IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–7388, p- ISSN: 2320-737x Volume 15, Issue 3 Ser. 1 (May. – June. 2025), 53-61
www.iosrjournals.org

Artificial Intelligence In Higher Education: A Systematic Review Of Impacts, Barriers, And Emerging Trends

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Abstract
The rapid proliferation of artificial intelligence (AI) technologies has introduced transformative opportunities and challenges in higher education. Understanding the impact, trends, and ethical implications of AI integration is crucial for educators and policymakers. This systematic review analyzed over 30 empirical studies from 2020-2025 on AI applications in higher education, extracting insights related to instructional approaches, learning outcomes, AI literacy, and ethical concerns. Findings reveal that AI enhances personalization, engagement, and academic performance. However, critical evaluation skills and ethical frameworks remain underdeveloped among students. Emerging trends include a shift toward AI-human collaboration and increased calls for AI literacy programs. While AI holds substantial potential to revolutionize education, its integration must prioritize critical thinking, ethical awareness, and human-centered learning principles.

Keywords: *Artificial Intelligence, Higher Education, AI Literacy, Educational Technology, Ethical Concerns*.

Date of Submission: 04-05-2025 Date of Acceptance: 14-05-2025

I. Introduction

Artificial Intelligence (AI) has become an increasingly prominent force in reshaping higher education, particularly through the rise of generative tools like ChatGPT, Gemini (formerly Bard), and other large language models (LLMs). These technologies have the potential to transform how students learn, how instructors teach, and how educational institutions manage and evaluate learning processes (Crompton & Burke, 2023).

Recent years have seen a surge in the adoption of AI-powered tools in university settings, with applications ranging from writing assistance and content generation, to personalized tutoring, grading automation, and interactive simulations (Celik et al., 2024). Among these, generative AI models like ChatGPT have gained remarkable traction for their ability to assist students with summarization, paraphrasing, brainstorming, and feedback — often in real time (Deng et al., 2024).

Alongside the promise of enhanced learning experiences, AI also introduces a set of pedagogical, ethical, and institutional challenges. Concerns have been raised about plagiarism, overreliance, misinformation, data privacy, and the lack of AI literacy among both students and faculty (Schaeffer et al., 2024). Moreover, there is significant variation in how AI is adopted across disciplines, institutions, and geographic regions (Xie et al., 2024).

While several conceptual and review papers have explored the potential of AI in education, there remains a lack of comprehensive synthesis focusing specifically on empirical studies that evaluate actual impacts on learning outcomes and adoption barriers in higher education (Bond et al., 2024).

This paper aims to fill that gap by analyzing 30 empirical studies published between 2020 and 2025. The review focuses on two key research questions:

RQ1: What are the impacts of AI technologies on learning outcomes in higher education?

RQ2: What are the key barriers that hinder the effective adoption of AI in higher education learning environments?

By synthesizing recent evidence, this review seeks to provide educators, policymakers, and researchers with a clearer understanding of how AI is currently shaping and being shaped by - the realities of higher education.

II. Research Methods And Process

This systematic review followed the general principles of the PRISMA framework to identify and synthesize empirical studies on the use of AI in higher education. The focus was to examine both the impacts of AI on student learning outcomes (RQ1) and the barriers to its effective adoption (RQ2).

Search Strategy and Database

The literature search was conducted through the EBSCOhost database, which indexes a wide range of peer-reviewed journals in education, psychology, and technology. The search used the following boolean combination of keywords:

- (AI OR "artificial intelligence")
- AND (literacy OR skill OR competence)
- AND (undergraduate OR graduate OR "higher education" OR university OR college)
- AND "learning outcome"

The search was limited to peer-reviewed full-text journal articles published in English between 2020 and 2025.

Screening and Eligibility Process

The initial search yielded 131 articles. After removing duplicates and screening titles and abstracts, 87 articles were retained for full-text review. Following a detailed eligibility assessment, only empirical studies were included. Papers were excluded if they were literature reviews, conceptual discussions, editorials, or case/project reports without primary data. This process resulted in a final sample of 30 empirical studies for in-depth analysis.

Data Extraction and Synthesis

Key data were extracted from each study, including: authorship, publication year, country, educational context, AI tools used, learning domain, research design, and main findings. The results were synthesized thematically to address the two research questions. Summary tables were developed to visualize study characteristics, outcomes, challenges, and emerging trends.

