AI integration in higher education: a systematic literature review of tools, perceptions, and pedagogical impacts

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ARTICLE INFO

ABSTRACT

Artificial Intelligence (AI) is rapidly transforming higher education, offering both opportunities and challenges in teaching, learning, and assessment. This systematic literature review (SLR) examines the integration of AI into higher education settings, focusing on its applications, stakeholder perceptions, learning outcomes, and emerging pedagogical practices. A total of 100 peer-reviewed journal articles, published between January 2020 and December 2024, were analysed using the PRISMA framework. The review also employed Voyant Tools, a text mining software, to extract frequently used terms and uncover thematic patterns across studies. Five core themes emerged: (1) AI applications in teaching and learning, (2) personalised learning and skill development, (3) teacher and student perceptions of AI, (4) motivational and engagement strategies, and (5) innovative AI-driven teaching methods such as virtual tutors, AR, and simulations. Findings indicate that AI fosters personalised learning environments, enhances teacher effectiveness, and improves student motivation through adaptive feedback and gamification. However, challenges persist, including ethical concerns, limited AI literacy, potential overreliance, and uneven access across educational contexts. Notably, perceptions differ between generally optimistic students and educators, who express caution regarding AI's long-term pedagogical implications. This review recommends future longitudinal studies, broader exploration across disciplines, and inclusive policy development. These steps are essential to ensure that AI is adopted not only efficiently but also ethically and equitably in higher education.

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1.   INTRODUCTION

Artificial Intelligence (AI) has become a defining force in reshaping various sectors, including education. In higher education, AI is increasingly being adopted to enhance teaching and learning practices, automate administrative processes, and facilitate data-driven decision-making (Chassignol et al., 2018; Zawacki-Richter et al., 2019). One of its most promising applications lies in supporting adaptive and personalised learning environments, where instructional content and pacing can be tailored to individual student needs (Miao et al., 2021). AI also plays a pivotal role in streamlining feedback mechanisms, assessment, and learner support through intelligent tutoring systems, chatbots, and learning analytics platforms.

Despite the enthusiasm surrounding AI in education, its integration raises several critical concerns. These include ethical issues such as data privacy, algorithmic bias, and the potential reduction of human interaction in teaching and learning (Luckin et al., 2016). Additionally, uneven digital access, lack of institutional readiness, and limited AI literacy among both educators and students continue to hinder widespread and effective adoption. There are also concerns about whether AI tools truly support deep learning and critical thinking or reinforce surface-level engagement (Perrotta & Selwyn, 2019).

While numerous studies have explored AI's capabilities and limitations, a comprehensive synthesis of recent research findings, particularly within the context of higher education, is still lacking. To address this gap, the present study systematically reviews relevant literature to map current applications, stakeholder perceptions, and pedagogical impacts of AI in higher education institutions.

The main aim of this study is to investigate the current landscape of AI integration in higher education by addressing the following research questions:

1. How are AI tools currently applied in higher education teaching and learning practices?

2. What are the key perceptions of students and educators regarding AI integration?

3. In what ways does AI influence learning outcomes, engagement, and teaching effectiveness?

4. What challenges and gaps remain in the use of AI in higher education?

By addressing these questions, this review seeks to offer valuable insights and recommendations for educators, policymakers, and institutions navigating AI adoption in tertiary education.

2.   LITERATURE REVIEW

2.1   Skill development

The integration of artificial intelligence (AI) tools into educational settings has shown significant potential for enhancing skill development across disciplines. Boubker (2024) highlights the role of ChatGPT in Moroccan higher education, noting its ability to improve learning outcomes through accurate, relevant, and high-quality responses that aid comprehension and engagement. However, concerns remain regarding over-reliance on AI and its potential to hinder deeper critical thinking skills. Similarly, Alghaithi et al. (2022) emphasise AI's capacity to personalise learning, offering tailored resources and immediate feedback, particularly in technical subjects, thereby fostering inclusivity and optimised outcomes. Nonetheless, ethical considerations such as bias, data privacy, and transparency require careful attention. In engineering education, Sánchez-Ruiz et al. (2023) demonstrate how ChatGPT supports blended learning approaches, including flipped classrooms and game-based learning, enhancing technical proficiency. However, they caution that such integration may not fully develop lateral competencies like critical thinking and problem-solving, revealing the need for a balance between technical and soft skills. In programming education, Yilmaz and Karaoglan Yilmaz (2023) find that ChatGPT significantly boosts computational thinking skills, programming self-efficacy, and student motivation through problem-solving assistance and

immediate feedback. These findings suggest that AI can facilitate complex problem breakdowns and enhance learning confidence. Vashista et al. (2023) extend this discussion to management education, reporting that educators view AI as transformative for teaching efficiency, engagement, and decision-making, while stressing the importance of preserving human-centred learning. Collectively, these studies reveal substantial benefits in skill acquisition and engagement but call for further research into the long-term sustainability of these gains and their impact on deep learning and critical thinking.

2.2   Perception of AI

Teacher and student perceptions of AI in education reveal both enthusiasm and caution regarding its potential. Students often view AI as a valuable tool for improving task performance and educational services (Okulich-Kazarin, 2024), with some even predicting that AI could replace university teachers within five years. Similarly, Chan and Lee (2023) report that Generation Z students are optimistic about AI's role in enhancing productivity, efficiency, and personalised learning. In contrast, Generation X and Y teachers, while acknowledging AI's benefits, express reservations about overreliance, ethical implications, and the need for clear usage guidelines. Students' positive perceptions are further supported by Araujo and Cruz-Correia (2023), who found that AI tools like ChatGPT are valued for academic content generation, brainstorming, and fostering critical thinking and professional skills. However, concerns about potential biases in AI outputs underline the importance of informed use. From the teaching perspective, Galindo-Domínguez et al. (2023) report generally favourable attitudes towards AI but note that only 25% of teachers actively use it. Primary and secondary educators primarily employ AI for content creation, whereas higher education teachers apply it to research and technical tasks, indicating varying readiness and adoption patterns. In the healthcare context, Alghamdi and Alashban (2024) show that newly graduated Saudi medical students perceive AI positively for professional development, though most lack a strong understanding of AI principles, highlighting the need for improved AI education. Collectively, these studies suggest that while AI is perceived as transformative for learning and engagement, successful adoption depends on addressing ethical concerns, bridging knowledge gaps, and aligning teacher–student perspectives for responsible and effective integration.

