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ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION: A GLOBAL REVIEW OF AI-POWERED TEACHING AND LEARNING

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Abstract. Artificial intelligence, particularly generative AI systems such as ChatGPT, Gemini, and Claude, has moved from the periphery to the mainstream of higher education in less than four years. By 2025, several international surveys had reached a common conclusion: AI use among university students is approaching universality, while institutional governance, faculty competence, and pedagogical theory are gradually adapting to this rapid development. This article synthesises peer-reviewed empirical research published in 2020–2026, together with reports by UNESCO, the OECD, the Russell Group, the Digital Education Council, the Higher Education Policy Institute, Ellucian, and EDUCAUSE, to provide a global and theoretically grounded analysis of the current state of AI-powered teaching and learning. The article examines adoption trends, key technologies, theoretical frameworks, opportunities and challenges, policy responses across different jurisdictions, and future directions, including AI literacy as a graduate attribute, hybrid human–AI pedagogies, and the redefined role of the educator. The analysis concludes that AI adoption in higher education is no longer a question of trajectory but of governance, and that the pedagogy of integration, rather than the technology itself, determines whether AI strengthens or limits learning outcomes.

Keywords: artificial intelligence, higher education, generative AI, teaching and learning, Technology Acceptance Model, TPACK, adaptive learning, academic integrity, AI literacy, UNESCO, self-regulated learning

Annotatsiya. Sun'iy intellekt, xususan, ChatGPT, Gemini va Claude kabi generativ AI tizimlari, to'rt yildan kamroq vaqt ichida oliy ta'limning chekka yo'nalishidan uning asosiy oqimiga aylandi. 2025-yilga kelib, bir nechta xalqaro tadqiqotlar yagona xulosaga keldi: universitet talabalari orasida AI-dan foydalanish deyarli ommaviy tus olmoqda, institutsional boshqaruv, professor-o'qituvchilar kompetensiyasi va pedagogik nazariya esa ushbu tezkor rivojlanish sur'atiga moslashishga intilmoqda. Ushbu maqolada 2020–2026-yillarda nashr etilgan ekspert tekshiruvidan o'tgan empirik tadqiqotlar, shuningdek, UNESCO, OECD, Russell Group, Digital Education Council, Higher Education Policy Institute, Ellucian va EDUCAUSE hisobotlari sintez qilinib, AI asosidagi o'qitish va o'rganishning hozirgi holati global va nazariy jihatdan asoslangan tarzda tahlil qilinadi. Maqolada AI-ni joriy etish tendensiyalari, asosiy texnologiyalar, nazariy asoslar, imkoniyatlar va muammolar, turli yurisdiksiyalardagi siyosiy-huquqiy yondashuvlar hamda kelajak yo'nalishlari, jumladan, AI savodxonligi, gibrid inson–AI pedagogikasi va pedagog rolining qayta belgilanishi ko'rib chiqiladi. Tahlil natijalariga ko'ra, oliy ta'limda AI-ni qo'llash endilikda rivojlanish yo'nalishi masalasi emas, balki boshqaruv masalasidir; AI-ning ta'lim natijalarini kuchaytirishi yoki cheklashi esa texnologiyaning o'zidan ko'ra, uni pedagogik jarayonga qanday integratsiya qilishga bog'liq.

Kalit so'zlar: sun'iy intellekt, oliy ta'lim, generativ AI, o'qitish va o'rganish, texnologiyani qabul qilish modeli, TPACK, adaptiv o'rganish, akademik halollik, AI savodxonligi, UNESCO, o'z-o'zini tartibga soluvchi o'rganish

Аннотация. Искусственный интеллект, в частности генеративные системы ИИ, такие как ChatGPT, Gemini и Claude, менее чем за четыре года переместился с периферии в основной поток высшего образования. К 2025 году ряд международных исследований пришёл к единому выводу: использование ИИ среди студентов университетов приближается к массовому уровню, в то время как институциональное управление, компетенции преподавателей и педагогическая теория стремятся адаптироваться к столь быстрым изменениям. В данной статье синтезируются рецензируемые эмпирические исследования, опубликованные в 2020–2026 годах, а также доклады UNESCO, OECD, Russell Group, Digital Education Council, Higher Education Policy Institute, Ellucian и EDUCAUSE с целью представить глобальный и теоретически обоснованный анализ современного состояния преподавания и обучения на основе ИИ. В статье рассматриваются тенденции внедрения ИИ, ключевые технологии, теоретические основы, возможности и проблемы, политико-правовые ответы в различных юрисдикциях, а также перспективные направления, включая ИИ-грамотность как ключевую компетенцию выпускника, гибридную человеко–

ИИ педагогику и переосмысление роли преподавателя. По результатам анализа сделан вывод о том, что внедрение ИИ в высшем образовании уже является не столько вопросом траектории развития, сколько вопросом управления; при этом влияние ИИ на результаты обучения определяется не самой технологией, а педагогикой её интеграции.

