Artificial intelligence as a pedagogical partner: A conceptual analysis of personalized learning, teacher agency, and ethical governance

Ida Dian Sukmawati[1], Tri Pujiani[2], Zohaib Hassan Sain[3], and Jaime Da Costa Lobo Soares[4]
[1,2]English Education Department, Harapan Bangsa University, Purwokerto, Indonesia
[3] Faculty of Arts, Humanities & Social Sciences SGD, Superior University, Lahore, Pakistan
[4] Instituto Profissional De Canossa, Timor Leste

Abstract. Artificial intelligence has become a transformative force in contemporary education, reshaping how learning is personalized, assessed, supported, and governed. While AI offers significant potential through adaptive learning, intelligent tutoring systems, automated feedback, and generative learning support, its rapid adoption also raises concerns about teacher agency, academic integrity, privacy, bias, equity, and learner overdependence. This conceptual paper aims to examine how AI can be positioned as a pedagogical partner rather than a replacement for teachers and learners. Using a conceptual review design, this study synthesized recent peer-reviewed journal articles published between 2021 and 2025. The article selection process began with 96 identified records, followed by title and abstract screening, full-text review of 43 articles, and final thematic synthesis of 28 articles. Data were analysed using thematic synthesis to identify conceptual patterns, convergences, and gaps across the literature. The findings reveal six major themes: AI-supported personalized learning ecosystems, intelligent tutoring systems, generative AI and learning support, teacher augmentation, ethical governance, and AI literacy for future learning. The paper contributes a human-centred conceptual framework that positions AI as an ethically governed pedagogical partner requiring teacher mediation, learner responsibility, institutional accountability, and future-oriented AI literacy.

Keywords: artificial intelligence in education; personalized learning; generative AI; teacher agency; ethical AI; AI literacy

1 Introduction

Artificial intelligence has moved from being a distant technological concept to becoming a visible and influential force in everyday life. In education, AI is no longer limited to experimental laboratories or advanced computing contexts; it now appears in adaptive learning platforms, intelligent tutoring systems, automated grading tools, learning analytics

[2]Corresponding author: tripujiani@uhb.ac.id

dashboards, conversational agents, and generative AI applications. The presentation on Artificial Intelligence in Today's World emphasizes that AI is increasingly associated with personalized learning, automated feedback, intelligent tutoring, accessible education, teacher support, and future learning environments involving global classrooms, augmented reality, virtual reality, and lifelong learning. These ideas reflect a broader global phenomenon: education systems are now being challenged to rethink how learning should be designed, delivered, assessed, and governed in an AI-mediated era.

The current state of the art shows that AI in education has developed across several major application areas. Wang et al. (2024) identify adaptive learning, personalized tutoring, intelligent assessment, prediction, profiling, and educational management as major categories in AI in education research. Their systematic review shows that AI is not a single educational tool but a broad ecosystem of technologies designed to support learning, teaching, assessment, and institutional decision-making. Similarly, generative AI has intensified the debate because it can produce text, images, feedback, explanations, and learning materials at scale. Kasneci et al. (2023) argue that large language models create opportunities for content generation, student support, engagement, and personalized learning, but they also raise concerns about accuracy, bias, competence development, and responsible use. These developments suggest that AI has become a powerful educational infrastructure rather than a supplementary tool.

Despite this promise, the rapid adoption of AI in education has created a complex pedagogical dilemma. On one hand, AI can support individualized learning pathways, provide immediate feedback, automate repetitive tasks, and help teachers identify students who need additional support. Intelligent tutoring systems, for example, have been widely studied because they can offer adaptive instruction and immediate responses to learners. A recent systematic review of AI-driven intelligent tutoring systems in K–12 education found generally positive effects on learning and performance, although the authors also noted the need for longer interventions, larger samples, more diverse populations, and deeper ethical investigation (Létourneau et al., 2025). On the other hand, AI may produce shallow learning if students use it merely to generate answers rather than to develop understanding. It may also reduce teacher-student interaction, intensify surveillance, reproduce social bias, and increase educational inequality when access to reliable AI tools is uneven.

The rise of generative AI has further complicated the educational landscape. Batista et al. (2024) show that generative AI in higher education has affected teaching, learning, assessment, academic integrity, and institutional policy. Although generative AI can help students brainstorm, revise, summarize, translate, and receive feedback, it also challenges conventional assumptions about authorship, originality, assessment, and academic honesty. Giannakos et al. (2025) similarly warn that educational institutions should not adopt generative AI hastily without considering efficacy, ethics, ecosystem-level consequences, and pedagogical soundness. This means that AI integration should not be understood merely as a technical upgrade. Instead, it requires a deeper conceptual shift concerning the relationship between human learning, machine assistance, teacher authority, learner autonomy, and institutional governance.

In this context, one of the most important issues is the role of teachers. The presentation clearly states that AI supports teachers but does not replace them, and that teachers remain essential for creativity, empathy, critical thinking, and classroom interaction. This position is strongly supported by recent literature. AI can automate certain instructional and administrative tasks, but it cannot fully replace professional judgment, ethical sensitivity, contextual understanding, emotional support, and pedagogical improvisation. Teachers are not merely users of AI tools; they are mediators who decide when, why, and how AI should be used to support learning. Therefore, the future of AI in education depends on teacher agency, AI literacy, and institutional support.