2.3   AI in specific education

The integration of AI in education demonstrates significant variation across disciplines, with adoption levels and impacts shaped by the distinct pedagogical needs and skill levels of students and teachers (Grájeda et al., 2023). In language learning, AI tools have been shown to enhance communicative competence; however, concerns persist regarding the potential loss of natural interaction, spontaneity, and creativity (Viktorivna et al., 2022). Lee and Maeng (2023) emphasise that while AI can enrich language education through interactive, adaptive learning experiences, it is crucial to preserve human elements such as creativity and emotional engagement. In higher education, AI chatbots provide immediate support, enhancing student engagement and streamlining academic interactions. However, Antony and Ramnath (2023) caution that an overreliance on rapid AI responses may diminish the role of human expertise, highlighting the need for balance. Similarly, Tonbuloğlu (2023) reveals that AI can be customised for specialised fields such as medicine, engineering, and the arts, offering personalised learning, visual and audio support, and assistance in tackling complex tasks, thereby fostering both skill acquisition and engagement. In business and engineering contexts, AI's capacity to cultivate advanced competencies and boost productivity aligns well with industry-relevant pedagogical demands (Grájeda et al., 2023). However, the broader integration of AI must address ethical, pedagogical, and practical concerns, ensuring responsible use tailored to each discipline (Niedbał, Sokołowski & Wrzalik, 2023). Overall, the effectiveness of AI in specific educational contexts depends on strategic customisation that leverages its capabilities while safeguarding essential human interactions and addressing discipline-specific challenges.

2.4   Motivation and engagement

AI technologies hold significant promise for enhancing student motivation and sustaining long-term engagement by personalising learning experiences and aligning them with learners' intrinsic interests and abilities. Onyebuchi et al. (2024) highlight that personalised AI learning, when connected to real-world applications, can foster intrinsic motivation, making learning both dynamic and accessible to students of varying capabilities. Similarly, Shi, Li, and Zhang (2024) emphasise AI-driven situational teaching methods that immerse students in interactive environments, promoting both cognitive and emotional engagement and reinforcing motivation through positive feedback. AI also facilitates the early identification and resolution of motivational barriers through real-time data analysis and tailored interventions. Shi, Li, and Zhang (2024) note that AI can adapt instructional strategies based on ongoing assessments of learning effectiveness, maintaining immersion and motivation. Demir and Güraksın (2022) further suggest that AI-assisted teaching, by delivering interactive and engaging content, can transform negative learning attitudes into positive experiences. Ayanwale and Molefi (2024) add that AI's adaptability, shaped by perceptions of trust, usefulness, and ease of use, enables strategies like trialability to re-engage learners and strengthen continued use intentions. Targeted interventions are also crucial for addressing varied learning abilities. Multimodal AI approaches, combining visual, verbal, and auditory elements, significantly enhance vocabulary acquisition, particularly for higher-ability students. However, these findings reveal a gap in optimising AI to maintain motivation among lower-ability learners and across broader learning contexts beyond vocabulary acquisition or computational thinking. Addressing this gap is essential for maximising AI's potential to foster sustained, meaningful student engagement

2.5   Innovative teaching method

AI-driven teaching methods offer transformative potential for enhancing traditional pedagogical approaches through adaptive technologies and personalised learning tools. By aligning educational materials with individual learning styles and needs, AI fosters both personalised and collaborative learning experiences. Tools such as AI-enabled platforms, web-based simulations, chatbots, and recommendation systems can categorise learners based on skills, predict performance, and deliver tailored feedback, thereby complementing foundational teaching and aiding comprehension of complex subjects (Yang, Shankar, & Velliangiri, 2023; Kaiss, Mansouri & Poirier, 2023; Seebut, Wongsason, & Kim, 2024). These innovations also support meaningful collaborative tasks, enhancing engagement and interactivity in learning environments. However, integrating AI into teaching methods presents challenges, particularly regarding the preservation of essential human elements in education. Yang, Shankar, and Velliangiri (2023) and Kaiss, Mansouri, and Poirier (2023) caution against overreliance on AI, which could undermine mentorship, emotional support, and the nuanced guidance provided by educators. Lai (2021) stresses the importance of maintaining interactive guidance and emotional connection, ensuring AI serves to enhance rather than replace professional instructional roles. Students increasingly expect AI to facilitate social interaction and support higher-order thinking, revealing the need for thoughtful design in AI applications (Lai, 2021; Seebut, Wongsason, & Kim, 2024). Effective integration must therefore balance technological innovation with the irreplaceable human dimensions of teaching. The current research gap lies in developing frameworks that harmonise AI's adaptive capabilities with the preservation of mentorship and emotional engagement, ensuring AI complements rather than diminishes the core human aspects of education.
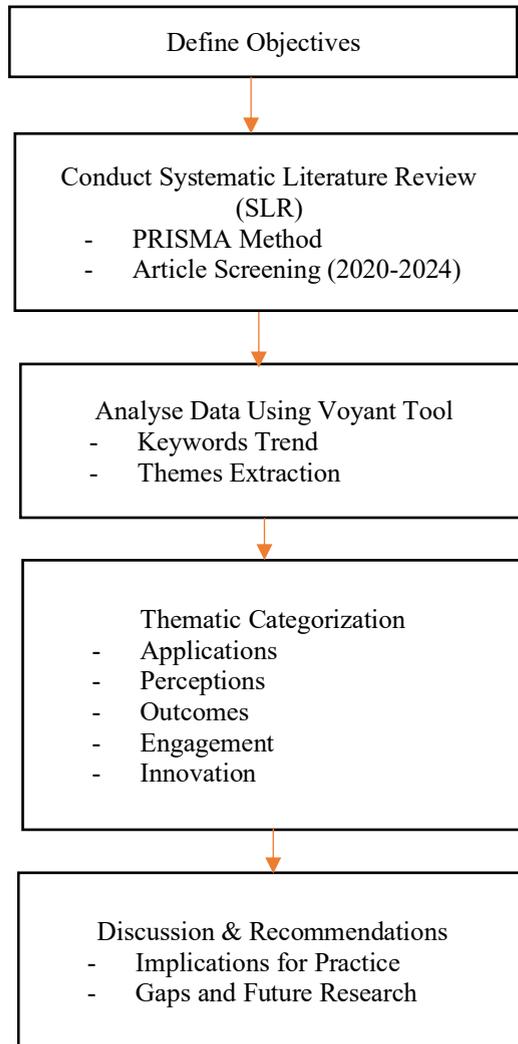
3.   METHODOLOGY