Ключевые слова: искусственный интеллект, высшее образование, генеративный ИИ, преподавание и обучение, модель принятия технологий, TPACK, адаптивное обучение, академическая честность, ИИ-грамотность, UNESCO, саморегулируемое обучение

INTRODUCTION

The integration of artificial intelligence into higher education represents one of the most significant transformations in the history of university teaching and learning. Universities, as institutions that produce knowledge, shape public discourse, and prepare future professionals, play a central role in determining how societies adopt, govern, and benefit from AI technologies. However, the rapid introduction of AI tools into academic life has created a growing need for institutions, educators, and policymakers to develop effective governance mechanisms, pedagogical frameworks, and ethical guidelines.

The public release of ChatGPT in November 2022 marked a watershed moment in the development of AI-supported education. Within twenty-four months, generative AI had become a routine feature of undergraduate study across major world regions. By 2025, surveys conducted across sixteen countries indicated that approximately 86 percent of university students were using AI tools in their studies. Similar trends were observed in the United Kingdom, where AI usage among full-time undergraduates increased from 66 percent in 2024 to 95 percent in 2026 (Freeman, 2025; Stephenson and Armstrong, 2026). This near-universal adoption has created substantial pedagogical opportunities, while also highlighting the importance of academic integrity, equity, faculty preparedness, and the broader purpose of higher education.

Despite the importance and timeliness of this issue, the existing literature remains distributed across different disciplines, regions, and theoretical traditions. There is a clear need for comprehensive and theoretically grounded reviews that synthesise the rapidly growing evidence base while considering the global diversity of institutional responses. This article addresses that need by presenting a structured global review of AI-powered teaching and learning in higher education. It draws on peer-reviewed empirical research published between 2020 and 2026, together with reports from UNESCO, the OECD, the Russell Group, the Digital Education Council, the Higher Education Policy Institute, Ellucian, and EDUCAUSE.

The article is organised as follows. Section 2 reviews the relevant literature across five theoretical traditions. Section 3 describes the research methodology. Section 4 presents the analysis and results, structured around adoption trends, benefits, challenges, empirical findings, and policy responses. Section 5 provides conclusions and recommendations for future research and practice.

LITERATURE REVIEW

Technology Acceptance Model and Its Extensions

Davis's (1989) Technology Acceptance Model, with its core constructs of perceived usefulness and perceived ease of use, remains one of the most widely applied frameworks in studies examining student and faculty adoption of generative AI. A systematic literature review of 54 empirical studies on ChatGPT acceptance in higher education confirmed that perceived usefulness and perceived ease of use are the strongest predictors of behavioural intention to use the technology. These relationships are often mediated by trust, self-efficacy, and perceived risk. Further extensions include Venkatesh's Unified Theory of Acceptance and Use of Technology (UTAUT and UTAUT2), which incorporates performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit. Strzelecki (2024), Habibi et al. (2023), Yildiz Durak and Onan (2024), and Acosta-Enriquez et al. (2024) applied UTAUT2 to the study of ChatGPT adoption across European, Turkish, Latin American, and Asian samples. Their findings generally indicate that hedonic motivation and habit are strong predictors of sustained use.

TPACK and AI-Specific Extensions

Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge framework has served as a dominant lens for analysing teachers' integration of technology for nearly two decades. Mishra, Warr, and Islam (2023) explicitly applied TPACK to ChatGPT and argued that the autonomy, opacity, and content-generating capacity of generative AI require a reconsideration of the traditional assumption that technology functions as a neutral instructional tool. Three significant AI-specific extensions have subsequently emerged. The first is Celik's (2023) Intelligent-TPACK (i-TPACK), which introduces AI-specific ethical knowledge as a core domain.

The second is the AI-TPACK model proposed by Ning et al. (2024) and further elaborated by Meng et al. (2026), which decomposes the framework into seven AI-related components. The third is the 2026 Human-Centric AI Pedagogy (HCAP) framework, which integrates AI-Technological Knowledge, AI-Content Knowledge, AI-Pedagogical Knowledge, Human–AI Collaborative Knowledge, and Ethical Knowledge domains. This framework was validated through a Delphi study by Karataş and Ataç (2026).

