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Artificial Intelligence in the Classroom: Can GenAI Teach Effectively?

Emergent Research Forum (ERF) Paper

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Abstract

Driven by the current blend of curiosity, skepticism, and concern regarding the potential of GenAI to replace teachers in the classroom, this short paper seeks to identify the strengths and weaknesses of current agentic teaching systems. To this end, we first conceptualize what constitutes effective teaching by considering the recent shift towards student-centered learning in higher education, as well as Bloom's revised taxonomy of educational objectives. Then, we review the literature from both educational sciences and information systems to assess GenAI effectiveness in facilitating learning, across Bloom's educational objectives in higher education. What we found is that GenAI can facilitate learning across all levels of Bloom's taxonomy, but significant challenges remain. Based on these insights, we propose future research avenues to enable the IS discipline to take a leading role in shaping the future of GenAI in education.

Keywords

Artificial intelligence, GenAI, effective teaching, research agenda.

Introduction

Recent advances in generative artificial intelligence (GenAI) have enabled widespread access to conversational agents that are capable of addressing complex queries and providing substantive feedback on user-generated content (Peres et al., 2023). These technological developments have disrupted established educational practices. For instance, a recent Forbes survey indicates that 60% of teachers already incorporate AI into their classrooms (Forbes, 2024), while data from the Digital Education Council reveal that more than 85% of students currently employ AI in their studies (Digital Education Council, 2024). Yet, some teachers express concerns that AI tools do more harm than good in educational contexts (Pew Research Center, 2024), while some students, who frequently use generative AI, report diminished learning outcomes (KPMG, 2024). Consequently, debates have emerged regarding the extent to which conversational GenAI systems, such as ChatGPT, can fulfill functions traditionally performed by human teachers, or even substitute them (Chan & Tsi, 2024).

This paper contributes by examining the object of these debates – agentic teaching systems – by mapping capabilities of current systems to educational objectives. First, we conceptualize effective teaching in higher education under the consideration of the recent shift towards student-centered learning, and Bloom's revised taxonomy of educational objectives. Then, based on an interdisciplinary review of related literature, we assess the effectiveness of GenAI in facilitating learning, across Bloom's educational objectives. This evidence suggests that GenAI can facilitate learning across all levels of Bloom's taxonomy, but significant challenges remain. Informed by these insights, we propose future research avenues to enable the IS discipline to take a leading role in shaping the future of GenAI in education.

What Is Effective Teaching?

Teachers as Facilitators

In a post-modern world that is characterized by the wide availability of online education, higher education is increasingly shifting toward student-centered learning (Khoury, 2022), drawing on humanistic (DeCarvalho, 2010; Rogers, 1969) and social-constructivist (Rutt et al., 2013; Vygotsky, 1978) approaches. This shift away from conventional teacher-centered models, reframes the role of teachers in higher education as facilitators of learning, rather than just knowledge transmitters.

Student-centered approaches also emphasize independence and critical thinking (Wang et al., 2015) by fostering safe, supportive, and motivating learning environments that facilitate students' own learning processes (Rogers, 1969). In this sense, the teacher serves as a guide and mentor – someone with sufficient domain knowledge who inspires, motivates, and introduces students to the knowledge culture of the discipline – that supports students in developing their own understanding and in drawing their own independent conclusions. The formation of mental constructs is further shaped by interactions with peers and cognitive tools, highlighting the importance of a learner's social interactions with knowledgeable members of the specific domain (Vygotsky, 1978). High-quality teaching can thus be seen as a dynamic and interactive process of creating, fostering, and adapting learning environments in which students engage in activities that improve learning outcomes (Bardach & Klassen, 2020).

Bloom's Taxonomy

Bloom's (1956) taxonomy is a foundational framework in educational psychology that structures cognitive learning objectives and curriculum design aimed at fostering cognitive skills. As a hierarchical model, it categorizes educational goals and has been extensively applied across disciplines to guide the creation of curricula, and the assessment of learning outcomes (Chan & Wong, 2025). The systematic approach is particularly relevant in higher education, where cognitive thinking skills are central (Chan & Wong, 2025).

Over time, the taxonomy has been revised to reflect a more dynamic understanding of educational objectives, introducing knowledge dimensions and elevating creation above synthesis as the highest cognitive process (Krathwohl, 2002). Creation involves producing knowledge artifacts that are relevant and valuable to the domain and recognized by domain experts, drawing on the learner's accumulated domain expertise. The revised version thus defines six levels of cognitive learning processes, ranging from basic knowledge recall to advanced competencies (Xia et al., 2025). Hence, according to this taxonomy, remembering and understanding represent low-level skills, applying and analyzing constitute mid-level skills, and evaluating and creating represent high-level skills (Anderson & Krathwohl, 2001). Hence, based on our understanding of teachers as facilitators and Bloom's revised taxonomy of educational objectives, we define an effective teacher as one who emphasizes cognitive processes and critical thinking, enabling students to achieve learning outcomes across all levels of Bloom's revised taxonomy.

Which Educational Objectives Can GenAI Help Students Achieve?