However, current research still leaves an important conceptual gap. Many studies examine AI tools, student perceptions, system effectiveness, or ethical concerns separately. Systematic reviews have mapped the field broadly, and empirical studies have tested specific AI applications, but fewer studies integrate these strands into a coherent human-centred conceptual explanation of how AI should function pedagogically. The gap is not only whether AI works, but under what pedagogical, ethical, and institutional conditions AI can enhance learning without weakening human agency. This paper responds to that gap by conceptualizing AI as a pedagogical partner. This concept emphasizes that AI should augment, not replace, the human dimensions of education.

Therefore, this conceptual paper aims to synthesize recent literature on AI in education and develop a human-centred understanding of AI integration. The paper is guided by the following research questions:

1. How can artificial intelligence support personalized, adaptive, and accessible learning in contemporary education?
2. What ethical, pedagogical, and institutional conditions are required for AI to function as a human-centred pedagogical partner rather than as a replacement for teachers and learners' cognitive agency?

By addressing these questions, this paper contributes to the literature in three ways. First, it synthesizes current developments in AI-supported personalization, intelligent tutoring, automated feedback, and generative AI. Second, it critically examines the risks of AI integration, particularly bias, privacy, overdependence, academic integrity, and unequal access. Third, it proposes a conceptual orientation in which AI is positioned as a pedagogical partner whose value depends on teacher mediation, ethical governance, and learner-centred use.

2 Literature Review

2.1 Theoretical Framework: Human-Centred AI and Sociotechnical Learning

This paper is grounded in a human-centred view of AI in education. Human-centred AI assumes that technological systems should be designed and implemented to enhance human capabilities, protect human agency, and support ethical decision-making. In education, this perspective means that AI should not be evaluated only by its efficiency or automation capacity, but by its contribution to meaningful learning, learner autonomy, teacher professionalism, and equitable access. This theoretical position is appropriate because AI in education operates within a sociotechnical system: learning outcomes are shaped not only by technology, but also by teachers, students, institutions, policies, data practices, curriculum goals, and social contexts.

From this perspective, AI is best understood as an augmentative technology. It can assist teachers by generating materials, identifying learning gaps, providing feedback, and supporting assessment, but it cannot replace the interpretive and relational dimensions of teaching. The presentation's emphasis on AI as a support system for teachers rather than a replacement reflects this human-centred orientation. Recent literature similarly suggests that the educational value of AI depends on how it is embedded within pedagogical practice, not merely on the sophistication of the tool itself. Kasneci et al. (2023) argue that large language models can support personalized learning and content creation, but responsible use requires both teachers and learners to understand their limitations.

2.2 Previous Relevant Studies

Recent studies have shown that AI can improve education through personalization, adaptive instruction, intelligent tutoring, automated feedback, and learning analytics. Wang et al.

(2024), in a broad systematic review of AI in education, found that research has expanded across adaptive learning, personalized tutoring, intelligent assessment, profiling, prediction, and educational management. Their findings suggest that AI has become a multidimensional educational field involving both technical design and pedagogical implementation.

In relation to intelligent tutoring systems, Létourneau et al. (2025) reviewed AI-driven ITS in K–12 education and found that such systems generally show positive potential for supporting learning and performance. However, the review also emphasizes that stronger evidence is needed through longer interventions, larger samples, diverse educational contexts, and deeper examination of ethical implications. This finding is important because it shows that AI-supported tutoring should not be treated as universally effective without attention to context and research design.

Generative AI has also become a major research focus. Batista et al. (2024) reviewed generative AI in higher education and found that it influences teaching, learning, assessment, institutional practice, and academic integrity. The study indicates that generative AI can support productivity and personalized assistance, but it also requires clear institutional policies and pedagogical redesign. Giannakos et al. (2025) further argue that generative AI can support learning design, regulation of learning, automated content, feedback, and assessment, but the field must carefully consider ethics, pedagogical soundness, and ecosystem-level consequences.

Other studies highlight student and teacher perspectives. Chan and Hu (2023) found that students perceive generative AI as useful for learning support, but they also recognize concerns related to accuracy, academic integrity, and responsible use. Such findings suggest that students need AI literacy, not merely access to AI tools. Similarly, teacher readiness remains a major concern because effective AI integration depends on teachers' ability to evaluate AI outputs, design meaningful tasks, guide students' ethical use, and prevent overdependence.

2.2 Research Gap and Significance

Although recent studies have extensively discussed AI applications, there remains a gap in conceptualizing AI as a pedagogical partner within a human-centred educational framework. Much of the literature focuses either on technical applications, empirical effectiveness, or ethical risks. However, fewer conceptual discussions synthesize these dimensions into a coherent model that explains how AI can support learning while preserving teacher agency, learner autonomy, and ethical responsibility.