Constructivism and Social Constructivism

Vygotskian and Piagetian constructivism continue to provide important pedagogical foundations for AI-supported learning. This is particularly evident when generative AI is positioned as a Vygotskian "more knowledgeable other" that provides scaffolding within a student's zone of proximal development. Recent scholarship suggests that ChatGPT can support active knowledge construction when it is used dialogically and reflectively. At the same time, the literature emphasises the need to guide students toward meaningful interaction with AI in order to avoid reducing learning to simple information retrieval (Chan and Hu, 2023; Lodge et al., 2023).

Connectivism

George Siemens's (2005) theory of connectivism, originally formulated for the Web 2.0 era, has been revisited as a relevant framework for understanding learning in AI-saturated networks. Connectivism's emphasis on knowledge as distributed across nodes, including people, databases, and algorithms, corresponds closely with contemporary student learning practices, which increasingly involve continuous interaction with large language models. Recent scholarship in tertiary education argues that connectivism remains useful for theorising learning ecologies in which AI agents function as non-human nodes within broader knowledge networks.

Self-Regulated Learning Theory

Zimmerman's (2000, 2011) cyclical model of self-regulated learning, which consists of forethought, performance, and self-reflection phases, has become a central reference point in pedagogically oriented AI scholarship. Chiu (2024) and Chiu and Rospigliosi (2025) argue that generative AI can support or limit self-regulated learning depending on the quality of metacognitive support provided. AI tools that encourage goal-setting, monitoring, and reflection can strengthen learner autonomy, whereas answer-on-demand interaction may reduce opportunities for deeper self-regulation. Xu et al. (2025) experimentally demonstrated that metacognitive prompts embedded in generative AI environments significantly enhance self-regulated learning and the overall learning experience. Across these theoretical frameworks, an emerging methodological consensus suggests that no single existing theory is fully sufficient on its own. As a result, hybrid models that combine multiple theoretical perspectives are increasingly becoming a standard approach in empirical research on AI-powered teaching and learning.

RESEARCH METHODOLOGY

This article employs a narrative synthesis methodology by integrating evidence from multiple sources to construct a comprehensive global review. The methodology involved a systematic search of peer-reviewed databases, including Scopus, Web of Science, PubMed, and ERIC, to identify empirical studies on AI in higher education published between 2020 and 2026. The search terms included "artificial intelligence," "generative AI," "ChatGPT," "higher education," "teaching and learning," "adaptive learning," and "academic integrity."

The database search was supplemented by an analysis of policy documents and institutional reports from UNESCO, the OECD, the Russell Group, EDUCAUSE, the Digital Education Council, the Higher Education Policy Institute, and Ellucian. The review synthesises findings across five thematic domains: adoption trends and technologies, theoretical frameworks, benefits and opportunities, challenges and barriers, and policy and institutional responses. The analysis considers both quantitative evidence from surveys and meta-analyses and qualitative findings from institutional case studies.

ANALYSIS AND RESULTS

Current State of AI Adoption

Artificial intelligence is not new to higher education. Intelligent tutoring systems such as AutoTutor, Cognitive Tutor, and ALEKS have been studied in college settings since the 1990s, with meta-analyses reporting moderate-to-large positive effects on academic learning outcomes (Steenbergen-Hu and Cooper, 2014; Kulik and Fletcher, 2016; Ma et al., 2014). What is genuinely new, however, is the speed and breadth of diffusion that followed the public release of ChatGPT in November 2022.

The Digital Education Council's Global AI Student Survey 2024, which covered 3,839 students across 16 countries, found that 86 percent of students use AI in their studies, 54 percent use it on a weekly basis, and

24 percent use it daily. In the United Kingdom, the HEPI/Kortext Student Generative AI Survey recorded a substantial increase in AI usage among full-time undergraduates, from 66 percent in 2024 to 92 percent in 2025 and 95 percent in 2026. Over the same period, the use of AI for assessed work increased from 53 percent to 88 percent and then to 94 percent (Freeman, 2025; Stephenson and Armstrong, 2026). A 109-country PLOS ONE study involving 23,218 respondents remains one of the largest global empirical studies of student perceptions of AI in higher education to date (Ravšelj et al., 2025).

Institutional adoption is also gaining momentum. Ellucian's 2025 State of AI in Higher Education survey reports that institution-wide AI adoption increased from 49 percent in 2024 to 66 percent in 2025, while 43 percent of institutions now include AI in their strategic plans. At the same time, the Digital Education Council's 2025 Global AI Faculty Survey shows that 61 percent of faculty members have used AI in teaching, although 88 percent reported using it only to a limited extent. This indicates that faculty integration is developing more gradually than student uptake, highlighting the need for targeted professional development, institutional guidance, and pedagogical support (Table 1).