Recently, Bloom's Taxonomy has increasingly been applied to the study of AI in higher education. Examples include evaluating the quality of AI-generated content (Chan & Wang, 2025), examining its effects on critical thinking (Gonsalves, 2024), or assessing its role in fostering cognitive thinking in AI-supported learning tasks (Hachoumi et al., 2025). Despite the increasing juxtaposition of Bloom's Taxonomy and AI, there is little empirical synthesis on whether and how AI can serve as a learning facilitator and enhance teaching effectiveness. This highlights the need to explore how GenAI can support different educational objectives from Bloom's taxonomy and take on roles traditionally fulfilled by human teachers (see Table 1).

Bloom's Objective and associated activities	**Evidence for Positive Teaching Impact**	**Evidence for Negative Teaching Impact**
Remember Define, duplicate, list, memorize, repeat, state	• Generate exercises for students to review the lecture content (similar effects as flashcards) (Neumann et al., 2025)	• Missing specific errors, 81% accuracy, fact-checking service falls short (Neumann et al., 2025) • Misconceptions about exam relevance and misuse (Neumann et al., 2025)
Understand Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate	• Answer questions about the lecture content, assist students in understanding broader content (Neumann et al., 2025) • Information forging: explore new information landscape and elaborate further on interesting content (Flores Romero et al., 2025)	• Sometimes repetitive, unhelpful, complex, confusing information (Neumann et al., 2025) • Mix-up of terms, unprecise terminology (Neumann et al., 2025)
Apply Execute, implement, solve, use, interpret, demonstrate, operate, schedule, sketch	• Simulating students and realistic environments to prepare pre-service teachers (Zheng et al., 2025) • Benefitting teaching skill development and learning transfer (Zheng et al., 2025)	• Perceived authenticity barriers: Lagging response, weak comprehension of complex contexts, inconsistencies in simulated students' cognition, and incongruent feedback (Zheng et al., 2025) • AI systems such as the SozyAI model face challenges in handling abstract reasoning tasks (Canyakan, 2025; Pau et al, 2024)
Analyze Differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test	• Adaptive feedback on a written diagnostic reasoning task for pre-service teachers, improved quality of justification in writing compared to static human feedback, students engaged longer with the feedback (Kinder et al., 2025)	• AI's practical limitations, including issues such as hallucinations, biases, database constraints, and data protection. Risk that students may develop overreliance on AI tools. (Morrice et al., 2025)
Create Design, assemble, construct, conjecture, develop, formulate, author, investigate	• Write an essay on a hypothetical study and a research plan, assignments inspired by LLM-interactions (Flores Romero et al., 2025)	• AI's limited effectiveness in fostering creativity across all skill levels (Jia et al., 2024) • AI's autonomous capacity for creative thinking beyond provided data is limited (Raisch & Fomina, 2025), which would also apply to mentoring such processes.
Evaluate Appraise, argue, defend, judge, select, support, value, critique, weigh	• AI-supported peer review systems empower students to provide more valuable feedback on peers' written work (Guo et al., 2025).	• None found to date

Table 1. Evidence of GenAI Teaching Capabilities

Research Agenda for Effective GenAI Teaching Facilitators

Current research indicates that GenAI can facilitate learning across all levels of Bloom's taxonomy despite several key issues that remain to be addressed. Hence, GenAI should be seen as a complementary tool that can be leveraged by teachers to facilitate learning, rather than as a tool to substitute or replace them. In addition, the effectiveness of current GenAI-based teaching systems seems to be highly dependent on context, subject, and implementation.

While these insights highlight the current limits of GenAI-based teaching systems, our literature review also shows that current research on this topic focuses on improving the accuracy of these systems and how they can support pedagogical objectives. Hence, truly transformative questions lying at the intersections of psychology, ethics, system design, and long-term impact remain unanswered. Accordingly, we encourage IS researchers to tackle the following research questions in the scope of their future work:

Developing Metacognition: Can GenAI be designed not just to teach facts, but to explicitly teach students how to learn? Can it help them develop better study strategies, self-assessment skills, and awareness of their own knowledge gaps in human-centric skills like creativity, ethics, leadership, and entrepreneurship?

Credibility and Ethics: Should we augment teaching with GenAI-based systems? How can an AI tutor transparently show its "sources" or reasoning process to build trust and teach students how to evaluate information credibility?

System Design and Human-AI Collaboration: Can GenAI be designed to emulate critical elements of teaching such as social presence, emotional engagement, and empathy? How can we devise a flexible hybrid teaching experience where students can receive teaching input from both a GenAI tutor and a human teacher? How else can AI tutors be used to complement the work of human teachers?

Long-Term Impact: What can longitudinal studies teach us about the long-term impact (over 5-10 years) of learning primarily with an AI tutor, in terms of students' knowledge retention, career-readiness, and overall intellectual development?

Conclusion

These profound research questions we identified challenge us to think not just about what we learn, but also about how we learn, and what it means to be an educated human in the age of AI. We, as the IS community, need to provide answers to these questions if we want to take the lead in shaping the future of GenAI in education.

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