III. Results

Table 1 provides an overview of the 30 empirical studies included in this review, detailing their contexts, AI tools, learning domains, and reported outcomes.

Table 1. Summary of Included Studies

Author & Country	Short Description	AI Tool / Branch	Educational Context	Targeted Learning Domain	Outcome Highlights (Key Figures/ Learning Impacts/ Barriers)
Adjekum et al. (2024) (USA)	Evaluates impact of ethical attitudes and AI use on aviation learning outcomes. (n=271)	ChatGPT, Bard, Claude	Aviation Training	Academic Writing, Ethics	• Model explains 59% of behavior. • Improvement in feedback quality and engagement. • Plagiarism, bias, misinformation.
Akhavan-Safar et al. (2025) (Portugal)	Explores AI/video learning in mechanical engineering. (n=145)	AI Chatbots, Video	Engineering	Digital Skills, AI Perception	• 85% of students reported using AI chatbots in their learning process. • AI use contributed to improved comprehension of course content. • Concerns were raised about the reliability and consistency of AI tools.
Al-Abdullatif & Alsubaie (2024) (Saudi Arabia)	Assesses how perceived value and AI literacy affect ChatGPT use intention. (n=676)	ChatGPT	Computer Science, Agriculture, Health Sciences	AI Literacy, Use Intention	• Value explains 62% of intention. • Usefulness and enjoyment increased with AI literacy. • AI literacy did not reduce perceived risk.
Albelo & McIntire (2024) (USA)	Evaluates learning outcomes and AI use in nursing simulation training. (n=202)	ChatGPT	Nursing Education	Simulation, Feedback, Decision-Making	• 77% of students reported improved understanding through the use of AI tools. • Improvement in clinical reasoning attributed to AI-supported activities. • Risks of hallucination and overreliance were noted.
Alenazi (2025) (Saudi Arabia)	Studies AI ethics and acceptance among computing students using UTAUT2. (n=421)	General AI	Computer Science	Ethics, AI Acceptance	• AI ethics accounted for 62.4% of behavioral variance in AI usage. • Greater ethical awareness was associated with stronger intention to use AI responsibly. • Lack of formal ethical training and ambiguity in responsibility were identified as key challenges.

Black & Tomlison (2025) (UK)	Explores how ChatGPT supports assessment writing and feedback in healthcare education. (n=28)	ChatGPT	Healthcare Training	Assessment, Writing, Reflection	• AI use contributed to increased learner self-efficacy. • Improved reflective thinking and enhanced formative feedback. • Concerns about authenticity and risk of student dependency on AI tools.
Chang et al. (2025) (Taiwan)	Compares flipped classrooms with and without ChatGPT in science education. (n=98)	ChatGPT	Science Education	Flipped Learning, Concept Mastery	• Students using AI outperformed those in the control group. • Improved conceptual understanding through AI-supported learning. • Need for effective prompting skills to maximize AI benefits.
El Shazly (2021) (Egypt)	Examines nursing students' perspectives on AI integration in medical education. (n=274)	General AI	Nursing	Digital Competency, Attitudes	• 86% of participants expressed favorable attitudes toward AI use. • Greater affinity for technology and AI-supported learning. • Concerns about AI potentially replacing human professionals.
Fareed et al. (2024) (Pakistan)	Assesses ChatGPT adoption in EFL writing using TAM framework. (n=300)	ChatGPT	EFL / Language Education	Writing, TAM, Use Intention	• 73% of students reported regular use of ChatGPT. • Enhanced idea generation and increased learner confidence. • Concerns about authenticity and overreliance on AI tools.
Hasanein & Sobaih (2023) (Jordan)	Studies behavioral intention to use ChatGPT among faculty using TAM3. (n=221)	ChatGPT	Multiple Disciplines	Faculty Adoption, Pedagogy	• Key predictors from the TAM3 model were statistically significant. • Increased intention to use AI tools for teaching purposes. • Lack of institutional policies governing AI use.
Ilieva et al. (2023) (Bulgaria)	Explores student views on ChatGPT in education, focusing on critical use. (n=317)	ChatGPT	Multiple Disciplines	Student Awareness, Evaluation	• 59% of students reported using AI tools on a weekly basis. • Increased motivation for learning through AI-enhanced support. • Superficial understanding of AI and potential for misuse.
Ipatov et al. (2024) (Russia)	Tests AI chatbot in engineering language practice. (n=100)	ChatGPT + Telegram Bot	Engineering	Speaking, Writing, Feedback	• Students using AI showed a 20% improvement in speaking skills. • Oral fluency was enhanced through AI-supported language practice. • Barriers included concerns about authorship and ethical boundaries in AI-assisted work.
Jaboob et al. (2025) (India)	Assesses flipped AI-integrated teaching in engineering mechanics. (n=122)	AI Tools (unspecified)	Engineering	Flipped Learning, Engagement	• Students in the AI-supported flipped classroom outperformed those in the traditional setting. • Increased student engagement with AI-integrated instruction. • Limited familiarity with AI tools and unequal access.
Kanwal et al. (2023) (Pakistan)	Surveys 600 faculty on ChatGPT awareness and attitudes.	ChatGPT	Multiple Disciplines	Faculty Readiness, Ethics	• 86% of students were aware of AI tools, while 49% expressed concern about their use. • AI use was associated with increased academic productivity. • A major barrier was the absence of formal training or guidance.
Kazanidis & Pellas (2024) (Greece)	Evaluates ChatGPT's usefulness in MOOC learning for adult learners. (n=387)	ChatGPT	MOOCs / Adult Learning	Autonomy, Self-Regulation	• Perceived usefulness of AI tools increased among learners. • Improved self-efficacy and heightened motivation through AI-supported activities. • High dropout rates in MOOCs and concerns about tool reliability.
Kocatas & Wu (2023) (Turkey)	Investigates AI use and attitudes among business students. (n=313)	AI in general	Business School	Awareness, Skills, Motivation	• Students demonstrated high awareness of AI but limited practical skills. • Increased curiosity and interest in AI-supported learning.

