Applications and Explorations of Artificial Intelligence in University Engineering Classroom Teaching

Dan Zhao*

Shanghai Jian Qiao University, Shanghai, China

*1178179354@qq.com

Abstract. With the rapid advancement of artificial intelligence (AI), its adoption in higher education has expanded substantially, demonstrating particularly strong potential in engineering-oriented classroom instruction. This study focuses on AI-assisted teaching practices in university engineering classrooms. Based on a questionnaire survey of undergraduate students majoring in Digital Media Technology, we examine the current state of AI-supported instruction, its perceived advantages, existing challenges, and directions for improvement. The findings indicate that students generally hold positive attitudes toward AI in enhancing depth of conceptual understanding, post-class review efficiency, and learning initiative, especially through real-time question answering, personalized learning pathways, and multimodal learning resources. However, current AI-assisted teaching still faces limitations, including insufficient accuracy, misalignment with classroom content, and weak technical stability. Accordingly, we recommend improving content alignment with course objectives, clarifying appropriate use scenarios, strengthening technical support, and guiding students to adopt AI tools critically and responsibly. These measures aim to promote a more effective integration of AI with conventional instruction and support high-quality development in university engineering education.

Keywords: artificial intelligence, university engineering education, classroom teaching, teaching reform.

1 Introduction

In recent years, rapid advances in artificial intelligence (AI) have begun to reshape higher education, bringing both disruption to established teaching practices and new opportunities for pedagogical innovation. China's Outline for Building a Leading Education Nation (2024–2035) explicitly calls for leveraging AI to drive educational transformation, developing talent cultivation models for the AI era, and promoting instructional reform and innovation in evaluation approaches [1]. Against this policy backdrop and broader technological trends, university instructors, particularly in engineering-oriented programs, are increasingly expected to explore how AI can be integrated into authentic course contexts to enhance learning efficiency, strengthen students' problem-

A. T. Patanasorn et al. (eds.), *Proceedings of the 3rd International Conference on Educational Development and Social Sciences (EDSS 2026)*, Advances in Social Science, Education and Humanities Research 1010,
https://doi.org/10.2991/978-2-38476-569-0_13

solving capabilities, and support the cultivation of digitally intelligent, high-quality talent.

AI has been widely adopted in educational settings because it can integrate learning resources, extract and analyze data intelligently, guide practice-based training, enrich learning experiences, reduce instructional costs, improve students' capacity for self-directed learning, and alleviate teachers' workload [2].

In higher education, commonly used AI-enabled tools include generative language models, editing and rewriting assistants, learning and assessment software, management and search tools, visualization and design tools, and analytics and management systems [3]. In particular, generative AI has been viewed as offering substantial opportunities across AI tutoring, AI-supported learning companionship, learning assistance, assignment assessment, course design, and lesson preparation [4].

Beyond tool adoption, AI is also influencing the construction of blended learning through intelligent resource generation, adaptive learning pathways, collaborative tutoring models, and comprehensive evaluation systems [5]. From instructors' perspectives, AI can support instructional design, resource recommendation, and learning analytics before class, thereby improving preparation efficiency and teaching quality. During class, intelligent teaching systems may enable personalized instruction and provide real-time feedback on students' learning status, allowing teachers to adjust instructional strategies dynamically. After class, automated grading of assignments and exams can reduce routine workload and enable instructors to focus more on pedagogical innovation and individualized student guidance.

From students' perspectives, AI can facilitate personalized learning by continuously collecting learning data and adjusting learning content based on analytic insights. It can also generate deeper learning resources tailored to different learning styles, thereby advancing personalization in higher education [6]. By using learning behavior data to construct individualized learning plans and provide targeted feedback, AI can support students in learning efficiently at their own pace [7]. However, in engineering courses, while generative AI is often perceived as beneficial—especially through real-time question answering, personalized learning pathways, and improved post-class review efficiency—persistent challenges remain, including limited answer accuracy and misalignment with instructional objectives [8].

Accordingly, this study examines AI-assisted teaching practices in a university engineering-oriented context, focusing on students' usage patterns, perceived benefits, key challenges, and improvement needs, with the goal of proposing actionable recommendations for achieving more effective integration between AI and conventional instruction.

