimension	Focus Area	Specific Topic	Sources
AI Adoption & Acceptance	Student Perspectives	Technology Acceptance & Usage	(Kanont et al., 2024), (Strzelecki, 2024), (Almulla, 2024), (Baidoo-Anu et al., 2024), (Zhou et al., 2024), (Delcker et al., 2024), (Kelly et al., 2023)
	Faculty Perspectives	Use, Self-Efficacy & Professional Development	(Mah & Groß, 2024), (Mohsin et al., 2024)
	Institutional & Policy Factors	Policy & Integration Challenges	(Walczak & Cellary, 2023), (Dai et al., 2023), (Jafari & Keykha, 2024), (Idris et al., 2024), (Bhullar et al., 2024)
AI Impact on Learning & Assessment	Personalised Learning	Engagement & Performance	(Rahiman & Kodikal, 2024), (Nguyen et al., 2024)
	Generative AI in Learning	Academic Writing & Creativity	(Wood & Moss, 2024), (Urban et al., 2024), (Kolade et al., 2024)
	Holistic Assessment	Shift in Assessment Methods	(Ateeq et al., 2024), (Kolade et al., 2024)
Ethical & Academic Integrity Concerns	Academic Integrity	Challenges & Misconduct	(Fowler, 2023), (Ateeq et al., 2024), (Walczak & Cellary, 2023), (Yusuf et al., 2024),
	Dual Effects of AI	Opportunities vs. Threats	(Rawas, 2024), (Dai et al., 2023), (Yusuf et al., 2024), (Idris et al., 2024)
Future Directions & Frameworks	Conceptual Frameworks	AI-Enabled Education Models	(Rahiman & Kodikal, 2024), (Idris et al., 2024), (Kolade et al., 2024)
	Research Agendas	Future Trends & Needs	(Rawas, 2024), (Jafari & Keykha, 2024), (Bhullar et al., 2024)

Articles selected for the (AI Adoption & Acceptance) dimension present important insights on this topic. On the one hand, findings on students' acceptance and use of AI indicate that perceived usefulness, facilitating conditions, institutional policies regarding AI use, and perceived ease of use are particularly important for generative AI technologies such as ChatGPT (Strzelecki, 2024). Students have reported positivity with AI as a learning companion; however, more research should be done to discover ways students can become over-dependent on AI, cheat, and cause students' problem-solving skills to deteriorate when AI tools are used for purposes that lack sound educational intentions (Walczak & Cellary, 2023; Kolade et al., 2024; Yusuf et al., 2024). On the other hand, barriers to faculty AI adoption and use include self-efficacy and perceived usefulness, as well as a lack of professional development (Mah & Groß, 2024). Institutional policies were also found to influence faculty and students' AI use, as ambiguity around expectations can leave students unsure about what AI-chatbot use is acceptable and what is not in academic settings (Walczak & Cellary, 2023).

Regarding the (AI Impact on Learning & Assessment) dimension, recent literature illustrates AI's ability to provide personalised learning for students. Research on AI-enabled personalised learning indicates that adaptive systems may facilitate student engagement and achievement if they align with learning objectives and are paired with suitable feedback strategies

(Rahiman & Kodikal, 2024; Nguyen et al., 2024). Another study examining how generative AI could impact student creativity found that students who were allowed to collaborate with AI showed significant improvement in problem-solving performance (Urban et al., 2024). While AI shows promise for improving student learning, there are obstacles to assessment design, as conventional assessments are challenged by AI-assisted coursework completion (Kolade et al., 2024). A recent study suggested that moving toward more holistic assessments can help educators focus more on students' learning process rather than the products they produce (Ateeq et al., 2024). Findings from articles categorised in the (Ethical & Academic Integrity Concerns) dimension provided insights into the ongoing issue of AI use in education. Although some literature posits that AI can level the playing field for students with more resources than others, there remains a risk that students will use this technology to engage in academic dishonesty (Fowler, 2023; Yusuf et al., 2024). Further, research indicates persistent confusion about plagiarism and appropriate AI use, as students and teachers may not share a common understanding of where to draw the line between acceptable support and cheating (Fowler, 2023; Walczak & Cellary, 2023; Yusuf et al., 2024).