This gap is significant because education systems are increasingly pressured to adopt AI tools quickly, often before teachers, students, and institutions are fully prepared. Without a clear conceptual framework, AI adoption may become tool-driven rather than pedagogy-driven. This paper therefore contributes by arguing that AI should be positioned as a pedagogical partner: a system that supports personalization, feedback, access, and efficiency while remaining subordinate to human judgment, ethical governance, and educational purpose.

2.3 Method

2.3.1 Design

This study employed a conceptual review design to examine the role of artificial intelligence in education, particularly in relation to personalized learning, intelligent tutoring systems, generative AI, teacher agency, ethical governance, and future-oriented AI literacy. A conceptual review was considered appropriate because this study did not aim to test hypotheses or collect empirical field data. Instead, it sought to synthesize existing scholarly

discussions, identify conceptual patterns, and develop an integrated argument about how AI can function as a pedagogical partner in education.

The presentation file on Artificial Intelligence in Today's World was used as the initial conceptual foundation because it highlighted key issues such as personalized learning, intelligent tutoring systems, automated grading, teacher support, privacy, bias, equity, and the future of AI-enhanced education. These issues were then expanded through a review of recent scholarly articles to build a broader conceptual discussion on AI in education.

2.3.2 Articles' Inclusion Criteria

The literature included in this conceptual review was selected based on predetermined criteria to ensure relevance, credibility, and recency. First, the articles had to discuss artificial intelligence in educational contexts, including AI-supported personalized learning, intelligent tutoring systems, automated grading and feedback, generative AI, AI literacy, teacher roles, ethical issues, equity, privacy, and governance in education. Second, the articles had to be published within the last five years to reflect the rapid development of AI technologies and their recent educational implications. Third, the articles had to be published in reputable peer-reviewed journals, preferably indexed in major academic databases such as Scopus, Web of Science, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, or other recognized scholarly platforms. Fourth, the articles had to provide conceptual, empirical, or systematic review-based insights relevant to the purpose of this paper.

Articles were excluded if they focused only on technical AI engineering, algorithmic development, or computer science performance without clear educational implications. Non-journal publications, unpublished manuscripts, opinion pieces without scholarly grounding, conference abstracts, and articles that were not directly related to AI in education were also excluded.

2.3.3 Data Collection and Literature Search Procedure

Steps of data gathering include the following. First of all, keywords were selected based on concepts discussed in the presentation file. Such notions as AI in education, personalized learning, intelligent tutoring systems, generative AI in education, automated feedback, assessment aided by AI, teachers' role in AI-driven learning, AI ethics, privacy, bias, equity, and AI literacy belong to those concepts.

Second of all, a search for literature was carried out in reputable databases and scholarly search engines, which are Scopus, Web of Science, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, and Google Scholar. The timeframe of searches covered years 2021-2025 to provide relevant literature concerning recent developments in AI in education. In order to ensure transparency and replicability, the following keywords combinations were used:

1. "artificial intelligence in education" AND "personalized learning""artificial intelligence in education" AND "adaptive learning"
2. "intelligent tutoring systems" AND "education"
3. "intelligent tutoring systems" AND "K-12 education"
4. "generative AI" AND "education"
5. "generative AI" AND "higher education"
6. "ChatGPT" AND "education"
7. "large language models" AND "education"
8. "AI-assisted assessment" AND "education"
9. "automated feedback" AND "artificial intelligence"
10. "teacher role" AND "artificial intelligence in education"
11. "teacher professional development" AND "AI literacy"

12. “AI literacy” AND “education”
13. “AI ethics” AND “education”
14. “artificial intelligence” AND “privacy” AND “education”
15. “artificial intelligence” AND “bias” AND “education”
16. “artificial intelligence” AND “equity” AND “education”

Third, the searching procedure yielded an initial result of about 96 articles relating to the use of AI in education. Following this, the removal of duplicate articles and articles that did not publish in peer-reviewed academic journals yielded 82 articles for further review. In this phase, articles were reviewed by assessing their relevance concerning the research objective. Articles that were highly technical, irrelevant to the education setting, or had little relevance to AI-supported learning were disregarded at this point.

Fourth, there were 43 articles left for full-text review. After the full-text review, 28 articles were finally selected and reviewed in depth. These articles were considered the most relevant because they directly addressed AI-supported personalized learning, intelligent tutoring systems, generative AI, teacher augmentation, ethical governance, and AI literacy. Finally, the selected articles were organized in a literature review matrix. The matrix included the author, year of publication, journal source, research focus, type of AI application, educational context, key findings, ethical issues, implications, and research gaps. This procedure ensured that the literature used in this study was recent, credible, and directly connected to the conceptual focus of the paper. Figure 1 shows the process of filtering the articles.