Fig. 1. Research framework diagram based on the PRISMA methodology, showing the process from objectives to discussion
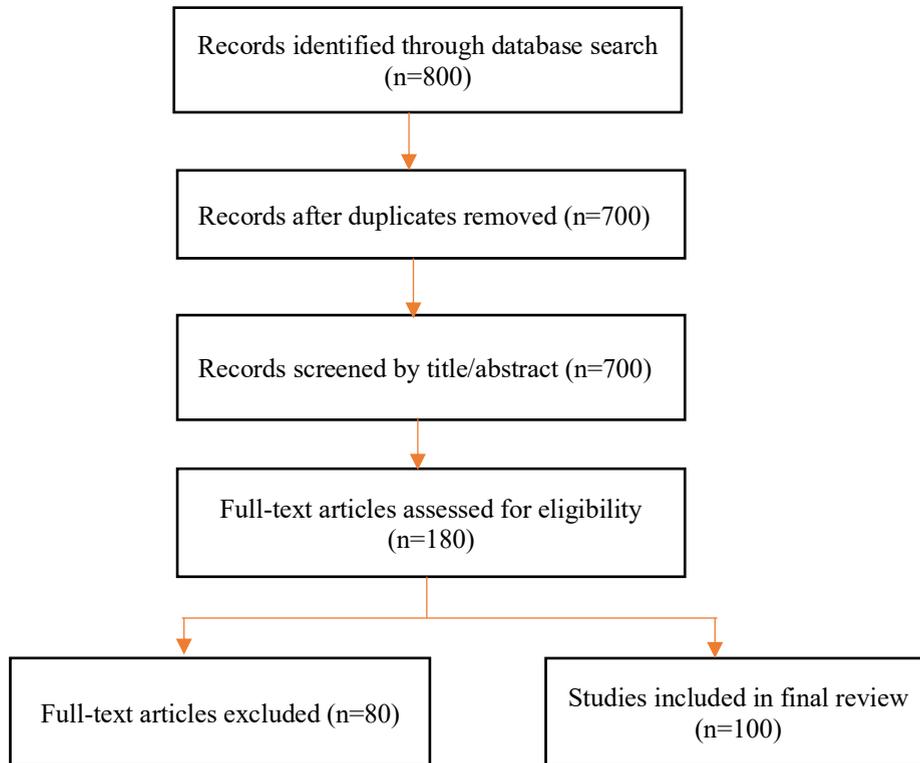
PRISMA flow diagram

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┌─────────────────────────────────────────┐
│  Records identified through database search │
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│  Records after duplicates removed (n=700) │
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│  Records screened by title/abstract (n=700) │
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│  Full-text articles assessed for eligibility │
│                 (n=180)                    │
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│ Full-text articles    │  │ Studies included in   │
│ excluded (n=80)       │  │ final review (n=100)  │
└──────────────────────┘  └──────────────────────┘
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Fig. 2. Research procedure

To complement thematic analysis, Voyant Tools, a web-based text mining platform (Rockwell & Sinclair, 2016), was used to identify frequently occurring terms and thematic patterns across the full texts. Its use provided additional insights into the dominant language and concepts that emerged from the literature.

Table 1. Summarising key search information

Criteria	Description
Databases Searched	Scopus, ScienceDirect, Taylor & Francis, Springer, Wiley
Time Frame	January 2020 – December 2024
Keywords Used	"Artificial Intelligence", "AI in education", "higher education", "AI tools", "teaching and learning", "systematic literature review"
Inclusion Criteria	Peer-reviewed journal articles, English language, Higher Education focus
Exclusion Criteria	Non-peer-reviewed sources, articles unrelated to education or AI

To ensure a comprehensive and relevant review of the literature on the use of Artificial Intelligence (AI) in Education, a clear selection criterion was established. Articles were selected based on the following criteria: they needed to be published between January 1, 2020, and December 31, 2024, to capture recent developments in the field; they had to be written in English to maintain consistency in analysis; and they had to be peer-reviewed to ensure the quality and credibility of the sources. Additionally, the articles had to explicitly focus on the application of AI in educational settings, covering areas such as AI-driven personalised learning, AI in assessment and evaluation, AI for administrative purposes in education, and ethical considerations of AI in education. The search was conducted in major academic databases, including PubMed, IEEE Xplore, Google Scholar, Scopus, and Web of Science, using a combination of keywords such as "artificial intelligence," "education," "machine learning," "educational technology," "AI-driven learning," and "AI in education."

The data collection process involved several steps to ensure that a comprehensive set of articles that met the selection criteria could be gathered. Initially, searches were conducted in the specified academic databases using the mentioned keywords. Boolean operators were used to refine the search results (e.g., "artificial intelligence AND education"). Then, the titles and abstracts of the retrieved articles were screened to identify those that met the selection criteria. Articles that did not focus on the use of AI in education or were not peer-reviewed were excluded. After that, the full texts of the remaining articles were reviewed to ensure they met all inclusion criteria. This would eliminate the articles that did not provide substantial information on the application of AI in educational contexts (despite having relevant titles and abstracts).

The relevant data from the selected articles were extracted and compiled into a structured dataset. This dataset included information such as the article title, authors, publication year, journal name, study type, focus area within AI in education, key findings, and other pertinent details. The final set of 100 articles was then compiled into an Excel spreadsheet, which served as the foundation for subsequent text analysis, using Voyant Tools. The detailed information from the Excel file contains comprehensive data about the selected articles and was imported into Voyant Tools for text analysis. This analysis involved generating keyword frequencies, identifying major themes, and visualising trends over time. Through this methodology, a rigorous and systematic approach was ensured to select and analyse relevant literature on AI in education. This process aimed to capture the breadth and depth of recent research in the field, providing a robust foundation for the thematic review.

Voyant Tools is a web-based suite for text analysis. It is designed to help users explore and interpret textual data more easily. The suite offers a variety of powerful tools and visualisations that are especially useful for analysing large collections of text. With Voyant Tools, users can perform various text analysis tasks such as counting word frequencies, analysing keywords in context (KWIC), examining trends, and conducting topic modelling. The platform is highly interactive, allowing users to dive deep into their data and discover patterns and themes that may not be immediately obvious.

The decision to use Voyant Tools for this thematic review was based on several important factors. Firstly, Voyant Tools provides a wide range of analytical functions that are necessary for conducting a comprehensive analysis of the selected literature. Its ability to generate word clouds, frequency lists, and keyword trends aids in identifying the most significant themes and concepts within the corpus. Secondly, the suite offers robust visualisation options, including word clouds and trend graphs, which are extremely useful for presenting findings concisely and compellingly. These visualisations effectively showcase the prevalence and evolution of key terms and themes over time.

Moreover, Voyant Tools is a user-friendly and accessible tool that does not require advanced technical skills to operate. This ease of use ensures that the analysis can be conducted efficiently, allowing users to focus on interpreting and synthesising the findings rather than getting caught up in technical execution. Additionally, the interactive nature of Voyant Tools enables dynamic exploration of text data. Users can simply click on terms and themes within the visualisations to view their contexts and connections,

providing deeper insights into the relationships between different concepts. Given the large number of articles (100) included in this review, Voyant Tools is particularly advantageous due to its ability to handle and process large volumes of text quickly and effectively.

Voyant Tools supports research reproducibility and transparency. Other researchers can readily replicate the analyses conducted, and the tool's outputs can be shared and verified, thereby enhancing the study's robustness. By using Voyant Tools, text data from selected articles could be systematically analysed. The key themes, trends, and insights that form the basis of the thematic review could also be revealed. This approach ensures a comprehensive and detailed examination of the literature on AI in education, providing valuable contributions to the field.