AI in Medical Education: Applications and Ethical Considerations

The integration of artificial intelligence into medical education was deemed a unique topic given its significant affordances and consequences in this field. Referring to Table (3), the studies included have been grouped into four AI application areas in medical education.

Table (3): Taxonomy of AI Applications in Medical Education

Application Area	Key Focus	Sources
Simulation & Training	AI in healthcare simulation for medical interventions and patient outcomes	(Hamilton, 2024)
Classroom & Assessment	AI applications in pharmacology instruction and student assessment	(Sridharan & Sequeira, 2024)
Ethical & Critical Perspectives	Ethical considerations and critical understanding of AI integration in medical education	(Cooper & Rodman, 2023), (F. Alam et al., 2023)
Generative AI Tools	Impact of ChatGPT and generative AI on medical education	(Boscardin et al., 2024)
Research & Collaboration	AI for monitoring research landscapes and identifying cause-effect relationships	(Narayanan et al., 2023)

The (Simulation & Training) category is extremely relevant clinically because AI technology can provide students with simulations that help them analyses certain medications and treatments, such as radiation. For example, Hamilton (2024) describes how students utilized AI simulations to determine outcomes of certain medical treatments while receiving feedback on what could happen if they were to treat a real patient. Essentially, students can learn to conduct risk-free medical treatments while also improving their abilities to make clinical decisions. In their study of AI's application to pharmacology education, Sridharan and Sequeira (2024) assess coursework through a case-study lens. For example, while Sridharan and Sequeira's study help inform practice within the classroom/assessment strand by illustrating how AI can be used when implementing pharmacology instruction, case-based learning design and assessment, this study will not add much to the broader evidence base if measures of outcomes or comparison of student performance are not evaluated.

The (Ethical & Critical Perspectives) articles focus on concerns raised about medical education and AI. (Cooper & Rodman, 2023) state that medical education AI should be viewed as

a "21st-century Pandora's box." While the study explores the many positive avenues AI can take in medical education, it also notes significant concerns about this technology. In a similar vein, F. Alam et al. (2023) talks about how medical students should both learn to use AI while also understanding how to use it ethically and knowing the limitations of AI.

The studies across the articles review AI less as a supplemental learning tool and more as high-stakes pedagogical technology that must be validated. Simulation-heavy studies focus on practicing without risk to patients and supplementing clinical decision-making. Classroom and assessment-focused studies focus on using AI for case-based learning. Despite this attention to the promises and risks of AI in medical education, the strength of available data is mixed, as some studies discussed were theoretical or descriptive. As such, conclusions regarding improving learners' clinical reasoning skills, diagnostic accuracy, and/or knowledge retention are limited. This suggests that medical educators should emphasize the empirical examination of AI, its ethical use, and the avoidance of misinformation when integrating AI into medical education.

Ethical and Fairness Issues in AI Education

The incorporation of AI into learning environments can raise complex fairness and ethical issues that must be addressed. Table (4) describes how the study group included studies into three themes representing different facets of this topic.

Table (4): Taxonomy of Ethical and Fairness Issues in AI Education

Dimension	Focus Area	Specific Topic	Sources
Ethical Frameworks	Policy & Governance	Global AI ethics policies in education	(Slimi & Carballido, 2023), (Holmes et al., 2022)
		Community-wide ethical frameworks	(Holmes et al., 2022), (Holmes & Porayska-Pomsta, 2023)
	AI Ethics Education	Teaching AI ethics to students	(Usher & Barak, 2024), (Kamali et al., 2024)
		Educators' alignment with AI ethics	(Kamali et al., 2024), (Boulay, 2022)
Bias & Fairness	Algorithmic Bias	Fairness in AI-powered evaluations	(Massala, 2023), (Madaio et al., 2022)
		Structural justice in AI applications	(Madaio et al., 2022)
	Impact on Equity	Gender and experience-based disparities	(Jang et al., 2022)
Emerging Challenges	Generative AI in Education	Ethical implications of chatbots in higher ed	(Williams, 2024)
	Risks & Mitigation	Recognizing ethical risks in AI development	(Silor, 2024)
	Research & Analysis	Bibliometric analysis of AI ethics in education	(L. Yu & Yu, 2023)

Articles in the (Ethical Frameworks) dimension provide evidence that the existing governance of AI is fragmented across different policy documents on education. (Slimi & Carballido, 2023) present an analysis of seven AI ethics policies from different regions around the world. Policies differ in how they address the application of AI in education, while others offer few concrete takeaways for educators. Instead, some policies focus on establishing broad technical standards. (Holmes et al., 2022) offers a conceptual approach to implementing ethical frameworks for AI across all stakeholders in learning communities.