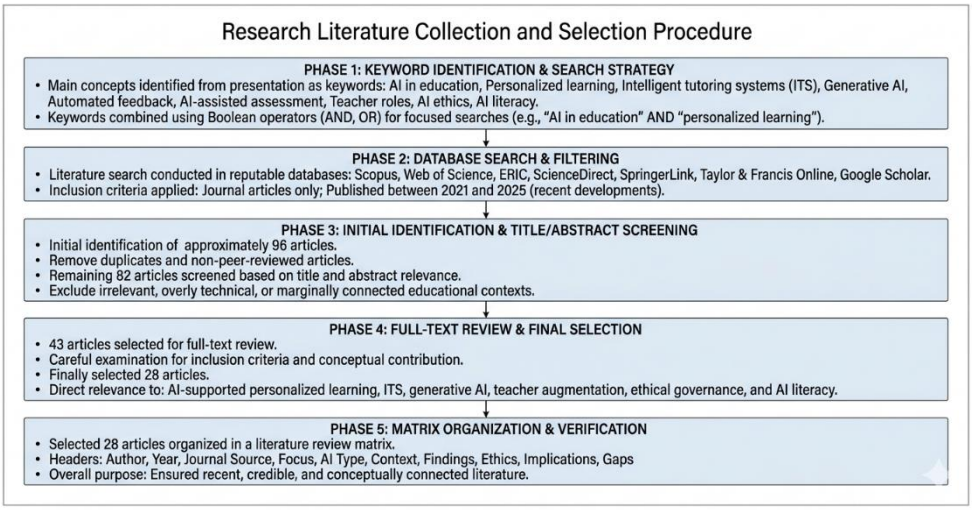

Fig 1. Article Selection Process

2.3.4 Quality Appraisal of Selected Articles

Although this study was designed as a conceptual review rather than a systematic review or meta-analysis, a quality appraisal procedure was applied to ensure that the selected articles were academically credible and conceptually useful. The quality appraisal focused on five aspects: source credibility, relevance to the research focus, methodological clarity, conceptual contribution, and recency.

First, source credibility was evaluated by checking whether the article was published in a peer-reviewed journal and indexed in reputable databases or published by recognized academic publishers. The second criterion concerned relevance in which the articles had to have direct concerns for AI in education rather than purely computational issues.

Methodological rigor was considered through assessing the explanation of research method used, review method, data sources, analysis method, or conceptual foundation of the research article. The fifth aspect involved the assessment of conceptual contributions in terms of offering new insights about learning with the help of AI, intelligent tutoring systems, generative AI, teachers' roles in such environments, ethical governance and AI literacy. Recency was another important quality consideration and it required including research articles published from 2021 to 2025.

All those articles which satisfied the criteria mentioned above were selected for further analysis. Those articles which lacked relevance, methodological rigor, or clear scholarly contribution, among others, were excluded at the full-text review stage. It was aimed at ensuring the trustworthiness of the final conceptual synthesis and discussion. Data Analysis

The data were analysed using thematic synthesis. First, key concepts from the presentation and selected literature were identified and coded. Second, similar concepts were grouped into broader thematic categories. Third, the emerging themes were compared across studies to identify points of convergence, contradiction, and conceptual gaps. Through this process, six major themes were developed: AI-supported personalized learning, intelligent tutoring systems, generative AI and learning support, teacher augmentation and professional roles, ethical governance, and AI literacy for future learning.

These themes were then interpreted conceptually to develop the main argument of the paper: that AI should be positioned as a pedagogical partner that supports, rather than replaces, teachers and learners. The analysis emphasized synthesis and conceptual interpretation rather than statistical calculation, as the study aimed to generate a theoretically grounded understanding of AI integration in education.

3 Results and Discussion

3.1 Results

The reviewed literature was synthesized thematically based on the key issues emerging from the discourse and recent studies on AI in education. The discourse highlights several central issues, including personalized learning, intelligent tutoring systems, automated grading and feedback, teacher support, privacy, bias, equity, and the future of AI-enhanced education. Based on the literature review, the findings were organized into six major themes, as presented in Table 1.

Table 1. The matrix of reviewed papers

No.	Theme	Number of Articles Reviewed	Authors and Year	Key Points
1	AI-supported personalized learning	5 articles	(Crompton & Burke, 2023; Lin et al., 2023; Luo et al., 2025; Rojas & Chlappe, 2024; Wang et al., 2024)	AI supports adaptive learning, individualized learning paths, learning analytics, and differentiated content. However, personalization requires teacher mediation to avoid algorithmic labeling and unequal learning tracks.
2	Intelligent tutoring systems	4 articles	(Almasri, 2024; Kim & Su, 2024; Létourneau et al., 2025; Lin et al., 2023)	Intelligent tutoring systems provide real-time feedback, adaptive questioning, scaffolding, and repeated practice. Their effectiveness depends on instructional design, learner context, teacher monitoring, and ethical implementation.

3	Generative AI and learning support	6 articles	(Batista et al., 2024; Chan & Hu, 2023; Giannakos et al., 2025; Kasneci et al., 2023; Lee et al., 2024; Strzelecki, 2024)	Generative AI supports content creation, brainstorming, writing assistance, feedback, translation, and learning interaction. However, it raises concerns about accuracy, hallucination, plagiarism, academic integrity, and student overdependence.
4	Teacher augmentation and professional roles	4 articles	(Giannakos et al., 2025; Labadze et al., 2024; Lee et al., 2024; Tan et al., 2025)	AI can reduce teachers' administrative workload, assist lesson planning, support assessment, and provide learning analytics. Nevertheless, teachers remain central as designers, mediators, evaluators, and ethical guides.
5	Ethical governance, privacy, and equity	4 articles	(Batista et al., 2024; Humble, 2024; Mouta et al., 2024; Zhai et al., 2024)	Responsible AI integration requires attention to privacy, data protection, transparency, fairness, bias, accountability, and equitable access. Institutional policies are needed to ensure safe and ethical AI use.
6	AI literacy and future learning	3 articles	(Almatrafi et al., 2024; Tan et al., 2025; Yim & Su, 2025)	AI literacy is essential for both teachers and students. It includes technical understanding, critical evaluation, ethical awareness, prompt literacy, data literacy, and responsible human-AI collaboration.

