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Editorial: AI's impact on higher education: transforming research, teaching, and learning

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Editorial on the Research Topic

[AI's impact on higher education: transforming research, teaching, and learning](#)

This Research Topic provides a comprehensive examination of how artificial intelligence (AI) is transforming higher education. The collected studies reveal several interconnected themes that illuminate both the opportunities and challenges of AI integration in academic settings. This editorial summarizes these themes and articulates their significance for the future of higher education.

Four critical themes on AI and higher education

Student perceptions and engagement

Research by [Li et al.](#) revealed that undergraduate students at a private university in China have moderate familiarity with AI tools, particularly ChatGPT, which is recognized by 94.3% and used by 90.4% of surveyed students. However, a concerning paradox emerged: while 89% of students use AI tools for academic tasks and 86.6% acknowledge their usefulness, only 39.7% report that these tools have significantly improved their understanding of course material. This gap between usage and perceived learning benefits demands further investigation.

Similarly, [Sallam et al.](#) explored health sciences students' attitudes toward generative AI, identifying factors that influence their perceptions and usage patterns. Their findings suggest that students generally view AI positively but express concerns about over-dependence, reduced independent thinking, algorithmic bias, and data security issues.

[Wang et al.](#) demonstrated that educating students about large language models can positively shift their perceptions and understanding of generative AI. After learning about AI mechanisms, students reported significantly greater approval of AI use in various contexts, suggesting that AI literacy is a crucial component for effective integration.

Supporting these findings, recent research from Jordanian universities revealed similar patterns of AI adoption among students. The study found that ChatGPT was the most

recognized (94.3%) and frequently used (90.4%) AI tool among students across 27 universities, with 89% employing AI tools for academic tasks. However, echoing the concerns identified by [Li et al.](#), only 39.7% of Jordanian students felt that these tools significantly improved their understanding, despite 57.6% reporting a positive impact on their academic performance ([Mashagbeh et al.](#)). This cross-cultural consistency suggests that the gap between AI usage and perceived learning benefits may be a widespread phenomenon requiring global attention.

Pedagogical approaches and frameworks

Thoughtful pedagogical frameworks are essential for integrating AI into teaching practices. [Schell et al.](#) presented a case study of UT Sage, a tutor bot designed to provide personalized learning support while maintaining pedagogical integrity. Their work emphasizes the importance of aligning AI tools with evidence-based teaching practices and learning outcomes.

[Malusay et al.](#) demonstrated how professional development programs can enhance teachers' technological, pedagogical, and content knowledge (TPACK) in specific subject areas. Their research shows that teachers' TPACK progressed from "limited" to "expert" levels through targeted training, enabling them to effectively integrate technology into their teaching.

[Temper et al.](#) introduced the Higher Education AI Teaching (HEAT-AI) framework, a risk-based approach to regulating AI use in academic settings. This framework categorizes AI applications according to their risk levels, providing clear guidelines for their appropriate use while fostering innovation.

A systematic review conducted during the first 9 months after the release of ChatGPT provided valuable early insights into how AI has affected teaching, curriculum design, and assessment practices in higher education. The review identified the benefits and risks of AI integration, offering preliminary evidence to inform institutional policies and faculty practices ([Liang et al.](#)). As the authors note, this represents "a first wave" of research, acknowledging how quickly AI systems are evolving and changing educational landscapes.

Additionally, in specialized fields such as Mechanical Engineering Education (MEE), AI integration demonstrates unique applications and challenges. Research has shown that AI significantly enhances learning experiences through technologies such as computer-aided translation and natural language processing, making education more accessible and interactive. However, this integration demands substantial changes in teaching methods, emphasizing adaptability and responsible technology use ([Alghazo et al.](#)). The development of an "AI in MEE framework" provides a structured approach to implementation that could serve as a model for other disciplines.

Institutional leadership and administration

[Khairullah et al.](#) examined how AI is reshaping administrative processes in higher education institutions through "responsible

strategic leadership." Their research highlights the role of AI in improving student success metrics, streamlining administrative tasks, and supporting strategic leadership initiatives.

[Moreira-Choez et al.](#) employed structural equation modeling to validate teaching models in higher education, distinguishing between traditional, collaborative, spontaneous, constructivist, and technological approaches. Their findings underscore the importance of adopting adaptive and evidence-based teaching methods to meet contemporary educational demands.

Ethical considerations and academic integrity

[Kovari](#) addressed strategies for maintaining academic integrity in the era of ChatGPT, offering comprehensive approaches to combat AI-induced plagiarism. These include regulating AI usage within curricula, enhancing plagiarism detection tools, and designing unique and creative assignments that are less susceptible to AI generation.