2 Exploring AI in Engineering-Classroom Teaching

2.1 Method

This study employed a questionnaire survey. The instrument covered four dimensions: (1) basic usage of AI, (2) advantages of AI in classroom teaching, (3) integration between AI and traditional instruction, and (4) directions for improvement. Participants

were second-year undergraduate students in the Digital Media Technology major, a program aligned with China's "New Engineering" development goals and focused on cultivating students' capabilities to solve real-world problems using technology. A total of 73 questionnaires were distributed, 68 were returned (response rate: 93%), and all 68 were valid (valid response rate: 100%).

2.2 Basic Patterns of AI Use

The survey results indicate that the AI tools most frequently used by students are Doubao, DeepSeek, and Wenxin Yiyan (ERNIE Bot), all of which are representative generative AI applications. Most respondents believed that AI-supported instruction enhances the depth of conceptual understanding: 92.65% reported an improvement, 7.35% reported no difference, and none reported a decline. These findings suggest that AI-assisted teaching is perceived as effective in supporting deeper understanding. Follow-up inquiries will target the subgroup reporting "no difference" to identify underlying reasons and refine instructional strategies accordingly.

2.3 Perceived Advantages of AI in Classroom Teaching

As shown in Fig1, Real-time question answering emerged as the most salient advantage of AI-assisted teaching. Specifically, 92.65% of respondents selected real-time Q&A, which was substantially higher than all other options. In addition, providing personalized learning pathways (66.18%) and offering rich multimedia learning resources (58.82%) were also frequently endorsed. In contrast, automated learning report generation and flexible scheduling were selected less often, at 41.18% and 42.65%, respectively.

The survey further shows that AI-assisted teaching significantly improves post-class review efficiency. Approximately 90% of students perceived higher review efficiency compared with traditional instruction: 44.12% reported a substantial improvement and 45.59% reported a slight improvement. Only a small proportion indicated no notable change, while 4.41% reported a slight decrease; no respondents reported a substantial decrease. Overall, these results suggest a clear perceived benefit of AI assistance for post-class consolidation and review.

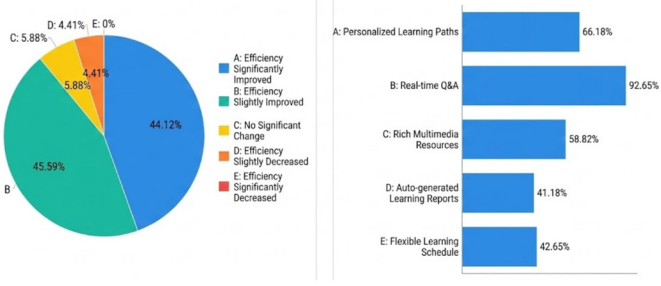

Fig. 1. Perceived advantages of AI in classroom teaching and Impact of AI-assisted teaching on post-class review efficiency.

2.4 Integration of AI with Traditional Teaching

As depicted in Fig2, AI-assisted teaching was also reported to increase students' willingness to participate actively in classroom learning. About 90% of respondents indicated that they were willing or very willing to engage proactively in AI-supported classes, representing a marked improvement relative to traditional teaching and suggesting that AI may effectively stimulate learning interest and engagement. Nevertheless, 8.82% expressed a neutral stance, and 1.47% reported that they were not fully willing to participate.

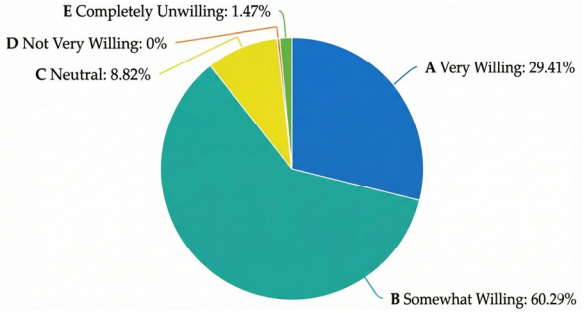

Fig. 2. Impact of AI on learning initiative.

2.5 Recommendations for Improving AI-Assisted Teaching

As illustrated in Fig3, Regarding the perceived importance of key elements in AI-assisted teaching, respondents prioritized the alignment between AI-generated content and course objectives. This factor was most frequently ranked as "most important" (67.65%) and achieved the highest composite score (3.51), indicating its centrality in students' evaluations. Response speed for real-time feedback ranked second (composite score = 2.66). Interactive functionality (teacher–student and student–student interaction) ranked third (composite score = 2.19). Interface intuitiveness received the lowest composite score, highlighting its comparatively secondary role. Overall, students prioritized content alignment and timely feedback over interaction features and interface design.