					• Insufficient training opportunities for effective AI use.
Kohnke et al. (2024) (Hong Kong)	Examines EFL students' use of ChatGPT for writing tasks. (n=231)	ChatGPT	Language Learning	Writing, Feedback, Engagement	• 81% of students reported using ChatGPT. • Improved writing draft quality and increased learner confidence. • Concerns about the accuracy and reliability of AI-generated outputs.
Kong et al. (2024) (China)	Analyzes ethical perception and AI trust among college students. (n=620)	General AI	Higher Ed General	Ethics, Trust	• Trust was a significant predictor of AI adoption. • Responsible AI use increased with higher perceived trust. • Institutional policy on AI remained unclear or underdeveloped.
Maqbool et al. (2024) (India)	Studies perception of AI-assisted teaching effectiveness. (n=128)	ChatGPT	University Teaching	Effectiveness, Engagement	• Students perceived AI tools as effective in supporting learning. • Increased student participation linked to AI integration. • Concerns about potential misuse of AI tools were reported.
Moldt et al. (2023) (Germany)	Tests AI-chatbot elective for medical students. (n=12)	Chatbots (unspecified)	Medical Education	AI Literacy, Patient Communication	• Privacy concerns decreased after completing the AI-integrated course. • Students reported increased awareness and confidence in using AI tools. • Doubts remained about the maturity and reliability of AI chatbots.
Moosa et al. (2024) (Maldives)	Analyzes AI literacy and its impact on student performance perception. (n=260)	General AI	Multiple Disciplines	AI Literacy, Performance	• The model explained 47.2% of the variance in AI-related behavior ($R^2 = .472$). • Increased motivation and awareness associated with AI use. • Gaps in user confidence and surface-level engagement were identified as barriers.
Mwakapina (2024) (Tanzania)	Explores AI tools in language learning in under-resourced settings. (n=128)	ChatGPT, Google Translate, Grammarly	Language Learning	Equity, Motivation	• 75% of students supported the use of AI for personalized learning. • Improvements were noted in grammar usage and responsiveness to feedback. • Barriers included limited infrastructure and risks of overuse.
Ozguven et al. (2024) (China)	Examines staff concerns on ChatGPT use in student assessment. (n=24 (staff))	ChatGPT	Multiple Disciplines	Academic Integrity, AI Ethics	• A total of 475 students reported using AI tools for completing assignments. • Curriculum redesign efforts promoted more responsible AI use. • Key barriers included risks of "AI-giarism" and institutional policy gaps.
Rad et al. (2024) (Romania)	Tests AI benefit perception via mediation model. (n=675)	General AI	Multiple Disciplines	Attitudes, Career Readiness	• The model accounted for 48.6% of the variance in student responses ($R^2 = 0.486$). • AI use improved feedback quality and highlighted relevance to future careers. • A noted barrier was the perceived lack of direct, tangible academic benefit.
Radif (2024) (Iraq)	Surveys link between AI use and student engagement/learning environment. (n=722)	General AI	Multiple Disciplines	Engagement, Personalization	• The model explained 59.1% of the variance in AI-related learning behavior ($R^2 = 0.591$). • AI use was associated with increased motivation and more adaptive learning experiences. • Barriers included limited AI literacy and infrastructural constraints.
Salama et al. (2025) (Palestine)	Explores ChatGPT awareness and attitudes among nursing students. (n=304)	ChatGPT	Nursing	Digital Literacy, Attitudes	• 84.5% of students were aware of ChatGPT, and 58.6% had used it. • AI use contributed to increased confidence in academic skills. • A key barrier was the lack of formal training on responsible AI use.
Tupper et al. (2025) (UK)	Tests ChatGPT's ability to co-design marine field courses. (n=2 case studies)	ChatGPT	Field Education	Design Thinking, Prompting	• AI was found to be feasible for use in teaching when proper supervision was in place. • AI-assisted instruction reduced course design time. • Barriers included hallucinated outputs and unsafe logistical planning by AI tools.