The path forward: five strategic imperatives

The research presented in this Research Topic revealed five strategic imperatives for the future of higher education. First, building AI literacy has emerged as an urgent priority for both students and educators to use these tools effectively and ethically. Understanding how AI works enables users to critically evaluate its outputs and make informed decisions about its appropriate use. [Wang et al.](#)'s findings suggested that education about AI mechanisms can positively influence perceptions and appropriate use. This literacy encompasses not only technical knowledge but also ethical considerations and practical skills for responsible AI integration. This imperative is further supported by [Al Mashagbeh et al.](#)'s findings from Jordanian universities, which revealed that while 90.4% of students use ChatGPT, only 39.7% reported significant improvement in their understanding of course material. This cross-cultural consistency with [Li et al.](#)'s findings from China suggests that mere access to AI tools without proper literacy leads to superficial engagement rather than meaningful learning. The gap between usage rates and perceived learning benefits highlights the urgent need for implementing structured AI literacy programs that educate students not just on how to use these tools, but on how to use them effectively for deeper learning.

Second, AI integration necessitates a fundamental reconsideration of traditional teaching approaches. [Schell et al.](#) and [Malusay et al.](#) demonstrated how AI can enhance pedagogical practices when aligned with evidence-based teaching methods and learning outcomes. The challenge for educators is to leverage AI while preserving and enhancing critical thinking and creativity. This reimagining of pedagogy involves developing new assessment strategies, creating more interactive learning experiences, and finding ways to use AI as a complement to, rather than a replacement for, human

instruction. [Liang et al.](#)'s systematic review of early research following the release of ChatGPT provided valuable insights into how AI is reshaping the curriculum-instruction-assessment (CIA) triad in higher education. Their analysis of empirical studies published within the first 9 months after ChatGPT's launch identified both benefits and challenges of AI integration, offering preliminary evidence to inform pedagogical practices. According to their analysis, this work represents initial investigation in a dynamic field, highlighting the imperative for ongoing modification of instructional methods in response to developing AI technologies.

Third, as highlighted by [Temper et al.](#) and [Kovari](#), clear ethical frameworks and guidelines are essential for the responsible use of AI in education. Risk-based approaches that categorize AI applications according to their potential impact on academic integrity and privacy can help institutions navigate this complex landscape. These frameworks must address data privacy, algorithmic bias, and the appropriate attribution of AI-generated content while still encouraging innovation and the exploration of AI's educational potential. The need for ethical frameworks is particularly evident in specialized fields. [Alghazo et al.](#)'s research on AI integration in Mechanical Engineering Education (MEE) highlighted discipline-specific ethical concerns, including data privacy and potential biases in AI-driven assessments. Their development of an "AI in MEE framework" demonstrated how ethical considerations can be incorporated into technical disciplines, providing a model that could be adapted across various academic fields. Their work emphasized that ethical frameworks must be tailored to the unique challenges and opportunities of different disciplines while maintaining the core principles of responsible AI use.

Fourth, the research suggests that AI integration may exacerbate existing educational disparities if not implemented thoughtfully. Ensuring equitable access to AI tools and training is crucial for preventing a digital divide that could further disadvantage certain student populations. Institutions must actively address how to provide equal opportunities for all students to benefit from AI technologies, regardless of their socioeconomic background, technical proficiency, or prior exposure to these tools. [Liang et al.](#)'s systematic review also pointed to geographical disparities in AI research and implementation, noting that while Asia accounted for a large number of studies, with emerging research from South America and the Middle East, there remains a need for "multi-lingual or culture-responsive studies" to ensure that AI integration addresses diverse educational contexts. This geographical imbalance in research mirrors potential inequities in AI access and implementation, reinforcing the importance of culturally responsive approaches to AI integration that consider diverse student populations and educational systems.

Finally, as AI becomes increasingly prevalent in higher education, institutions must prepare students for an AI-integrated future. This requires developing skills for working with AI rather than merely relying on it, fostering critical evaluation of AI outputs, and promoting the ethical use of these technologies. Educational programs should incorporate

opportunities for students to learn about AI's capabilities and limitations, practice using AI tools responsibly, and develop the human skills that will remain valuable in an increasingly automated world.

A call to action

The contributions in this Research Topic represent a significant contribution to our understanding of the role of AI in higher education. By examining current practices, student and faculty perspectives, and institutional responses, these studies provide a roadmap for navigating the complex terrain of educational AI.

The imperative is clear: the AI revolution in higher education is not merely about adopting new technologies but about thoughtfully reimagining the educational experience for the digital age. The research presented here offers a foundation for this important work, highlighting both the transformative potential of AI and the need for careful and ethical implementation.

Furthermore, the geographical disparities in AI research and implementation identified by [Liang et al.](#) and the concentration of publications in developed countries noted by [Alghazo et al.](#) highlight the urgent need for "multi-lingual or culture-responsive studies." The future of AI in higher education must be globally inclusive, with particular attention to diverse educational contexts and equitable access across socioeconomic boundaries.

The integration of AI also presents opportunities for interdisciplinary approaches, as suggested by [Liang et al.](#). By using AI to bridge "intersections of different disciplines" and incorporating ethical considerations into various courses, institutions can foster more holistic educational experiences that prepare students for the complex challenges of an AI-integrated world.

The future of higher education in an AI-enhanced world will depend on our ability to balance innovation with integrity, leverage technology to enhance rather than replace human connection, and ensure that AI serves our educational values rather than reshaping them. This Research Topic advances this ongoing conversation, providing insights that will help shape the future of teaching and learning in the age of AI.

Author contributions

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Generative AI statement

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