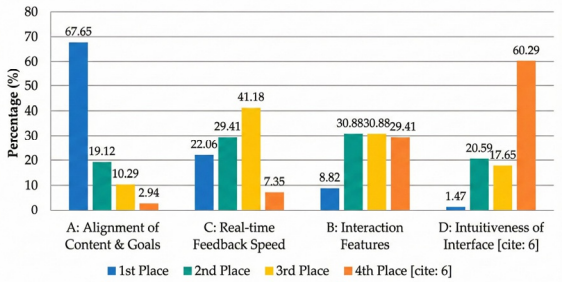

Fig. 3. Importance ranking of key elements in AI-assisted teaching.

3 Conclusion

In summary, current AI-assisted course teaching exhibits several limitations: (1) insufficient accuracy and reliability, with frequent incorrect answers that can undermine learning when students lack problem-solving capacity; (2) misalignment between AI outputs and instructors' teaching methods, causing disconnects in the learning process; (3) unclear positioning of use scenarios—some students view AI as unnecessary for simple content and believe classroom leadership should remain with instructors while AI is more suitable for after-class self-study; (4) lack of support resources (e.g., prompt scaffolds), constraining effective use; and (5) limited intelligence and inadequate interaction mechanisms, including insufficient affective interaction, which some students expect to be strengthened.

To address these constraints, we propose the following recommendations. First, actively control and verify AI output to safeguard instructional quality: guide students to use AI-generated information critically, explicitly communicate the limitations of AI answers, and encourage cross-validation via authoritative sources, step-by-step reasoning checks, and comparison across cases. Second, instructors should lead the alignment between AI and course teaching to avoid learning-process fragmentation: based on teaching style, syllabus, and pacing, instructors can specify output requirements—for example, requiring AI to prioritize the problem-solving methods taught in class and to reference textbook examples in Q&A. Third, precisely define AI use scenarios while maintaining student-centered learning: for pre-class preparation, AI can provide foundational concept Q&A and preview outlines; for post-class review, AI can support exercises and procedural recap; in project-based learning, AI can assist with literature search and preliminary structuring of solution frameworks. However, core knowledge explanation, classroom facilitation, and essential skill demonstrations should remain instructor-led, with students as the primary agents rather than relying on AI. Fourth, strengthen usage support to reduce barriers: establish an LMS discussion board aligned with course content, encourage students to share difficulties encountered in using AI, and have instructors summarize recurring issues and offer brief training sessions on effective AI usage strategies.

References

1. Zhou, H.: An Outline Document for Accelerating the Construction of a Leading Education Nation: Interpretation of the Outline for Building a Leading Education Nation (2024–2035). Journal of Hebei Normal University (Educational Science Edition) 27(2), 13–18 (2025). https://doi.org/10.13763/j.cnki.jhebnu.ese.2025.02.002
2. Yang, S.: Research on Application of Artificial Intelligence in Higher Education Management. Education Journal 7(1), 120 (2024). https://doi.org/10.31058/J.EDU.2023.71014
3. Chinoracky, R., Stalmasekova, N.: Ethical Problems in the Use of Artificial Intelligence by University Educators. Education Sciences 15(10), 1322 (2025). https://doi.org/10.3390/educsci15101322

4. Tao, D.H., Xi, W.: Research on the Role Transformation of Teachers in the AI Era. International Journal on Social and Education Sciences 7(4), 346–359 (2025). https://doi.org/10.46328/ijonses.5774
5. Du, R.: AI-Empowered Blended Teaching in Higher Education: Construction, Challenges, Strategies and Future Trends. Journal of International Education and Science Studies 2(11), 67–70 (2025). https://doi.org/10.62639/SSPJIESS12.20250211
6. Baidoo-Anu, D., Ansah, L.O.: Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning. Journal of AI 7(1), 52–62 (2023). https://doi.org/10.61969/jai.1337500
7. Guo, L.: The Mechanisms, Risks and Responses of Generative Artificial Intelligence Driving Educational Transformation: Taking DeepSeek as an Example. Chongqing Higher Education Research 13(3), 38–47 (2025). https://doi.org/10.15998/j.cnki.issn1673-8012.2025.03.004
8. Tlili, A., Shehata, B., Adarkwah, M.A., et al.: What if the Devil Is My Guardian Angel: ChatGPT as a Case Study of Using Chatbots in Education. Smart Learning Environments 10, 15 (2023). https://doi.org/10.1186/s40561-023-00237-x