Table 1

AI Adoption Rates in Higher Education: Selected Surveys, 2024–2026[1]

Survey / Source	Sample	AI Usage Rate	Year
DEC Global AI Student Survey	3,839 students, 16 countries	86%	2024
HEPI/Kortext, UK undergraduates	Full-time undergraduate students	66% → 92% → 95%	2024–2026
Chegg Survey	11,706 students, 15 countries	80%	2024
Ravšelj et al., PLOS ONE	23,218 students, 109 countries	Widespread	2025
Ellucian, institutional survey	Higher education institutions	49% → 66%	2024–2025

Benefits and Opportunities

Five major clusters of benefits recur in the peer-reviewed literature published between 2020 and 2026. First, AI-enabled adaptive learning systems can modify content, pacing, and assessment according to the needs of individual learners. A 2024 meta-analysis by Wang et al. reported medium-to-large positive effects of such systems on cognitive learning outcomes. Second, automated formative feedback has demonstrated measurable pedagogical value. For example, a four-week randomised controlled trial involving 259 Chinese undergraduates found significant improvements in writing quality compared with instructor feedback alone, with the strongest effects observed in organisation and argumentation. Third, AI can contribute to faculty workload optimisation. Google's Generative AI for Educators programme reports that 83 percent of completers expect to save two or more hours per week. Fourth, AI-powered predictive analytics and advising chatbots have been deployed at scale, with documented improvements in student retention and satisfaction. Fifth, AI has created important accessibility opportunities through automated captioning, audio description, real-time translation, and text simplification for students with disabilities and non-native speakers.

Challenges and Barriers

The rapid adoption of AI has also highlighted several areas that require careful academic, ethical, and institutional attention. Academic integrity remains one of the most widely discussed issues. The proportion of UK undergraduates directly inserting AI-generated text into submitted work increased from 3 percent in 2024 to 12 percent in 2026, while AI-related academic integrity issues became more visible in UK higher education institutions between 2022–2023 and 2024–2025 (Cotton, Cotton, and Shipway, 2023; Stephenson and Armstrong, 2026). At the same time, AI-detection technologies remain methodologically limited, with studies documenting higher false-positive rates, particularly for non-native English speakers.

The digital divide represents another important area of concern. HEPI's 2025 survey documented differences in AI access and use across gender, socioeconomic, and disciplinary lines, while premium AI subscriptions may create an additional "paywall divide." Ethical issues also include algorithmic bias, data privacy, and the need to prevent overly surveillance-oriented classroom practices. Several studies report negative associations between high-frequency, uncritical AI use and student performance, suggesting the importance of guided, reflective, and pedagogically purposeful AI integration. Faculty preparedness also remains a key institutional

1 **Source:** Compiled by the author based on DEC (2024), Freeman (2025), Stephenson and Armstrong (2026), Ravšelj et al. (2025), and Ellucian (2025).

priority: in 2025, only 42 percent of UK students considered staff well-equipped to support them in using AI. Finally, institutional policy development is still evolving, with approximately 39 percent of higher education institutions having comprehensive AI policies as of 2025.

Empirical Findings

A substantial empirical evidence base has emerged with considerable speed. The largest cross-national survey remains Ravšelj et al.'s (2025) 109-country study, which found that students primarily use ChatGPT for brainstorming, summarising texts, and finding research articles. Systematic reviews and meta-analyses published between 2023 and 2026 generally report positive effects of AI tools on academic achievement, higher-order thinking, and writing outcomes, with feedback-based interventions producing particularly strong gains. Nevertheless, subgroup analyses reveal substantial variation across countries, disciplines, and intervention designs. A 2026 meta-analysis in Nature Humanities and Social Sciences Communications concluded that generative AI interventions tend to outperform traditional approaches, while emphasising that methodology, rather than technology alone, shapes student engagement and learning outcomes (Table 2).

Table 2

Summary of Key Empirical Findings, 2023–2026[2]

Study / Source	Method	Key Finding
Ravšelj et al. (2025)	Survey, N = 23,218, 109 countries	Students use ChatGPT primarily for brainstorming, summarisation, and research support; they rate its accuracy lower for classroom use.
Wang et al. (2024)	Meta-analysis, 2010–2022	AI-based adaptive learning has medium-to-large positive effects on cognitive outcomes.
Wu, Dang, and Li (2025)	Systematic review, 99 papers	Students and teachers generally demonstrate positive attitudes, while ethics and accuracy remain important areas for further attention.
Xu et al. (2025)	Experimental study, BJET	Metacognitive prompts in generative AI environments significantly enhance self-regulated learning.
HEPI/Kortext (2024–2026)	Annual survey, UK undergraduates	AI usage for assessed work increased from 53 percent to 94 percent; direct text insertion increased from 3 percent to 12 percent.