Table 1 shows that recent literature on AI in education is not limited to technological innovation, but also covers pedagogical, ethical, institutional, and professional dimensions. The largest group of studies focuses on generative AI and learning support, reflecting the growing influence of tools such as ChatGPT and other large language models in educational settings. At the same time, the literature also emphasizes that AI-supported learning must be understood through human-centred principles, particularly teacher agency, learner responsibility, ethical governance, and AI literacy.

The following discussion maintains the six thematic areas identified in the table: AI-supported personalization, intelligent tutoring systems, generative AI as a learning partner, teacher augmentation, ethical governance, and AI literacy. Together, these themes support the central argument of this paper that AI should be conceptualized not as a replacement for teachers or learners' cognitive effort, but as a pedagogical partner that strengthens learning when guided by ethical, pedagogical, and institutional responsibility.

3.2 Discussion

3.2.1 AI-Supported Personalization as the Core Promise of AI in Education

The reviewed studies consistently show that personalization is one of the strongest educational promises of AI. The presentation emphasizes that AI can adjust learning difficulty, provide customized feedback, and curate learning materials according to students' needs. This idea is strongly supported by recent literature. Wang et al. (2024) show that AI in education has developed across adaptive learning, intelligent assessment, prediction, profiling, and educational management, while Crompton and Burke (2023) identify AI assistant systems, intelligent tutoring systems, and student learning management as key uses

of AI in higher education. These studies suggest that AI is shifting education from a one-size-fits-all model toward data-informed, adaptive, and individualized learning support.

However, personalization should not be interpreted simply as automatic adjustment of content. Luo et al. (2025) show that AI-based learning tools influence cognitive, skill-based, and affective learning outcomes, meaning that AI-supported learning should be evaluated beyond performance scores alone. Rojas and Chiappe (2024) further argue that AI works effectively only when it is embedded in a wider digital ecosystem, including infrastructure, institutional policy, teacher capacity, and learning design. Therefore, AI-supported personalization is not merely a technical function; it is a pedagogical and institutional process.

From a conceptual perspective, AI-supported personalization can be understood as a form of responsive learning mediation. AI can identify learning gaps, generate feedback, recommend tasks, and support differentiated pathways. Yet, teachers are still needed to interpret data, understand students' emotional and social conditions, and ensure that personalized pathways do not become algorithmic labelling. If personalization is fully delegated to AI, students may be placed into narrow learning tracks based on previous performance rather than encouraged to grow beyond predicted patterns. Therefore, the main contribution of AI is not replacing teacher judgment but expanding teachers' ability to respond to learner diversity.

3.2.2 Intelligent Tutoring Systems (ITS) as Adaptive Pedagogical Support

Intelligent tutoring systems represent one of the most established forms of AI in education. The discourse identifies AI tutors as systems that provide individualized learning paths, immediate feedback, explanations, and adaptive questioning. This aligns with recent reviews showing that intelligent tutoring systems can support students through personalized instruction, scaffolding, and real-time feedback. Létourneau et al. (2025), for example, found that AI-driven tutoring systems in K–12 education have positive potential for improving learning and performance, although the field still requires stronger evidence from longer interventions and more diverse contexts.

Lin, Huang, and Lu (2023) connect intelligent tutoring systems to sustainable education by arguing that AI can improve access, support personalized learning, and provide data-driven insights for teachers. Similarly, the systematic review on intelligent tutoring systems in mathematics education shows that ITS can support individualized learning paths and problem-solving scaffolds, but that teacher roles and educational contexts remain crucial. These findings suggest that intelligent tutoring systems should not be treated as independent teaching machines; rather, they function best when integrated into teacher-guided learning environments.

The conceptual implication is that ITS should be framed as adaptive pedagogical support, not as automated teaching. ITS can provide immediate feedback and repeated practice that teachers may not always have time to offer individually. Nevertheless, the system's instructional decisions are only as strong as its design assumptions, data quality, and pedagogical alignment. Teachers must therefore remain active in selecting systems, interpreting student progress, identifying misconceptions, and deciding when human intervention is needed.

3.2.3 Generative AI as a Double-Edged Learning Partner

Generative AI has changed the discussion of AI in education because it can generate explanations, summaries, lesson plans, feedback, translations, images, quizzes, and written assignments. The discourse's discussion of generative AI as a technology that creates content directly connects to this new educational reality. Kasneci et al. (2023) argue that large

language models can support personalized learning, accessibility, educational content generation, and teacher assistance. However, they also emphasize that these systems require critical use because their outputs may be inaccurate, biased, or pedagogically inappropriate.