Villarosa Jr (2024) (Philippines)	Explores flipped classrooms with AI support in math. (n=65)	ChatGPT, Grammarly, Gemini	Math Education	Study Habits, AI Use	• Students reported a moderate level of AI awareness (mean score = 3.72). • AI use was linked to increased student engagement. • A key barrier was the underutilization of available AI tools.
Yanan et al. (2024) (China)	Tests generative AI in a building materials design course. (n=Not reported)	Kimi, Canva, Kujiale	Architecture	Instructional Design, Engagement	• Students in the AI-supported group scored approximately 10% higher than the control group. • AI integration enhanced student motivation and engagement with simulations. • A key barrier was increased workload and cognitive demand for instructors.
Zhang & Dong (2024) (China)	Uses fsQCA to explore GenAI's effect in English learning. (n=33 classes)	SmartTutor, Essay GPS	Language Education	Fluency, System Modeling	• Two distinct high-outcome learning paths were identified; the model explained approximately 48% of variance ($R^2 \approx 0.48$). • AI supported learning personalization and improved feedback loops. • Barriers included increased cognitive load and unresolved ethical concerns.

Overview of Research Contexts and AI Applications

This review includes 30 empirical studies published between 2020 and 2025, representing a diverse range of disciplines and educational settings across more than 20 countries. Most studies were conducted in university contexts, primarily involving undergraduate students (e.g., Zhang & Dong, 2024; Yanan et al., 2024; Maqbool et al., 2024). For instance, Zhang & Dong (2024) implemented generative AI-supported English instruction in 33 classes at a Chinese university, integrating tools for speaking and writing enhancement. Maqbool et al. (2024) examined student perceptions of AI-assisted teaching effectiveness in an Indian university setting.

The disciplinary scope covers language education (e.g., Zhang & Dong, 2024; Kohnke et al., 2024), health sciences (e.g., Salama et al., 2025; Albelo & McIntire, 2024), engineering (e.g., Ipatov et al., 2024; Akhavan-Safar et al., 2025), teacher training (Moosa et al., 2024), and business and social sciences (Kocatas & Wu, 2023; Rad et al., 2024). Studies spanned multiple delivery formats, including traditional in-person classrooms, blended models, flipped classrooms, and MOOCs.

Generative AI tools - such as ChatGPT, Gemini (formerly Bard), QuillBot, Grammarly, and Canva AI - were the most frequently used, typically supporting writing, content creation, feedback, and tutoring tasks (e.g., Adjekum et al., 2024; Jaboob et al., 2025). Adaptive or domain-specific AI systems were also explored, particularly in engineering and medical education (e.g., Ipatov et al., 2024; Moldt et al., 2023). Several studies investigated students' and faculty's attitudes, ethical concerns, and readiness to adopt AI in instructional settings (e.g., Kanwal et al., 2023; Hasanein & Sobaih, 2023).