In terms of (Bias & Fairness), (Massala, 2023) provides insights into how assessments produced with the aid of algorithms can be biased against certain groups of students. Factors that may lead to unfair assessments include training data but can also be caused by inaccurate metrics. This study is supported by Madaio et al. (2022), which uses a structural justice approach to examine how fairness can be better implemented in AI-based education. It argues that, instead of attempting to fix bias in individual algorithms, it is essential to examine the roots of systemic issues in educational settings. This ties into findings from Jang et al. (2022), which provide statistical evidence that male and female students exhibit significant differences in their responses to questions about AI ethics. (Williams, 2024) describes a new concern related to plagiarism with the recent advancement of generative AI. In particular, their work focuses on chatbots and their use by students in post-secondary institutions. Confusion over what constitutes plagiarism in these contexts leaves students and faculty members with little guidance. Privacy concerns, surveillance, and the replication of current educational inequalities through technical systems are discussed in studies that focus on risks associated with the design and implementation of artificial intelligence (Holmes et al., 2022; Madaio et al., 2022; Massala, 2023; Silor, 2024). Topics discussed include privacy violations and the potential use of AI to surveil students. Silor (2024) provides readers with a balanced perspective on AI's impact on quality education. While AI has been shown to directly improve the quality of education in certain contexts, there is significant potential for AI to introduce new ethical risks through inadvertent side effects. Lastly, L. Yu & Yu (2023) conducted bibliometric analyses to examine trends in the AI ethics literature. Their results show that while AI ethics has been rapidly growing as a research topic in recent years, papers specifically mentioning 'generative AI' or 'ChatGPT' have increased rapidly in the last year.

AI and Language Learning: Emerging Technologies and Pedagogical Shifts

In Table (5), the study divides these studies into three major categories that span from granular, skill-oriented tasks to wide-ranging learning applications.

Table (5): Taxonomy of AI Applications in Language Learning

Dimension	Focus Area	AI Technology	Key Findings	Sources
Skill Development	Speaking Skills	Conversational AI	Improved fluency and self-regulation through interactive chatbots	(Luckyardi et al., 2024), (Qiao & Zhao, 2023),
	Vocabulary Acquisition	LLM-based Chatbots	Enhanced second language vocabulary retention through contextualized interactions	(Z. Zhang & Huang, 2024)
	Writing Proficiency	Generative AI (ChatGPT)	Balanced assistance improves EFL writing skills but raises concerns about over-reliance	(Faiz et al., 2023), (Sudrajad et al., 2024)
Learner Autonomy	Student Attitudes	Virtual Assistants	Positive correlation between AI tool usability and learner autonomy in ESL contexts	(Tahir & Tahir, 2023)
	Self-Regulation	AI Feedback Systems	Chinese EFL learners demonstrated improved speaking skills and metacognitive awareness	(Qiao & Zhao, 2023)
	Peer Assessment	AI-Integrated Platforms	Enhanced engagement in online IELTS writing courses through multimodal feedback	(Asadi & Taheri, 2024)

Pedagogical Integration	EFL/ESL Contexts	Various AI Tools	Current landscape shows promise but requires addressing implementation challenges	(Alshumaimeri & Alshememry, 2023)
	Material Design	Generative AI	ChatGPT optimizes EFL materials and assessments when properly scaffolded	(Koraishi, 2023)
	Mobile Learning	MALL Systems	AI-powered mobile platforms revolutionize accessibility in language education	(Alisoy & Sadiqzade, 2024)

Articles in the (Skill Development) dimension demonstrate how AI can facilitate language learning at various skill levels. The tools described by Luckyardi et al. (2024) and Qiao and Zhao (2023) offer learners opportunities to practice speaking by interacting with conversational AI to develop fluency, receive feedback, and self-regulate their learning. Their research concludes that students can develop fluency and feel less anxious about communicating in real time with AI-powered speaking partners. On the other hand, articles by Faiz et al. (2023) and Sudrajad et al. (2024) offer differing perspectives on using ChatGPT to support writing development. While one article shows promise for ChatGPT to support EFL writers, another cautions that overreliance on the tool may cause learners to lose their ability to compose texts independently.