4.   FINDINGS AND ANALYSIS
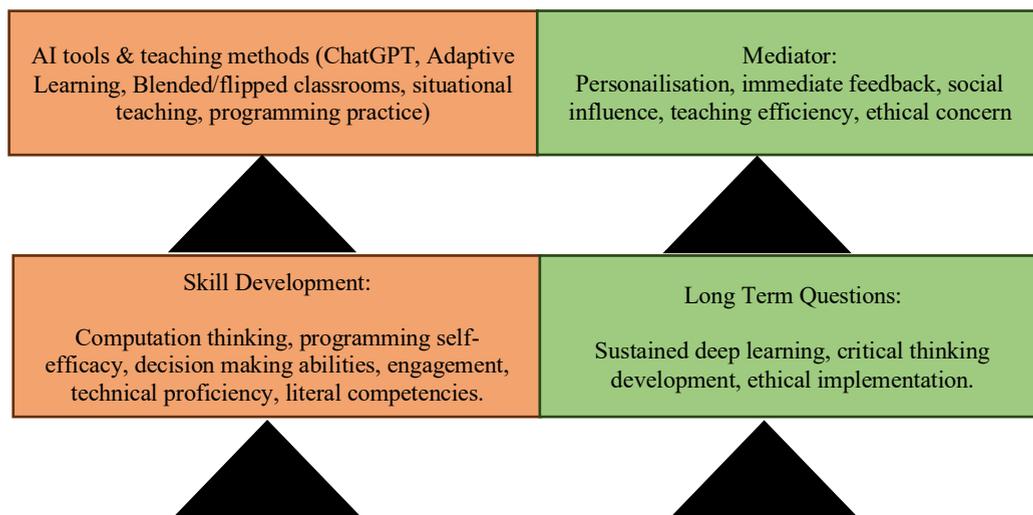
4.1   Finding 1

Fig. 3. Impact of AI-driven teaching methods on skill development conceptual framework

The conceptual framework above illustrates how AI-driven teaching methods influence educational outcomes and skills development. It begins with the integration of adaptive technologies, such as AI-enabled platforms, chatbots, web-based simulations, and recommendation systems. These tools function as catalysts, providing personalised learning paths, real-time feedback, and collaborative learning opportunities tailored to individual learner needs (Yang, Shankar, & Velliangiri, 2023). The next stage highlights the mediating factors that shape the effectiveness of AI integration. These include student engagement, self-directed learning, and educator facilitation, all critical in ensuring that AI complements rather than replaces human instructional roles (Kaiss, Mansouri & Poirier, 2023; Lai, 2021). Maintaining emotional connection, mentorship, and critical thinking support remains central to the learning process. From these mediators, the framework maps the development of key skills and outcomes: critical thinking, problem-solving abilities, programming skills, self-efficacy, and motivation. These competencies not only enhance academic performance but also improve employability and adaptability in rapidly evolving industries (Seebut, Wongsason, & Kim, 2024). Finally, the framework acknowledges the long-term considerations of AI adoption, emphasising the need for ethical integration, balanced human–AI interaction, and sustainable skills development that prepares learners for future societal and professional challenges.

4.2   Finding 2

Change perception to perceptions

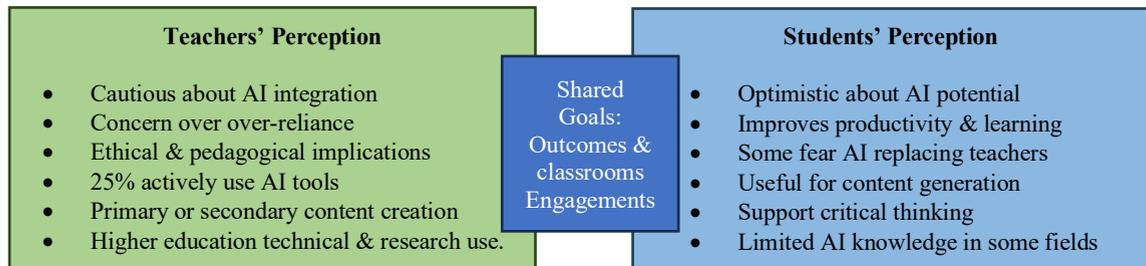| Teachers' Perception		Students' Perception
• Cautious about AI integration • Concern over over-reliance • Ethical & pedagogical implications • 25% actively use AI tools • Primary or secondary content creation • Higher education technical & research use.	Shared Goals: Outcomes & classrooms Engagements	• Optimistic about AI potential • Improves productivity & learning • Some fear AI replacing teachers • Useful for content generation • Support critical thinking • Limited AI knowledge in some fields

Fig. 4. Two-sided infographic on the teachers' and students' perceptions of AI

The two-sided infographic above presents a clear, side-by-side comparison of the teachers' and students' perceptions of AI in education, highlighting both differences and shared understandings. The left side is dedicated to teachers, particularly those from Generation X and Y, who generally acknowledge AI's potential for enhancing teaching and learning but express caution regarding overreliance, ethical implications, and the need for clear guidelines. This section also notes their selective use of AI; primary and secondary school teachers often apply it for content creation, while higher education instructors focus on research and technical applications. The right side of the diagram focuses on students, especially Generation Z, who are largely optimistic about AI's role in boosting productivity, personalising learning, and generating academic content. This also reflects the concerns of some students who fear AI could replace teachers, and those with limited understanding of AI principles, revealing the need for AI literacy programmes. At the centre, a shared space highlights the common ground where both groups acknowledge AI's potential to enhance educational outcomes, foster engagement, and expand learning opportunities, while agreeing on the importance of responsible and informed use. The structure visually balances optimism and caution, making it easy to compare perspectives and identify actionable strategies for effective AI integration in education.

4.3   Finding 3

Customisation

The comparative matrix infographic on AI Integration Across Educational Disciplines presents a clear, side-by-side comparison of how AI is adopted and impacts various fields of study. The matrix is organised into four columns: Discipline, Key AI Applications, Benefits, and Challenges. The rows represent specific disciplines such as Engineering, Business, Arts, Medicine, and Language Learning. In the Key AI Applications column, engineering highlights simulation tools and predictive analytics, business focuses on process automation and AI-driven decision support, arts emphasise creative generation tools, medicine showcases diagnostic AI and virtual patient simulations, and language learning features intelligent tutoring systems and chatbots. The Benefits column outlines discipline, specific advantages, for example, engineering gains from improved problem-solving efficiency, business benefits from productivity and strategic insights, the arts from enhanced creativity, medicine from more accurate diagnostics, and language learning from improved communicative competence. The Challenges column addresses unique concerns such as maintaining creativity in the arts, balancing AI with human expertise in business, preserving spontaneity in language learning, and ethical concerns in medicine. By visually aligning disciplines against their respective AI uses, strengths, and obstacles, the matrix allows the viewers to quickly grasp the diversity of AI's role in education while emphasising the need for tailored integration strategies.

Table 2. The comparative matrix on AI integration across educational disciplines

|	**Medicine**	**Engineering**	**Business**	**Arts**	**Language Learning**
AI Adoption	*Medium-High*	*High*	*High*	*Medium*	*Medium*
Benefits	Personalised learning diagnostic simulations, visual/audio anatomy tools	Problem-solving simulations, CAD-AI integration, skill acceleration	Market analysis automation, AI decision support, productivity boost	Creative assistance, visual/audio enhancement, adaptive critique	Speech recognition, interactive dialogue, cultural context tools
Challenges	Ethical concerns in diagnosis, patient privacy	Over-reliance on AI-generated solutions, the cost of implementation	Risk of depersonalised decisions, data security issues	Creativity dilution, authenticity concerns	Loss of spontaneity, reduced face-to-face interaction
Common Needs across all Disciplines	Customisation to learning objectives, Balancing AI capabilities with human expertise, and Ethical and pedagogical safeguards.				