While methodological diversity was high — including surveys, quasi-experiments, and mixed-methods designs — the studies consistently emphasized how AI technologies influenced student engagement, content mastery, academic productivity, and skill development. They also surfaced critical issues around ethics, misinformation, digital literacy, and overreliance, which are further explored in the following sections.

Table 2 summarizes the major categories of AI tools identified across the 30 studies and their associated educational functions. Generative large language models (LLMs) such as ChatGPT were the most commonly used, primarily supporting academic writing, feedback, and content creation. Other tools served more specialized purposes, including grammar correction, translation, simulation, or adaptive tutoring.

Table 2. Categories of AI Tools and Educational Functions

AI Tool Category	Representative Tools	Educational Functions	Example Studies
Generative LLMs	ChatGPT, Gemini, Bard, Claude	Writing assistance, feedback generation, content drafting, Q&A	Adjekum et al. (2024), Fareed et al. (2024), Zhang & Dong (2024), Villarosa Jr (2024)
Text Polishing Tools	Grammarly, Quillbot	Grammar correction, paraphrasing, readability enhancement	Fareed et al. (2024), Villarosa Jr (2024), Ilieva et al. (2023)
AI Chatbots	Custom Chatbots, Perplexity AI	Interactive feedback, concept explanation, inquiry-based learning	Moldt et al. (2023), Ipatov et al. (2024), Tupper et al. (2025)
Multimodal / Design Tools	Canva AI, Kujiale, Kimi	Visual design, simulation, architectural modeling	Yanan et al. (2024)
Translation / Language Tools	Google Translate, Grammarly	Vocabulary support, multilingual feedback	Mwakapina (2024), Ilieva et al. (2023)
Institutional AI Platforms	SmartTutor, EssayGPS	Adaptive tutoring, performance analytics, writing guidance	Zhang & Dong (2024)

Unspecified / General AI	Unspecified AI systems or university tools	Digital literacy, attitude shaping, engagement	Moosa et al. (2024), Kanwal et al. (2023), Kocatas & Wu (2023)

Enhancement of Learning Outcomes and Engagement

Across the 30 empirical studies reviewed, AI technologies — particularly generative tools like ChatGPT — were consistently reported to enhance learning outcomes, student motivation, and engagement across multiple domains.

In aviation training, Adjekum et al. (2024) found that AI-supported tutoring significantly predicted behavioral intention and student learning outcomes, explaining 61% of the variance. In science education, Chang et al. (2025) showed that a flipped classroom supported by ChatGPT yielded significantly higher performance in conceptual mastery compared to the control group. Similarly, Yanan et al. (2024) reported that students in the AI-enhanced group scored markedly higher in knowledge retention (85 vs. 75) and application ability (90 vs. 80).

In English language learning, Zhang & Dong (2024) demonstrated that generative AI tools improved speaking and writing proficiency, with system dynamics modeling showing strong feedback loops between engagement, teacher behavior, and learner outcomes. Kohnke et al. (2024) and Fareed et al. (2024) also confirmed enhanced writing fluency and confidence when students used AI for drafting and revision.

In health and nursing education, Salama et al. (2025) and Moldt et al. (2023) reported greater skill confidence, engagement, and ethical awareness among students using AI-supported training. In engineering and technical communication, Ipatov et al. (2024) found a 20% gain in speaking performance using a ChatGPT-based mobile assistant.

Studies like Kazanidis & Pellas (2024) and Jaboob et al. (2025) highlighted how AI integration supports learner autonomy, metacognitive engagement, and behavioral mediation in improving academic performance. Even among faculty participants, such as in Kanwal et al. (2023), AI was perceived to enhance content preparation and productivity.

Overall, the evidence suggests that AI-supported tools contribute meaningfully to students' academic development, particularly in terms of personalized feedback, self-regulated learning, critical thinking, and engagement.

Critical Literacy Gaps and Ethical Concerns

Despite the promising outcomes of AI integration in higher education, a significant number of studies reported concerns related to AI literacy gaps and ethical risks. Common issues included plagiarism, overreliance on AI outputs, misinformation, lack of critical evaluation skills, and absence of institutional guidance.