The (Learner Autonomy) dimension consists of articles by (Tahir & Tahir, 2023), which found a positive correlation between ESL learners' perceptions of AI tool usability and their self-directed learning (SDL) behaviours. Qiao and Zhao (2023) found that Chinese EFL learners who used AI for speaking practice were more likely to use self-regulation strategies compared to their peers. Finally, Asadi and Taheri (2024) found that AI can facilitate peer assessment among language learners, but that pedagogical intervention was needed to promote learner engagement.

The articles grouped within the (Pedagogical Integration) dimension focus on how AI is - or can be - integrated at different scales. First, Alshumaimeri & Alshememry (2023) and Alhur et al. (2022) provide insight into the affordances and limitations of AI in EFL contexts. Second, Koraishi (2023) discusses the use of generative AI for language teachers. The author provides recommendations on using ChatGPT to create learning materials and design assessments. Lastly, Alisoy and Sadiqzade (2024) demonstrate how AI is used to support language learning outside the classroom through MALL systems. The article discusses how AI has made language learning more accessible, but notes that not all learners have equal opportunities to leverage these technologies.

ChatGPT and Generative AI in Education: Transformative Potential and Emerging Challenges

As summarised in Table (6), the included papers are organised around four key dimensions that reflect diverse implications of the technologies for learning, teaching, and educational institutions.

Table (6): Taxonomy of ChatGPT and Generative AI Applications in Education

Dimension	Focus Area	Key Themes	Sources
Adoption & Integration	Institutional Policies	Waiting, banning, and embracing strategies	(Xiao et al., 2023), (Wyk, 2024)
	Educator Preparedness	Training needs and role adaptation	(H. Yu, 2024), (Su & Yang, 2023)
	Student Acceptance	Awareness and trust factors	(Shahzad et al., 2024), (Adarkwah et al., 2023)

Learning Enhancement	Cognitive Effects	Impact on learning and memory	(Bai et al., 2023)
	Skill Development	Higher-order thinking and problem-solving	(Lee et al., 2024), (Dao & Le, 2023)
	Subject-Specific Applications	Mathematics, science, and language learning	(Wardat, 2023), (Alneyadi & Wardat, 2023), (Hawanti & Zubaydulloevna, 2023)
Ethical & Academic Concerns	Integrity Issues	Plagiarism and assessment challenges	(Okaiyeto et al., 2023), (Alasadi & Baiz, 2023)
	Bias and Fairness	Algorithmic limitations in education	(Ellis & Slade, 2023), (Mills et al., 2023)
Future Directions	Framework Development	Implementation guidelines	(Zhu et al., 2023), (Moore et al., 2023)
	Longitudinal Effects	Sustained impact on education	(Arshad et al., 2024), (Livberber & Ayvaz, 2023)

A consensus across the generative AI literature is that ChatGPT can facilitate learning by providing feedback, generating content, and helping students solve problems. However, generative studies disagree on whether these improvements reflect long-term learning. Experimental studies find that ChatGPT temporarily improves learners' performance on tasks. On the other hand, ethical and assessment-centered studies conclude that generative AI will degrade learners' independent reasoning without proper scaffolding. This implies that ChatGPT's effectiveness hinges less on students' access to it and more on factors such as prompt engineering, teacher support, assessment redesign, and learners' AI literacy.

On the (Adoption & Integration) dimension, institutions have responded differently to the emergence of generative AI, ranging from waiting periods and bans on use to full support. (Xiao et al., 2023) On the one hand, research by H. Yu (2024) shows how teachers can learn to integrate these tools into the classroom and continue educating their students effectively. Shahzad et al. (2024) found that trust was a factor in students' acceptance of AI tools.