4.4 Finding 4

Personalisation
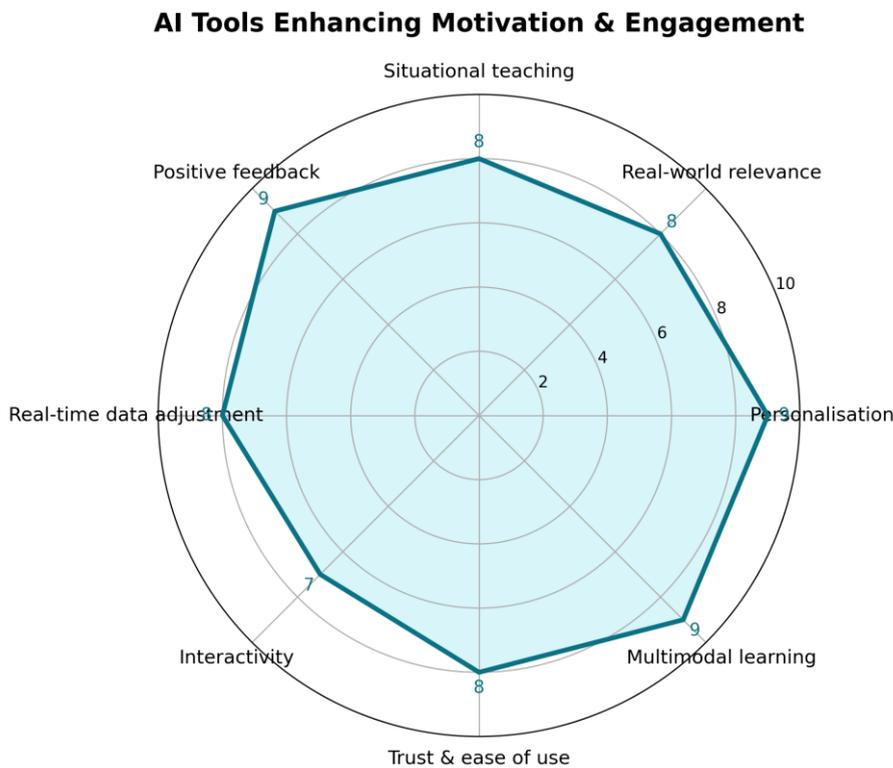
Fig. 5. Motivation and engagement in AI-assisted learning

The radar chart above on AI Tools Enhancing Motivation & Engagement visually depicts eight key factors identified in recent studies as vital for maintaining student motivation and long-term engagement in AI-supported learning environments. Each axis represents a specific factor, with scores on a 0-10 scale indicating the relative strength of each factor based on a review of the literature. Personalisation (score: 9) stands out as the most influential factor, demonstrating AI's ability to customise learning experiences to individual needs and preferences. Multimodal learning (score: 9) and positive feedback (score: 9) are equally important, highlighting the benefit of combining visual, auditory, and verbal cues with reinforcement to keep enthusiasm high. Real-world relevance (8) and situational teaching (8) show how contextual, immersive learning encourages deeper engagement. AI's ability for real-time data adjustment (8) ensures instructional strategies stay responsive, while trust and ease of use (8) support students' willingness to adopt AI tools. Interactivity (7), although slightly lower, still plays a vital role in making learning active and participatory. The chart's balanced yet high scores across most factors suggest that AI-driven education succeeds when combining personalisation, multimodal delivery, and adaptive teaching methods, creating a learning environment that is dynamic, inclusive, and sustainable for diverse student abilities.
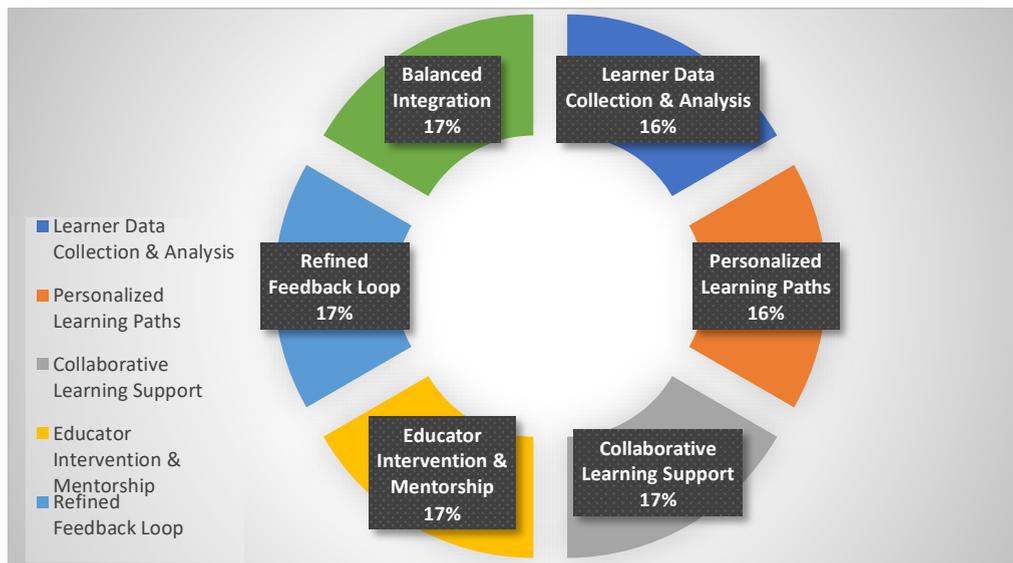
4.5   Finding 5

Fig. 6. Circle diagram on integrating AI-driven teaching methods

The illustrated cycle diagram above represents the continuous process of integrating AI-driven teaching methods with traditional pedagogical approaches to create a balanced and enriched learning environment. The cycle begins with AI Integration in Teaching Methods, where adaptive technologies, personalised learning tools, and intelligent platforms are introduced into the classroom. These tools enable Personalised and Collaborative Learning, aligning content with individual learning styles and fostering peer interaction through simulations, chatbots, and recommendation systems. From here, the process moves to Enhanced Learning Outcomes, where AI tools support the students in mastering complex concepts, predicting performance, and providing tailored feedback that complements traditional teaching. This step boosts engagement, comprehension, and skill development. The next stage emphasises Human-AI Balance, highlighting the importance of retaining human mentorship, emotional support, and interactive guidance. This ensures that AI acts as a supplement rather than a replacement for educators' roles. Finally, the cycle proceeds to Ethical and Effective AI Design, where AI applications are refined to maintain social

interaction, promote higher-order thinking, and uphold ethical standards. The cycle then loops back, with ongoing evaluation and improvement, ensuring AI integration remains student-focused, ethically sound, and aligned with educational goals while preserving essential human elements in teaching.

