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Exploring the Potential of AI Conversations in Architecture, Engineering, and Construction Education: Insights from a Building Systems Course

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Abstract:
The use of Artificial Intelligence (AI) in education is no longer a futuristic concept. Educational technology companies are actively integrating AI into course management systems and student engagement platforms to enhance communication between learners and educators. Blackboard, one of the most widely used Learning Management Systems, has consistently adopted AI-driven features, including the recent addition of an AI conversation tool.
This study explores the application of the AI conversation tool to enhance the learning experience of 41 Architecture, Construction Management, and Civil Engineering students enrolled in a Building Systems course during the Spring 2025 semester. Building Systems courses play an important role in Architecture, Engineering, and Construction (AEC) education by exposing students to multiple building systems including structural, HVAC, mechanical, electrical, and fire protection systems and improving their understanding of building design and construction.
In this experiment, the AI conversation tool enabled students to interact with AI personas, providing a more personalized and adaptive learning experience. At the end of the semester, a survey was conducted to gather student feedback, complemented by the instructor's observations, to evaluate the effectiveness of AI conversations as a supplemental learning tool. The findings revealed promising potential for AI integration in large, multidisciplinary classrooms: the AI conversations delivered immediate feedback, supported personalized learning, and enhanced student engagement. Both students' responses and the professor's reflections suggest that AI-driven conversations could play a transformative role in advancing AEC education in the future.

Introduction:
Artificial Intelligence (AI) quickly became an essential tool for both educators and learners, yet a lot of questions and concerns need to be addressed. Dakakni and N. Safa [1] showed that students reported using AI tools to help generate ideas and assist with project "blueprints" or even complete assignments, indicating AI's utility as a creative and task-support tool for learners. However, both students and teachers also expressed concerns about trust, equity, ethical use, and potential over-reliance on AI in educational contexts [1]. McDonald et al. (2025) demonstrate that generative artificial intelligence can enhance higher education by improving instructional efficiency, supporting curriculum development, and enabling pedagogical innovation. They further argue that, when guided by clear institutional policies, AI adoption can advance ethical, responsible, and inclusive academic practices [2]. Rodway and Schepman (2023) report that university students are generally receptive to AI educational technologies, particularly those that support career development, formative learning activities, and administrative tasks. However, the study also notes concerns about reduced course satisfaction under broader AI integration, underscoring the importance of aligning AI applications with student expectations and comfort levels [3].
Research on AI conversational agents in higher education highlights their transformative potential to address long-standing pedagogical challenges [4], such as the "teacher-bandwidth problem" in large-enrollment courses. Yusuf et al. [5] argue that these pedagogical

conversational agents (PCAs) can effectively scale up teaching practices by providing 24/7 personalized support, on-demand feedback, and immediate assistance with coursework. According to Wollny et al. [6], by simulating human-like dialogue, PCAs move beyond traditional rule-based interactions to offer sophisticated scaffolding that guides students through complex problem-solving and knowledge integration.

The implementation of AI tools has shown significant positive effects on student performance and engagement, particularly within STEM and Architecture, Engineering, and Construction (AEC) education. Meta-analyses conducted by Freeman et al. [7] demonstrate that active learning models lead to higher examination scores and lower failure rates compared to traditional lecturing. In architectural education, Jin et al. [8, 9] found that AI has been successfully embedded to assist with multidimensional tasks like architectural programming, data analysis, and creative brainstorming, significantly improving students' work efficiency and innovative thinking. Furthermore, Billings et al. [10] demonstrate that AI can be used to facilitate peer-to-peer discussions by maximizing the variety of ideas within student groups. However, the transition to AI-integrated classrooms reveals a disparity between student perceptions and actual academic outcomes. While Wang et al. [11] report that students often perceive high usefulness and satisfaction with AI tools for information organization, Thompson et al. [12] found no statistically significant difference in final learning gains between students using AI co-tutors and those in traditional settings. This suggests that while AI can mitigate isolation in virtual classrooms and enhance the learning experience, its impact on higher-order cognitive skills may be more moderate and heavily dependent on the duration and quality of the intervention, as noted by Labadze et al. [13].