Recent literature confirms that GenAI is both promising and risky. Batista, Mesquita, and Carnaz (2024) show that GenAI is transforming teaching, learning, assessment, academic integrity, and institutional policy. Giannakos et al. (2025) similarly emphasize that GenAI can support simulations, feedback, learning design, and self-regulated learning, but that these benefits depend on careful pedagogical and ethical integration.

Student-focused studies also reveal this double-edged nature. Chan and Hu (2023) found that students value GenAI for personalized learning, writing, brainstorming, and research support, but they also worry about accuracy, privacy, ethics, personal development, and social consequences. Strzelecki (2024) shows that student acceptance of ChatGPT is shaped by technology acceptance factors, meaning that students' willingness to use AI is not simply about access but also about perceived usefulness, ease of use, and behavioural intention.

For this conceptual paper, the key argument is that GenAI should be positioned as a learning partner, not as a substitute for learning. When students use GenAI to ask questions, compare explanations, revise drafts, test ideas, or receive formative feedback, it can support deeper engagement. However, when students use it simply to produce answers, it can weaken cognitive effort and academic integrity. Therefore, educational institutions must design tasks that require students to explain, reflect, verify, and personalize AI-assisted outputs.

3.2.4 Teacher Augmentation and the Changing Professional Role of Educators

A major theme across the reviewed literature is that AI changes, but does not eliminate, the role of teachers. The presentation explicitly states that AI supports teachers but does not replace them, especially because teachers remain responsible for creativity, empathy, critical thinking, and human interaction. This claim is strongly supported by Tan, Cheng, and Ling (2025), who found that although many studies focus on AI applications in teaching, fewer examine teacher professional development needs. This imbalance shows that AI adoption is often tool-driven rather than teacher-development-driven.

AI can reduce teachers' workload by supporting grading, feedback, lesson planning, material generation, and learning analytics. Labadze, Grigolia, and Machaidze (2024) found that AI chatbots can support both students and educators by providing learning assistance, personalized support, time-saving benefits, and improved pedagogy. However, these benefits require teachers who are able to evaluate AI outputs, correct inaccuracies, contextualize feedback, and guide ethical use.

Teacher AI literacy therefore becomes a central condition for effective AI integration. Lee and colleagues (2024) show that case-based professional development can strengthen teacher AI literacy, especially when direct instruction is combined with discussion of realistic teaching cases. This suggests that teacher training should not only introduce AI tools but also develop teachers' ability to make pedagogical and ethical decisions about AI use.

Conceptually, AI should be understood as a form of teacher augmentation. It can extend teachers' capacity, but it cannot replace professional judgment. Teachers remain responsible for interpreting learner needs, designing meaningful learning experiences, protecting students from harm, and ensuring that AI use supports educational goals. In this sense, the teacher's role shifts from being the sole source of knowledge to becoming a designer, curator, mediator, evaluator, and ethical guide.

3.2.5 Ethical Governance as the Foundation of Responsible AI Integration

The reviewed studies show that ethical governance is not a secondary concern but a central requirement for AI in education. The presentation identifies privacy, data security, bias,

fairness, transparency, and overdependence as major challenges. Mouta, Pinto-Llorente, and Torrecilla-Sánchez (2024) similarly show that AI ethics in education must address blind spots related to fairness, responsibility, transparency, and stakeholder protection.

The ethical concern becomes even more urgent with generative AI. A recent systematic review on ethical and regulatory challenges of GenAI in education found that GenAI can improve personalized feedback and learning accessibility, but it also introduces risks related to cognitive autonomy, student data misuse, and insufficient regulation. Humble (2024), using a SWOT-based review of GenAI in computing education, also shows that GenAI brings strengths and opportunities but requires risk management strategies to address weaknesses and threats.

Another important ethical issue is over-reliance. Zhai, Wibowo, and Li (2024) found that excessive reliance on AI dialogue systems may affect students' decision-making, critical thinking, and analytical reasoning. This is particularly important because AI tools often produce fluent and confident responses, which may encourage students to accept outputs without verification.

The conceptual implication is that AI integration must be governed by four ethical principles: transparency, accountability, fairness, and cognitive responsibility. Transparency means that students and teachers should understand when AI is used and how it influences learning processes. Accountability means that institutions must clarify who is responsible when AI produces errors, biased feedback, or harmful recommendations. Fairness means that AI systems should not reproduce social, linguistic, cultural, or economic inequalities. Cognitive responsibility means that students should remain intellectually active and not outsource thinking to AI systems.