5.   DISCUSSIONS

5.1   Impact on outcomes and skills development

The investigation into ChatGPT's role in enhancing students' learning outcomes is a crucial area of research. Specifically, one study focuses on how ChatGPT can improve educational experiences and outcomes across various subjects. Likewise, another research examines the impact of ChatGPT in programming education, specifically exploring its effect on the students' computational thinking skills, programming self-efficacy, and motivation towards lessons. Additionally, the implications of AI on management education are considered, with a particular emphasis on its influence on both students and educational institutions from the perspective of educators. Further research analyses the broader influence of AI on higher education, scrutinising its effects on the teaching and learning process, assessment methods, and grading. Moreover, it predicts how AI will shape graduates' future careers. Additionally, the potential impact of ChatGPT on blended learning (b-learning) methodologies in engineering education, particularly in mathematics, is investigated to gain insights into how AI can enhance learning in technical subjects.

Boubker (2024) conducted a study on the role of ChatGPT in Moroccan higher education institutions, focusing on its potential to improve learning outcomes in various subjects. The study emphasised the importance of high-quality output from ChatGPT for it to be perceived as useful. Additionally, accurate, relevant, and high-quality responses can greatly assist in understanding complex subjects, providing clear explanations, and offering additional information to enhance the learning process. Social influence also plays a significant role; when students observe their peers effectively using ChatGPT, they are more likely to adopt the tool themselves. The study also found that student satisfaction is directly linked to the ease of use of ChatGPT. Students who find the tool intuitive are more likely to incorporate it into their daily study routines. However, these promising findings raise questions about the depth of learning facilitated by ChatGPT. Does reliance on AI tools like ChatGPT truly promote a deeper understanding of subjects, or does it create a dependency that hinders critical thinking skills? This gap in understanding the long-term impact of AI tools on learning depth is particularly important when considering the broader effects of AI in education.

Alghaithi et al. (2022) investigated the broader impact of AI on higher education, specifically focusing on how it can transform teaching, learning, assessment, grading, and career development. One key advantage of AI is its ability to personalise teaching methods to cater to the unique needs of individual students. By using student performance data to tailor educational content and strategies, AI can optimise learning outcomes. This personalised approach ensures that education is more inclusive and effective, accommodating various learning paces and preferences. For example, AI can identify areas where students struggle in subjects such as mathematics or programming and subsequently provide targeted resources to enhance their understanding. Moreover, AI systems can offer immediate feedback, which is particularly important for subjects that require continuous practice. However, these advancements also give rise to ethical considerations, such as the need to safeguard data privacy, avoid biases in AI algorithms, and promote transparency. Therefore, the study emphasises the importance of higher education institutions addressing these ethical implications. Although the benefits of AI in education are evident, there is an ongoing debate as to whether the ethical challenges and potential biases introduced by AI can be effectively managed. This gap in addressing the ethical deployment of AI in education necessitates further examination, especially considering concerns raised by Sánchez-Ruiz et al. (2023) regarding the impact on lateral competencies.

Sánchez-Ruiz et al. (2023) explored the integration of AI, specifically ChatGPT, into blended learning methodologies in engineering education. Their study focused on a Mathematics I course for Aerospace Engineering students, demonstrating how blended learning combines in-person instruction with online components to create a more flexible learning environment. Specifically, the use of ChatGPT enabled flipped classrooms, game-based learning, practical problem-solving, and the utilisation of advanced computational tools. Consequently, while the study indicated positive feedback from students, it also raised concerns about the potential impact on the development of lateral competencies like critical thinking and problem-solving skills. This suggests that while AI tools can enhance technical proficiency, they may not fully support the cultivation of essential soft skills. Therefore, the challenge lies in achieving a balanced approach where AI supplements rather than replaces traditional teaching methods. This prompts the question: Can AI integration in education effectively harmonise technical proficiency with the development of critical lateral competencies? This gap reveals the necessity for further research on the holistic development of students in AI-enhanced learning environments, reinforcing the concerns and questions posed by both Boubker (2024) and Alghaithi et al. (2022). Meanwhile, studies by Boubker, Alghaithi, and Sánchez-Ruiz highlight the promising potential of AI tools like ChatGPT in enhancing educational outcomes. Nonetheless, they also reveal significant gaps, including the long-term impact on deep learning, ethical considerations, and the balance between technical skills and lateral competencies. Consequently, further investigation is needed to address these areas. Ultimately, it is crucial to address these gaps to responsibly and effectively integrate AI in education.

Skills development and the implications for management education have also been explored by researchers under this theme. The study conducted by Yilmaz and Karaoglan Yilmaz (2023) demonstrates that integrating ChatGPT into programming education significantly enhances students' computational thinking skills, programming self-efficacy, and motivation towards lessons. The research was specifically conducted with 45 undergraduate students in a university-level programming course, using a robust experimental design with pretest-post-test control groups. The students in the experimental group, who used ChatGPT during weekly programming practices, exhibited markedly higher computational thinking skills, suggesting that the AI tool facilitates the breakdown of complex problems and fosters deeper understanding. These students also reported increased programming self-efficacy, likely due to ChatGPT's immediate feedback and problem-solving assistance, which boosted their confidence in coding. Furthermore, their motivation towards the lessons was significantly higher, indicating that ChatGPT's interactive and responsive nature makes learning more engaging and reduces frustration. Therefore, the study emphasises the importance of strategically integrating AI tools like ChatGPT to complement traditional teaching methods and optimise educational outcomes. While the findings are promising, the study also calls for further research to explore the long-term impacts and best practices for AI use in various educational contexts, highlighting the need for continued investigation into AI's educational potential.

Similarly, Vashista et al. (2023) investigate the influence of AI on management education, with a focus on the perspectives of educators and the implications for students and educational institutions. The research utilises a qualitative methodology, including interviews and surveys with educators from management schools, to explore their views on how AI impacts teaching practices, curriculum design, and student engagement. The study finds that educators perceive AI as a transformative tool that improves teaching efficiency, student involvement, and decision-making capabilities. They stress the importance of integrating AI in a way that maintains the human aspects of education, such as critical thinking and ethical considerations. The study also highlights the need for ongoing professional development for educators to effectively incorporate AI into management education. Therefore, collaboration among instructors, educational institutions, and AI developers is crucial for the responsible integration of AI. Overall, the findings offer valuable insights for policymakers and educational strategists, encouraging discussions on how to harness the benefits of AI while ensuring the delivery of quality education and meaningful human interaction in management learning environments.

These studies highlight the benefits, including improved computational thinking skills, self-efficacy in programming, motivation, teaching efficiency, student engagement, and decision-making abilities. However, a notable gap in research remains when it comes to understanding the long-term impacts and sustainability of these benefits. Specifically, further investigation is needed to explore how the use of AI tools, like ChatGPT, affects deep learning and critical thinking skills over time.