Examples of research evidence in the (Learning Enhancement) Category: Bai et al. (2023) examine both the positive and negative cognitive impacts of ChatGPT on learners, including improvements in memory and potential dependency. Examples in the subtopic of (subject-specific) include Wardat (2023) discusses how ChatGPT has helped students improve in solving math problems. Moreover, Alneyadi & Wardat (2023) note positive impacts of using ChatGPT on high school students' understanding of physics concepts. Lee et al. (2024) found that using prompts can help prevent learners from having surface-level dependency.

(Ethical & Academic Concerns) Shows that there are continued issues with generative AI. Both Okaiyeto et al. (2023) and Alasadi & Baiz (2023) address issues of academic integrity, with students and teachers unclear about what constitutes acceptable use. Ellis and Slade (2023) discuss biases in the output of generative AI that, if left unaddressed, can lead to broader equity issues in education.

AI-Enabled Learning and Teaching Tools: Pedagogical Integration and Effectiveness

AI-enabled technologies used in education present opportunities for novel teaching and learning experiences. These tools are designed with adaptive capabilities, personalized learning journeys, and increased interactivity. Table (7) provides an overview of how the selected articles are classified into three dimensions.

Table (7): Taxonomy of AI-Enabled Learning and Teaching Tools

Dimension	Focus Area	Key Features	Sources
Adaptive Learning Systems	Personalized Pathways	AI-driven curriculum adaptation	(Tapalova & Zhiyenbayeva, 2022), (Sari et al., 2024), (Ejjami, 2024)
	Performance Optimization	Real-time feedback and analytics	(Das et al., 2023), (Naseer et al., 2024)
Interactive Learning Environments	Mobility & Interactivity	Convergence of pedagogy and technology	(A. Alam & Mohanty, 2023)
	Game-Based Learning	AI literacy through gamification	(Du & Wang, 2023)
Generative AI Applications	Content Creation	AI-assisted writing and coding	(Becker et al., 2023), (Nazari et al., 2021)
	Language Learning	AI-powered language e-learning systems	(Lin et al., 2022), (Ni & Cheung, 2023)

Adaptive Learning Systems: the ability of AI to personalise education based on individual learners' needs. Tapalova & Zhiyenbayeva (2022) discuss how AI can be used to personalize learning by analyzing student data and adapting educational content and strategies accordingly. Sari et al. (2024) focus on how AI can be leveraged to optimize learning paths by dynamically sequencing and selecting learning objects. Das et al. (2023) found that students performed better when taught with AI tailored to their needs. Naseer et al. (2024) showed that while AI has the potential to personalize learning, the decisions made by AI algorithms can be opaque, so teachers and students need to understand how the AI is making its decisions.

Interactive Learning Environments: Alam, A. & Mohanty, K. (2023) address the impact of Artificial Intelligence on teaching and learning through the lens of three evolving educational concepts: Mobility, Interactivity, and Artificial Intelligence. The authors highlight how AI disrupts conventional education models by enabling anytime-anywhere, just-in-time learning experiences. Du & Wang (2023) examine how game-based learning can help students develop AI literacy. Students who used the AI literacy game developed their problem-solving skills and knowledge of AI. Jia et al. (2024) found that gamification in STEM education increased intrinsic motivation and cognitive load.

Findings from the Generative AI Applications dimension focus on both affordances and drawbacks of generative AI-assisted content creation tools. First, focusing on the use of AI code-generation tools in programming education, Becker et al. (2023) describe how tools like GitHub's Copilot can reduce barriers to entry for novice coders while raising questions about skill degradation. Another research paper focused on the adoption of generative AI writing assistants in post-secondary education found that while students' writing quality improved, instructors also noted that students were overly reliant on the tool for writing assignments (Nazari et al., 2021). In the context of language education, researchers have studied AI-enabled multimodal conversational agents and found promising results in student engagement (Lin et al., 2022; Ni & Cheung, 2023). However, future work investigating the long-term efficacy of these tools for language education should carefully consider alignment with language-learning pedagogy.