In language and writing contexts, students frequently used generative AI for drafting assignments but lacked the ability to critically assess AI-generated content (e.g., Fareed et al., 2024; Kohnke et al., 2024). Moosa et al. (2024) emphasized the danger of shallow engagement with AI, where students may outsource cognitive work to AI tools without internalizing learning processes. Similarly, Maqbool et al. (2024) and Ilieva et al. (2023) reported that students often struggled to verify AI credibility or detect inaccuracies, underscoring a need for critical AI literacy.

Ethical concerns were raised in several domains. Salama et al. (2025) noted that nursing students feared ethical violations and lacked training on responsible AI use. Rad et al. (2024) and Kanwal et al. (2023) highlighted faculty concerns over data privacy, lack of transparency, and unclear institutional policies for AI use. Ozguven et al. (2024) warned that AI-generated work submitted in assessments without proper disclosure raises academic integrity issues, including "AI-giarism."

Furthermore, studies such as Al-Abdullatif & Alsubaie (2024) revealed a paradox: while AI-literate students rated AI tools more positively, they did not necessarily perceive higher risks, suggesting a blind spot in ethical sensitivity. This reinforces calls for integrated AI literacy curricula that go beyond technical skill to include ethical reasoning, source evaluation, and prompt engineering.

Table 3 summarizes the five most frequently reported categories of ethical and AI literacy-related concerns across the 30 empirical studies. Issues related to plagiarism, cognitive overreliance, and lack of critical evaluation were the most commonly cited.

Table 3- Most Common Ethical and Literacy Concerns

Theme	Number of Studies	Example Studies
Plagiarism / AI-giarism	14	Fareed et al. (2024), Ozguven et al. (2024), Kanwal et al. (2023)
Overreliance / Lazy cognition	12	Moosa et al. (2024), Ilieva et al. (2023), Maqbool et al. (2024)
Lack of critical evaluation	11	Al-Abdullatif & Alsubaie (2024), Kohnke et al. (2024)
Absence of training/guidelines	9	Hasanein & Sobaih (2023), Rad et al. (2024), Salama et al.
Privacy / data misuse	6	Ozguven et al. (2024), Kanwal et al. (2023), Rad et al. (2024)

Trends in AI Integration

Analysis of the 30 empirical studies revealed several emerging trends in the integration of AI into higher education contexts:

- *Trend 1: From Tool to Partner*. AI is evolving from a passive tool into an active collaborator in the learning process. Studies such as Tupper et al. (2025) and Zhang & Dong (2024) illustrate how ChatGPT and similar tools are co-designed into instructional workflows, shaping learning content and assessment.
- *Trend 2: Flipped and Scaffolded AI Use*. Multiple studies emphasized structured, instructor-guided use of AI in flipped learning models. For instance, Chang et al. (2025) and Villarosa Jr (2024) implemented flipped classrooms with AI support, resulting in improved conceptual mastery and learner engagement.
- *Trend 3: Faculty Readiness and Attitude Gaps.* Faculty awareness and institutional readiness remain uneven. Kanwal et al. (2023) and Hasanein & Sobaih (2023) noted a need for formal training, ethical clarity, and faculty development to promote pedagogically sound AI use.
- *Trend 4: Disciplinary Patterns.* Students in STEM and language learning domains reported higher levels of AI engagement, while those in nursing and health sciences expressed more ethical and practical concerns (e.g., Salama et al., 2025; Kocatas & Wu, 2023).
- *Trend 5: Institutional Literacy Initiatives*. Some studies highlighted emerging efforts to embed AI literacy in university-wide curricula, particularly post-2023 (Moosa et al., 2024; Rad et al., 2024).

These patterns point to a gradual pedagogical and institutional shift in how AI is being adopted across disciplines. Table 4 presents a summary of the most salient trends in AI integration identified across the 30 empirical studies.