5.2   Teacher and student perception of AI

The perceptions of teachers and students on the role of AI in enhancing educational outcomes and classroom engagement reveal a landscape of optimism and caution. According to Okulich-Kazarin (2024), students generally see AI as a valuable tool that optimises task performance and improves educational services. However, more than 10% of these students also believe that AI could replace university teachers within five years, reflecting both the potential benefits and underlying concerns regarding AI's integration into education. Similarly, Chan and Lee (2023) found that Generation Z students are optimistic about AI's potential to boost productivity, efficiency, and personalised learning, thereby enhancing educational outcomes. In contrast, Generation X and Generation Y teachers, while acknowledging these benefits, express significant concerns about overreliance on AI and the ethical and pedagogical implications it brings.

The positive perceptions of AI's role in education are further supported by Araujo and Cruz-Correia (2023), who report that students view AI technologies like ChatGPT as beneficial for generating academic content, brainstorming, and developing critical thinking and professional skills. This indicates a broad recognition of AI's capacity to enhance learning experiences. However, concerns about biases in AI and the necessity for informed use suggest a need for caution and proper guidance in AI integration. Additionally, Galindo-Domínguez et al. (2023) highlight that while teachers generally hold a positive attitude towards AI, only 25% have actively incorporated AI tools into their teaching. Primary and secondary school teachers primarily use AI for content creation, while higher education teachers leverage AI for academic and technical purposes, including enhancing student engagement through experimentation and research-related tasks.

Freshly graduated Saudi Arabian medical students, as reported by Alghamdi and Alashban (2024), also perceive AI positively, recognising its significant role in healthcare and its potential to enhance professional development. Despite this positive outlook, only a minority of these students have a strong understanding of AI principles, pointing to a need for better integration of AI education within medical curricula to improve comprehension and ease of use. This highlights a critical area for educational development, emphasising the necessity for comprehensive AI training programmes to ensure that students and teachers alike can fully leverage AI's potential to enhance educational outcomes and classroom engagement.

The integration of AI technologies into the educational environment presents a range of concerns and challenges for teachers and students, as indicated by several studies. Okulich-Kazarin (2024) highlights the potential impasse of AI replacing university teachers, which poses a conflict between enhancing educational quality and maintaining job security. Chan and Lee (2023) identify issues such as excessive reliance on AI, ethical and pedagogical implications, and the importance of establishing guidelines and policies for responsible use. Araujo and Cruz-Correia (2023) emphasise the potential biases in AI-generated content and stress the need for informed utilisation of AI tools. Alghamdi and Alashban (2024) draw attention to students' limited understanding of fundamental AI principles and their discomfort with AI-related terminology, indicating a critical need for better integration of AI education to enhance understanding and usability. Collectively, these studies suggest that while AI holds transformative potential in education, it is crucial to address these concerns to achieve effective and responsible implementation.

Teacher and student perceptions of AI in education differ significantly, which affects how AI tools are implemented and accepted. Generation Z students are optimistic about the potential of AI to improve productivity and even replace teachers soon. In contrast, Generation X and Y teachers approach the

integration of AI cautiously due to concerns about relying too heavily on technology, ethical issues, and the need for clear guidelines (Chan & Lee, 2023; Okulich-Kazarin, 2024). Students generally have a positive view of AI tools for enhancing learning outcomes through content generation and academic support, but they also express concerns about biases and proper use (Araujo & Cruz-Correia, 2023). Moreover, while teachers at all educational levels generally have positive attitudes towards AI, their integration of AI differs. Primary and secondary educators focus on content creation, while instructors in higher education use AI for technical and research purposes. This reflects different perceptions and levels of readiness for adopting AI (Galindo-Domínguez et al., 2023. These insights highlight the complexity of AI's role in education, emphasising the need for strategies to align perceptions and facilitate effective implementation across diverse educational environments.

5.3 AI in a specific education context

The integration of AI technologies in various educational disciplines reveals significant variation. Each field encounters unique challenges and opportunities. For example, engineering, business, and arts exhibit different levels of AI adoption and impact. These variations are influenced by the varying proficiency levels among the students and teachers, which ultimately affect the overall academic experience (Grájeda et al., 2023). In the context of language learning, AI tools enhance communicative competence while raising concerns about the potential loss of natural interaction, spontaneity, and creativity (Viktorivna et al., 2022). Similarly, AI chatbots have been shown to significantly enhance student engagement and support in higher education, but they also introduce challenges, such as striking a balance between quick AI-driven assistance and the need for human expertise (Antony & Ramnath, 2023).

AI technologies can be customised to meet the specific learning needs and objectives of students in specialised fields by focusing on the distinct requirements of each discipline. For instance, in fields such as medicine, engineering, or the arts, AI can be used to offer personalised learning experiences, increase engagement through visual and audio content, and provide specialised learning support. This ensures that these tools effectively aid in complex inquiries and skill development (Tonbuloğlu, 2023). In language education, it is crucial to carefully adapt AI to support interactive learning while maintaining the essential human elements of communication, creativity, and emotional engagement (Lee & Maeng, 2023; Viktorivna et al., 2022). Furthermore, AI's role in areas like engineering and business can evolve to cultivate advanced skills and improve productivity, aligning AI's capabilities with the unique pedagogical requirements of these fields (Grájeda et al., 2023).

Overall, while integrating AI into education offers significant benefits in various contexts, its effectiveness largely relies on how well it is customised to meet the specific needs and challenges of each discipline. This requires striking a careful balance between leveraging the potential of AI to enhance learning and addressing the ethical, pedagogical, and practical concerns that arise in specialised educational environments (Niedbał, Sokołowski & Wrzalik, 2023).

5.4 Motivation and engagement

AI tools have the potential to greatly enhance student motivation and maintain long-term engagement. This can be achieved by offering personalised learning experiences that align with students' intrinsic interests and computational thinking abilities. A study by Martín-Núñez et al. (2023 suggests that personalised AI learning can foster intrinsic motivation by connecting AI concepts to real-world applications. This approach not only makes learning dynamic but also accessible to students with varying capabilities. Additionally, Shi, Li, and Zhang (2024) stress the significance of AI-driven situational teaching methods. These methods immerse students in interactive learning environments, promoting cognitive and emotional engagement and reinforcing motivation through positive feedback. Collectively, these studies highlight the crucial role of AI in tailoring learning experiences to keep students engaged in both individual and group settings.

AI also plays a crucial role in identifying and addressing factors that harm student motivation. This is often done through real-time data analysis and personalised interventions. In a study by Shi, Li, and Zhang (2024, it was shown that AI can adjust instructional strategies based on data about learning effectiveness and engagement. This helps to maintain student immersion and motivation. Demir and Güraksın (2022) suggest that AI-assisted teaching can shape students' perceptions by providing interactive content. This can transform negative attitudes into positive learning experiences. Furthermore, as noted by Ayanwale et al. (2024), AI's adaptability allows for adjustments based on students' perceptions of trust, usefulness, and ease of use. This includes interventions like trialability, which can re-engage students and strengthen their intention to continue using AI tools.