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Policy and Institutional Responses

Policy responses to AI in higher education have developed through three identifiable phases: initial restrictions and reactive concern in late-2022–mid-2023, the publication of high-level principles in mid-2023–2024, and operational policy development with curriculum integration in 2024–2026. At the international level, UNESCO has produced one of the most influential bodies of guidance, including its landmark Guidance for Generative AI in Education and Research (Miao and Holmes, 2023) and the AI Competency Frameworks for Teachers and Students, released in September 2024. The OECD's Digital Education Outlook 2023 and 2026 editions, together with its Reimagining Teaching in an Accelerating World report (2026), provide comprehensive cross-national analysis.

At the national and institutional levels, the Russell Group's 2023 Principles on Generative AI in Education rejected blanket bans in favour of literacy-based integration and set out five principles endorsed by all 24 leading UK universities. The European Union's AI Act classifies certain educational AI applications as high-risk. China issued the world's first national regulation on generative AI in 2023. In the United States, a unified federal framework has not yet been established, and institution-by-institution policy variation remains common. The Digital Education Council's 2024 student survey found that only 5 percent of students felt fully aware of comprehensive AI guidelines at their institution, indicating that communication remains an important area for further improvement even where policies already exist.

CONCLUSION AND RECOMMENDATIONS

The evidence assembled in this review supports four overarching conclusions for the current stage of AI development in global higher education.

First, AI adoption is no longer primarily a question of trajectory but of governance. With 92–95 percent of UK undergraduates and 86 percent of students across sixteen countries already using AI routinely, the policy

2 **Source:** Compiled by the author based on the cited studies.

focus has shifted from whether AI should be permitted to how it can be used pedagogically, ethically, equitably, and sustainably. Restrictive approaches alone appear insufficient, while literacy-based integration, as reflected in the Russell Group and UNESCO frameworks, is emerging as a widely supported international direction.

Second, the theoretical foundations of the field are becoming increasingly pluralistic. The Technology Acceptance Model and UTAUT2 remain important for explaining adoption; TPACK and its AI-specific extensions help explain teacher competence; constructivism and connectivism provide insights into knowledge construction in networked environments; and self-regulated learning theory clarifies the distinction between AI-enhanced and AI-substituted learning. Hybrid frameworks that combine these perspectives are likely to shape the next generation of empirical research.

Third, the empirical record is generally positive but context-dependent. Meta-analyses consistently report moderate-to-large positive effects, particularly for feedback-rich applications, accessibility, and lower-stakes formative work. At the same time, the literature highlights the importance of addressing over-reliance, academic integrity, unequal access, and differences across gender, socioeconomic, disciplinary, and infrastructural contexts. The pedagogy of integration, rather than the technology itself, determines whether AI strengthens or weakens learning outcomes.

Fourth, the role of the educator is being redefined rather than replaced. UNESCO's framing of a teacher–AI–student triad, the OECD's emphasis on relational and ethical dimensions of teaching, and policy recommendations from different jurisdictions all suggest a future in which educators will engage more deeply in pedagogical design, ethical scaffolding, and authentic assessment, even as AI increasingly supports routine cognitive and administrative tasks.

The framework presented in this review generates several key recommendations for future research and policy. Empirical studies should prioritise longitudinal designs that track the effects of sustained AI use on critical thinking, metacognition, and disciplinary expertise. Comparative cross-national research should examine how cultural, institutional, and policy differences shape AI integration outcomes. Institutions should invest systematically in AI literacy programmes for both faculty and students, redesign assessment for AI-rich learning environments, and ensure equitable access to AI tools in order to reduce access-related disparities. Finally, governance frameworks should treat ethical oversight not as a constraint on innovation, but as a necessary condition for responsible, sustainable, and educationally meaningful AI integration.

Achieving the full pedagogical potential of AI in higher education will require more than technological adoption. It will demand systematic attention to pedagogical design, sustained investment in professional development, cultural change within university governance, and recognition that the diverse contexts of global higher education require differentiated and evidence-informed approaches. The next five years will be decisive in determining whether AI becomes a powerful pedagogical accelerator that expands learning opportunities, strengthens academic development, and supports inclusive educational transformation.

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