4. Discussion

This trend is consistent across all studies reviewed: research using a survey approach tends to find positive attitudes towards AI adoption for convenience, personalization, and administrative efficiency. Meanwhile, experimental or assessment-based research paints a more skeptical picture

of over-reliance, academic integrity, and independent problem-solving. Overall, positive attitudes towards AI should not be assumed to equate to better learning.

One notable comparison across studies is that positive results tend to be observed when AI is applied in structured, scaffolded, and activity-specific ways. At the same time, risks emerge when AI is used as an scaffolded replacement for learner effort. Positive results have been reported for personalized learning, simulations, speaking practice, and discipline-specific tutoring when AI is used to promote learner engagement, provide feedback, or facilitate conceptual understanding through narrowly defined learning activities. Negative impacts have been cautioned in the contexts of generative AI-assisted writing, coding, and assessment due to the likelihood of dependency, obfuscated authorship, reduced independent problem-solving, and challenges to academic integrity when learners use AI tools with few regulations. This comparison implies that AI's value may be determined more by how it is used (i.e., the instructional conditions) than by the technology itself.

Taken together, these results imply that the debate should not be about accepting or rejecting AI, but under what instructional conditions and settings AI can contribute to worthwhile learning. Consistent across contexts, AI can add the most value to support learning when it is leveraged to provide feedback, simulation/practice, opportunities for practice, differentiated support, and learner reflection, rather than AI taking over thinking that students should be doing themselves. Concerns around academic integrity, bias, and dependency, then, are issues of design and governance vs reasons to ban AI use outright. In the future, institutions should establish clear policies around AI use, reframe assessment to value process over product, and train teachers to determine when AI support is helpful for learning and when it inhibits independent thought.

There are some limitations to this review. One limitation is that these articles were only available in English. Education systems in other countries may have found different effects of AI. Some articles may already be outdated because AI is constantly evolving. New AI technology, such as being able to analyses pictures, is being developed. Finally, many of these articles focus on higher education. While this review features some school-level evidence regarding mathematics, physics, English learning, intelligent tutoring systems, and AI literacy, the literature skews heavily towards higher education. This impacts the generalizability of findings to younger learners who may need more teacher mediation, robust age-appropriate AI literacy skills, and safeguards against reliance on AI-generated answers. Future research should focus on the long-term effects of AI use.

Researchers should investigate how AI can be used in new and innovative ways. Some articles mention ethics but discuss them only theoretically (Massala, 2023). Future research should investigate how these ethics play out in the real world. How are students and teachers affected by different decisions about AI? Lastly, what is the teacher's role in a classroom where AI can teach? AI will become increasingly involved in education.

5. Conclusion

Across the body of literature reviewed, AI has shifted from an emerging education technology used on the margins of education to a central driver of pedagogy, assessment, institutional policy, and student support. Despite its expanding role in education, the overall evidence landscape remains mixed. There are many studies demonstrating positive learner perceptions of AI-enabled personalization, and a generative AI study supports this. Still, there are few longitudinal, experimental, or cross-cultural studies providing evidence of learning

improvements over time. Thus, this review identified a need for research to advance beyond investigations of adoption and perceptions and toward robust studies of learning outcomes, assessment redesign, teacher professional development, and equity-focused AI governance.

Applied to practice, this means educators should implement AI as a scaffold for providing feedback, practice, differentiation, and reflection, but not as a replacement for students' critical thinking. Institutions should establish clear policies for AI use, move towards assessment designs that reward learning behaviors in addition to a finished product, and continuously develop teachers. Policymakers can encourage ethical use by developing policies that support AI innovation while holding schools and universities accountable for responsible use, such as ethical guidelines that address data privacy, fairness in use, and accessibility for all students, and by providing schools with the infrastructure and training necessary to effectively and equitably implement AI. Taken together, this review found that there is a need for further research that moves beyond studying Edtech adoption and perceptions, and towards rigorous research to understand learning outcomes, redesign assessment, effectively provide teacher professional development, and develop equity-centered AI governance.

Declaration on the Use of Artificial Intelligence

The author did not use artificial intelligence during the preparation of this manuscript, except for proofreading tools, grammar editing, and copy editing.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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The author declares no conflicts of interest.

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The author conceived the study, conducted the research, analyzed the data, wrote the manuscript, and approved the final version.

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