3.2.6 AI as a Pedagogical Partner

Table 2. Human-Centred Framework of AI as a Pedagogical Partner

Conceptual Dimension	Role of AI	Human Responsibility	Risk if Ungoverned
Personalized learning	Provides adaptive content, feedback, and learning pathways	Teachers interpret learner needs and contextualize AI recommendations	Algorithmic labeling and unequal learning tracks
Intelligent tutoring	Offers immediate feedback, scaffolding, and repeated practice	Teachers monitor progress and provide emotional and conceptual support	Mechanical learning and reduced teacher interaction
Generative learning support	Generates explanations, drafts, examples, and learning materials	Students and teachers verify, revise, and reflect on outputs	Plagiarism, hallucination, and shallow learning
Teacher augmentation	Reduces workload and supports instructional design	Teachers evaluate, adapt, and ethically mediate AI use	Deskilling or overdependence on automation
Ethical governance	Supports data-informed decision-making	Institutions protect privacy, fairness, transparency, and accountability	Data misuse, bias, surveillance, and inequity
AI literacy	Builds future-oriented digital competence	Schools develop critical, ethical, and reflective AI users	Uncritical adoption and cognitive dependence

Based on the synthesis of more than 20 recent journal articles, this paper proposes that AI should be conceptualized as a pedagogical partner. This concept means that AI should function as a supportive educational agent that enhances personalization, feedback, accessibility, assessment, and teacher efficiency while remaining guided by human judgment,

ethics, and educational purpose. Table 2 summarizes the framework of human-centered AI use as pedagogical partner.

This model strengthens the conceptual contribution of the paper. It shows that the central issue is not whether AI should be used in education, but how AI can be pedagogically, ethically, and institutionally governed to strengthen human learning.

The broader literature review reveals that recent studies have examined AI in education from many angles: systematic reviews of AI applications, intelligent tutoring systems, generative AI, student perceptions, teacher professional development, AI literacy, ethics, and risk management. However, these discussions are often fragmented. Studies on personalization often focus on system effectiveness; studies on GenAI often focus on opportunities and academic integrity; studies on teacher roles often focus on readiness; and studies on ethics often focus on risk and regulation.

Therefore, the conceptual gap addressed in this paper is the lack of an integrated human-centred framework that connects AI-supported personalization, teacher augmentation, ethical governance, and AI literacy into one coherent educational argument. This paper responds to that gap by positioning AI as a pedagogical partner—a technology that can support learning only when guided by teacher agency, learner responsibility, institutional accountability, and ethical design.

4 Conclusion

This conceptual paper examined artificial intelligence in education by synthesizing recent literature on AI-supported personalized learning, intelligent tutoring systems, generative AI, teacher augmentation, ethical governance, and AI literacy. The first research question asked how AI can support personalized, adaptive, and accessible learning. The findings indicate that AI can enhance education through adaptive learning systems, intelligent tutoring, automated feedback, learning analytics, individualized content, and generative learning support. These technologies can help students learn at their own pace, receive immediate feedback, access diverse learning materials, and engage in more flexible learning experiences. However, the findings also show that personalization should not be understood as a purely technical process. Effective AI-supported personalization requires teacher mediation, pedagogical alignment, contextual sensitivity, and equitable access.

The second research question asked what ethical, pedagogical, and institutional conditions are required for AI to function as a human-centred pedagogical partner. The synthesis of the reviewed literature suggests that AI can support teachers by reducing administrative workload, assisting lesson planning, generating learning materials, providing assessment support, and offering data-informed insights into student progress. Nevertheless, AI cannot replace the professional, relational, ethical, and emotional roles of teachers. Teachers remain central as instructional designers, mediators, evaluators, and ethical guides who ensure that AI use supports meaningful learning rather than mechanical automation.

The findings also highlight that responsible AI integration requires strong ethical governance. Issues such as privacy, data protection, algorithmic bias, transparency, academic integrity, overdependence, and unequal access must be addressed through institutional policies and responsible pedagogical practice. In addition, AI literacy emerges as an essential future-oriented competence for both teachers and students. AI literacy involves not only technical ability to use AI tools, but also critical evaluation, ethical awareness, prompt literacy, data literacy, and responsible human-AI collaboration.

The implication of this paper is that educational institutions should adopt AI not as a replacement for human teaching and learning, but as a pedagogical partner that strengthens personalization, feedback, accessibility, and instructional efficiency. Teacher education

programs should integrate AI literacy and ethical AI use into professional preparation. Schools and universities should also develop clear guidelines for AI-assisted learning, assessment, data protection, and academic integrity. For classroom practice, teachers should guide students to use AI as a tool for questioning, reflecting, revising, and deepening understanding rather than as a shortcut for completing tasks.

This study is limited because it is conceptual and does not present empirical classroom data. Although it synthesizes recent journal articles, it does not apply a full systematic review protocol with database-specific search strings, screening flow diagrams, or quality appraisal procedures. Future research should therefore conduct empirical studies, systematic reviews, classroom-based interventions, and longitudinal investigations to examine how AI affects learning outcomes, teacher roles, learner autonomy, assessment validity, and educational equity across different levels and contexts.

Overall, this paper concludes that the future of AI in education should be guided by a human-centred framework. AI has significant potential to personalize learning, support teachers, expand access, and develop future learning possibilities. However, its educational value depends on how it is pedagogically designed, ethically governed, and critically used. Therefore, AI in education should be understood not as a substitute for teachers or learners' cognitive effort, but as a carefully governed pedagogical partner that enhances the human purposes of education.