Table 4. Key Emerging Trends in AI Integration

Trend	Description	Example Studies
AI as Collaborator	AI used in content generation, design, reflection	Zhang & Dong (2024), Tupper et al. (2025)
Flipped & Scaffolded AI Use	AI used in flipped models, guided prompting	Chang et al. (2025), Villarosa Jr (2024), Jaboob et al. (2025)
Faculty Awareness & Training Gap	Faculty need policy, training, clarity	Kanwal et al. (2023), Hasanein & Sobaih (2023)
Disciplinary Differences	STEM/Language vs. Nursing/Social Sciences in AI comfort	Kocatas & Wu (2023), Salama et al. (2025)
AI Literacy Curricula	AI ethics/literacy embedded in institutional strategies	Moosa et al. (2024), Rad et al. (2024)

Summary and Answers to the Research Questions

The findings from the 30 empirical studies reveal a nuanced picture of how AI technologies are shaping teaching and learning in higher education. Drawing on the synthesized evidence, the following summary addresses the two guiding research questions of this review.

RQ1: What are the impacts of AI technologies on learning outcomes in higher education? AI tools — particularly generative models like ChatGPT — have been shown to enhance various dimensions of student learning, including academic writing (e.g., Zhang & Dong, 2024; Fareed et al., 2024), language proficiency (e.g., Ipatov et al., 2024), conceptual mastery (e.g., Chang et al., 2025), and clinical reasoning (e.g., Salama et al., 2025). Students reported increased engagement, confidence, and productivity, especially when AI was embedded in flipped classrooms, mobile platforms, or MOOC environments. Several studies also emphasized improvements in metacognitive awareness and feedback reception when AI tools were scaffolded or used under instructor supervision (e.g., Adjekum et al., 2024; Kohnke et al., 2024).

RQ2: What are the key barriers that hinder the effective adoption of AI in higher education learning environments?

Despite these benefits, concerns about plagiarism, overreliance, and shallow engagement were common across studies (e.g., Ozguven et al., 2024; Moosa et al., 2024). Many students and faculty lacked the critical literacy to evaluate AI outputs or use them ethically. Institutional readiness was also uneven, with limited policies, training gaps, and unclear guidelines for AI use in assessment and instruction (e.g., Kanwal et al., 2023; Hasanein & Sobaih, 2023). These challenges were particularly acute in disciplines such as nursing and social sciences, where ethical concerns were more prominent.

Together, the evidence suggests that AI integration is most effective when paired with human guidance, scaffolded design, and institutional literacy support. These patterns serve as a foundation for further discussion on the pedagogical and policy implications of AI in higher education.

Limitations and Future Research

While the 30 empirical studies analyzed offer valuable insights into AI integration in higher education, several methodological and contextual limitations should be noted.

Most studies relied on self-reported survey data (e.g., Salama et al., 2025; Moosa et al., 2024), which may be subject to social desirability bias or overestimation of AI familiarity. Convenience sampling was common, limiting the generalizability of findings across different institutions and cultural contexts (e.g., Kazanidis & Pellas, 2024; Kocatas & Wu, 2023).

In terms of methodology, many studies employed cross-sectional quantitative designs, which are useful for initial trend mapping but do not capture longitudinal effects or behavioral shifts. Even when advanced techniques like system dynamics modeling (Zhang & Dong, 2024) or fsQCA (Zhang & Dong, 2024) were used, the designs remained largely observational, limiting causal claims.

Moreover, few studies incorporated student voice through qualitative or participatory methods. There is a need for mixed-methods, experimental, and longitudinal research to assess how AI tools influence learning trajectories, identity formation, and higher-order thinking over time.

Finally, technical and ethical limitations of AI tools — such as bias, hallucinations, and lack of nuance — were acknowledged in several studies (e.g., Ipatov et al., 2024; Ozguven et al., 2024), but seldom investigated directly. Future research should include robust evaluations of AI tool performance, interpretability, and fairness in educational settings.

IV. Conclusion

This systematic review synthesized findings from 30 empirical studies examining the use of AI in higher education between 2020 and 2025. The analysis revealed that AI — especially generative tools like ChatGPT — has been applied across a variety of disciplines and contexts, often with positive effects on student engagement, writing proficiency, feedback processes, and conceptual learning.

However, the integration of AI is not without challenges. Ethical risks, overreliance, lack of critical evaluation, and institutional readiness gaps remain major barriers. The studies show that effective implementation depends not only on tool availability but also on pedagogical scaffolding, faculty development, and student digital literacy.

Overall, the findings suggest a growing convergence toward viewing AI as both a cognitive tool and a pedagogical partner. To maximize its benefits while minimizing risks, future educational strategies should combine technological innovation with ethical guidance, inclusive design, and evidence-informed policy.

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