Moreover, AI's tailored interventions address motivational challenges by catering to different learning abilities, making it an effective tool for sustaining long-term engagement. Multimodal AI strategies, incorporating visual, verbal, and auditory elements, can enhance vocabulary acquisition, especially for higher-ability students. These findings illustrate that AI not only identifies the factors that diminish motivation but also provides targeted interventions that amplify the students' success across diverse learning levels, fostering sustained and meaningful engagement with educational content. The analysis highlights a research gap regarding the optimisation of AI tools to meet the needs of a wider range of learning abilities. Specifically, it focuses on sustaining motivation for lower-ability learners and addressing diverse learning contexts beyond vocabulary acquisition or computational thinking.

5.5   Innovative teaching method

AI-driven teaching methods have the potential to greatly enhance traditional pedagogical approaches. By incorporating adaptive technologies and personalised learning tools, these methods can align educational materials with individual learning styles and needs. This, in turn, fosters personalised and collaborative learning experiences. AI-enabled platforms, web-based simulations, and tools like chatbots and recommendation systems are utilised to achieve this goal. One example of how AI can enhance education is through its ability to categorise the learners based on their skills, predict their performances, and provide tailored feedback. This complements the foundational teaching provided by traditional methods and supports students in understanding complex subjects and engaging in meaningful collaborative tasks. Several studies have demonstrated the effectiveness of AI-driven teaching methods in improving the learning experience (Kim & Burić, 2020; Yang, Shankar, & Velliangiri, 2023; Kaiss, Mansouri, & Poirier, 2023; Seebut, Wongsason, & Kim, 2024).

Despite the promising benefits, integrating AI into teaching methods comes with challenges and ethical considerations. One major concern is the risk of relying too heavily on AI tools, which could undermine important human elements of teaching, including personalised mentorship, emotional support, and interactive guidance. It is crucial to strike a careful balance between AI and human interaction to maintain engagement and ensure that the educators' critical role in providing personalised guidance and fostering emotional connections in the learning environment is not replaced Yang, Shankar, & Velliangiri, 2023; Kaiss, Mansouri, & Poirier, 2023; Lai, 2021).

Moreover, the students' expectations for AI to provide social interaction and support higher-order thinking emphasise the importance of careful design in AI applications. Educators must ensure that AI tools are utilised to enhance, rather than replace, professional instructional guidance. The effective integration of AI should strive to support and enrich the learning experience, while still maintaining the essential human elements that contribute to a well-rounded educational experience (Lai, 2021; Seebut, Wongsason, & Kim, 2024). From the analysis, the research gap lies in the need to balance the integration of AI technologies with the preservation of essential human elements in teaching.

6.   CONCLUSION

This systematic review reveals that AI integration in higher education enhances personalised learning, skill acquisition, and student engagement through adaptive technologies and innovative pedagogical methods. While the students generally perceive AI positively, the educators express caution due to ethical concerns, uneven access, and the need to preserve human-centric teaching. A balanced, ethical, and discipline-sensitive approach is essential for sustainable AI adoption. To support responsible AI integration, institutions should implement inclusive AI literacy programmes for educators and students to bridge the understanding gaps and promote informed use. Clear ethical guidelines and institutional policies must be established to address data privacy, algorithmic bias, and the preservation of human mentorship. Additionally, discipline-specific AI strategies should be developed to align with pedagogical goals while safeguarding creativity, emotional engagement, and critical thinking. Future research should focus on longitudinal studies to evaluate AI's long-term impact on deep learning, critical thinking, and skill sustainability. Exploration of AI's role in underrepresented disciplines and diverse educational contexts is needed to ensure equitable integration. Moreover, developing frameworks for human–AI collaboration that maintain emotional support and mentorship while leveraging AI's adaptive capabilities will be crucial for effective implementation.

7.   RECOMMENDATIONS

To ensure responsible and effective AI integration in higher education, institutions should implement inclusive AI literacy programmes for both educators and students. These programmes will help bridge understanding gaps and promote informed, ethical use of AI technologies. Additionally, universities must establish clear ethical guidelines and institutional policies that address critical issues such as data privacy, algorithmic bias, and the preservation of human mentorship. Strategic discipline-specific integration plans should also be developed to align AI applications with pedagogical goals, ensuring that creativity, emotional engagement, and critical thinking remain central to the learning experience.

Future research should focus on conducting longitudinal studies to evaluate the long-term effects of AI on deep learning, critical thinking, and skill sustainability. It is also essential to explore AI's role in underrepresented disciplines and diverse educational contexts to promote equitable and effective integration. Moreover, researchers should investigate frameworks for human–AI collaboration that maintain emotional support and mentorship while leveraging AI's adaptive capabilities to enhance the learning outcomes.

University leaders, policymakers, and educators must take proactive steps to integrate AI in ways that are pedagogically sound and ethically responsible. Leadership should prioritise the development of institutional frameworks that support AI adoption while safeguarding academic integrity and inclusivity. Policymakers must collaborate with educational institutions to create regulatory standards that ensure transparency, fairness, and accountability in AI use. Educators should be empowered through continuous professional development to effectively incorporate AI tools into their teaching practices, maintaining a balance between technological innovation and human-centric education. Together, these strategic actions will foster an environment where AI enhances learning without compromising ethical standards or pedagogical quality.

8.   IMPLICATIONS

8.1   Managerial and Practical Implications

The findings of this review offer several actionable implications for higher education institutions seeking to integrate AI effectively and responsibly. From a managerial perspective, university leaders and policymakers must move beyond pilot experimentation and develop strategic frameworks that govern the ethical and pedagogical use of AI. These include establishing clear institutional policies on AI-assisted learning, data privacy protocols, and transparent academic integrity guidelines. Institutions should also prioritise faculty training programmes to enhance AI literacy among educators, ensuring that technology adoption is purposeful and pedagogically sound rather than reactive or tool-driven. Moreover, budget allocations and digital infrastructure planning must account for the long-term scalability and equitable access to AI tools across all departments and learner groups.

On a practical level, the lecturers and instructional designers should be encouraged to adopt AI in ways that enhance, rather than replace, human-centred teaching approaches. For example, AI-powered chatbots and feedback systems can streamline administrative and formative assessment tasks, freeing up instructors to focus on critical thinking development, collaborative learning design, and pastoral care. Educators are also urged to critically assess which AI tools align with their disciplinary contexts, student readiness, and learning outcomes, rather than relying on one-size-fits-all solutions.

Finally, both managerial and academic stakeholders should foster a culture of experimentation, where the use of AI is regularly evaluated, the students' perceptions are captured, and feedback loops inform continuous improvement in teaching and learning practices.

9.   CONTRIBUTION OF AUTHORS

Nurul Ilma Salleh led the conceptualisation of the study, developed the research framework, coordinated the systematic review methodology, and contributed to data analysis and manuscript writing. Nivakan Sritharan conducted the literature search and data extraction, contributed to the synthesis of findings, drafted substantial sections of the manuscript, and assisted in revising the paper. Jacqueline Chang Siak Gek wrote the conclusion section and contributed to the overall refinement of the manuscript. Hamsavathi A/P Ramalingam assisted with proofreading, editing, and ensuring accuracy and consistency in referencing.

10.   FUNDING

11.   CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funder.

12.   ACKNOWLEDGEMENT

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