References

Almasri, F. (2024). Exploring the Impact of Artificial Intelligence in Teaching and Learning of Science : A Systematic Review of Empirical. *Research in Science Education*, *54*, 977–997. https://doi.org/10.1007/s11165-024-10176-3

Almatrafi, O., Johri, A., & Lee, H. (2024). A systematic review of AI literacy conceptualization, constructs, and implementation and assessment efforts (2019–2023). *Computers and Education Open*, *6*(100173). https://doi.org/10.1016/j.caeo.2024.100173

Batista, J., Mesquita, A., & Carnaz, G. (2024). Generative AI and Higher Education : Trends , Challenges , and Future Directions from a Systematic Literature Review. *Information*, *15*(676). https://doi.org/10.3390/info15110676

Chan, C. K. Y., & Hu, W. (2023). Students ' voices on generative AI : perceptions , benefits , and challenges in higher education. *International Journal of Educational Technology in Higher Education*, *20*(43). https://doi.org/10.1186/s41239-023-00411-8

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education : the state of the field. *International Journal of Educational Technology in Higher Education*, *20*(22). https://doi.org/10.1186/s41239-023-00392-8

Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-leo, D., Järvelä, S., Mavrikis, M., Rienties, B., Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-leo, D., Järvelä, S., Mavrikis, M., & Rienties, B. (2025). The promise and challenges of generative AI in education. *Behaviour & Information Technology*, *44*(11), 2518–2544. https://doi.org/10.1080/0144929X.2024.2394886

Humble, N. (2024). Risk management strategy for generative AI in computing education : how to handle the strengths , weaknesses , opportunities , and threats ? *International Journal of Educational Technology in Higher Education*, *21*(61). https://doi.org/10.1186/s41239-024-00494-x

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, Stephan Hüllermeier, E., Krusche, S., Kutyniok, G.,

Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, Albrecht , Seidel, T., Stadler, M., & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, *103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kim, A., & Su, Y. (2024). How implementing an AI chatbot impacts Korean as a foreign language learners' willingness to communicate in Korean. *System*. https://doi.org/10.1016/j.system.2024.103256

Labadze, L., Grigolia, M., & Machaidze, L. (2024). Role of AI chatbots in education : systematic literature review. *International Journal of Educational Technology in Higher Education*, *20*(56), 1–17. https://doi.org/10.1186/s41239-023-00426-1

Lee, H. Y., Chen, P. H., Wang, W. S., Huang, Y. M., & Wu, T. T. (2024). Empowering ChatGPT with guidance mechanism in blended learning : effect of self - regulated learning , higher - order thinking skills , and knowledge construction. *International Journal of Educational Technology in Higher Education*, *21*(16), 1–28. https://doi.org/10.1186/s41239-024-00447-4

Létourneau, A., Martineau, M. D., Charland, P., Karran, J. A., Boasen, J., & Léger, P. M. (2025). A systematic review of AI-driven intelligent tutoring systems (ITS) in K-12 education. *Npj Science of Learning*, *10*(29). https://doi.org/10.1038/s41539-025-00320-7

Lin, C. C., Huang, A. Y. Q., & Lu, O. H. T. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education : a systematic review. *Smart Learning Environments*, *10*(41), 1–22. https://doi.org/10.1186/s40561-023-00260-y

Luo, J., Zheng, C., Yin, J., & Teo, H. H. (2025). Design and assessment of AI-based learning tools in higher education : a systematic review. *International Journal of Educational Technology in Higher Education*, *22*(42), 1–27. https://doi.org/10.1186/s41239-025-00540-2

Mouta, A., Pinto-LIorente, M. A., & Torrecilla-Sánchez, M. E. (2024). Uncovering Blind Spots in Education Ethics : Insights from a Systematic Literature Review on Artificial Intelligence in Education. *International Journal of Artificial Intelligence in Education*, *34*, 1166–1205. https://doi.org/10.1007/s40593-023-00384-9

Rojas, M. P., & Chlappe, A. (2024). Artificial Intelligence and Digital Ecosystems in Education : A Review. *Technology, Knowledge and Learning*, *29*, 2153–2170. https://doi.org/10.1007/s10758-024-09732-7

Strzelecki, A. (2024). Students ' Acceptance of ChatGPT in Higher Education : An Extended Unified Theory of Acceptance and Use of Technology. *Innovative Higher Education*, *49*(2), 223–245. https://doi.org/10.1007/s10755-023-09686-1

Tan, X., Cheng, G., & Ling, M. H. (2025). Computers and Education : Artificial Intelligence Artificial intelligence in teaching and teacher professional development : A systematic review. *Computers and Education: Artificial Intelligence*, *8*(November 2024), 100355. https://doi.org/10.1016/j.caeai.2024.100355

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications*, *252*, 124167. https://doi.org/https://doi.org/10.1016/j.eswa.2024.124167

Yim, I. H. Y., & Su, J. (2025). Artificial intelligence (AI) learning tools in K - 12 education : A scoping review. In *Journal of Computers in Education* (Vol. 12, Issue 1). Springer Berlin Heidelberg. https://doi.org/10.1007/s40692-023-00304-9

Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over - reliance on AI dialogue systems on students ' cognitive abilities : a systematic review. *Smart Learning Environments*, *11*(28), 1–37. https://doi.org/10.1186/s40561-024-00316-7