Reliability and systematic integration remain critical hurdles for widespread AI adoption. Khosrawi-Rad et al. [14] identify a "point-intervention" trend, where students use AI occasionally rather than as part of a comprehensive workflow. Technical challenges, such as AI "hallucinations" or unpredictable outputs in design generation, can mislead students in precise technical fields. Furthermore, Ortega-Ochoa et al. [15] emphasize the importance of designing empathic agents that can handle the emotional and social dimensions of learning to foster deeper student trust and persistence. The ethical and institutional landscape of AI in higher education is described by Dakakni et al. [1] as a "21st-century Pandora's Box," necessitating robust policy frameworks to address concerns about academic integrity, data privacy, and equity. For successful integration, a "human-in-the-loop" approach is essential, where educators provide the necessary pedagogical scaffolds to ensure AI tools complement rather than replace expert instruction. Future research must continue to explore long-term relationships between students and AI to ensure these tools promote equitable and effective learning environments [9].

Research problem and knowledge gap:

Building Systems courses in Architecture, Engineering, and Construction (AEC) education are inherently complex, requiring students from multiple disciplines to simultaneously comprehend and integrate structural, mechanical, electrical, HVAC, and fire protection systems. In large and multidisciplinary classrooms, traditional instructional methods often struggle to provide timely, individualized feedback and adaptive learning support, leading to uneven student engagement and learning outcomes. While Artificial Intelligence (AI) tools are increasingly being embedded within Learning Management Systems such as Blackboard, there remains limited empirical evidence examining how AI-driven conversational tools can effectively support student learning in technically intensive AEC courses. Specifically, there is a lack of systematic investigation into whether AI conversation tools can enhance personalized learning, improve student engagement, and serve as an effective supplemental instructional strategy within Building Systems education. Addressing this gap is essential to understanding the pedagogical value, limitations, and future role of AI-enabled conversational technologies in advancing AEC education.

Purpose:

The purpose of this study is to examine the effectiveness of an AI-driven conversation tool integrated within the Blackboard Learning Management System as a supplemental learning strategy in a multidisciplinary Building Systems course. The study aims to evaluate how AI-based conversational interactions can support personalized learning, enhance student engagement, and provide timely feedback for Architecture, Construction Management, and Civil Engineering students. By analyzing student perceptions alongside the instructor's observations, this research seeks to assess the pedagogical potential of AI conversations and their role in addressing instructional challenges in large, technically intensive AEC classrooms.

Objectives:

The specific objectives of this study are to:

1. Assess student perceptions of the AI conversation tool regarding its usability, clarity, and contribution to learning Building Systems concepts.
2. Evaluate the role of AI conversations in supporting personalized and adaptive learning experiences for students from different AEC disciplines.
3. Examine the impact of AI-driven conversations on student engagement and interaction with course content in a large, multidisciplinary classroom setting.

Method:

To assess the perception of the AI conversations tool, this study employed a mixed-methods exploratory research design to evaluate the effectiveness of an AI-driven conversation tool as a supplemental learning strategy in a Building Systems course, specifically in a large multidisciplinary class. Quantitative data were collected through a post-semester student survey, in addition to the qualitative instructor's observations.

The instructor employed the Blackboard AI conversation tool to enhance the learning experience and improve the level of engagement for 41 Architecture, Construction Management, and Civil Engineering students enrolled in a Building Systems course during the Spring 2025 semester. The instructor assigned the students an AI conversation as a classroom activity every week. Instructor's observations and survey results were used to identify the efficacy of these class activities in various areas including personalized learning, engagement and participation, in addition to the overall experience.

Instructors' observations and student feedback were used to identify the potential benefits and challenges of using AI conversations in a large building systems classroom Figure 1.

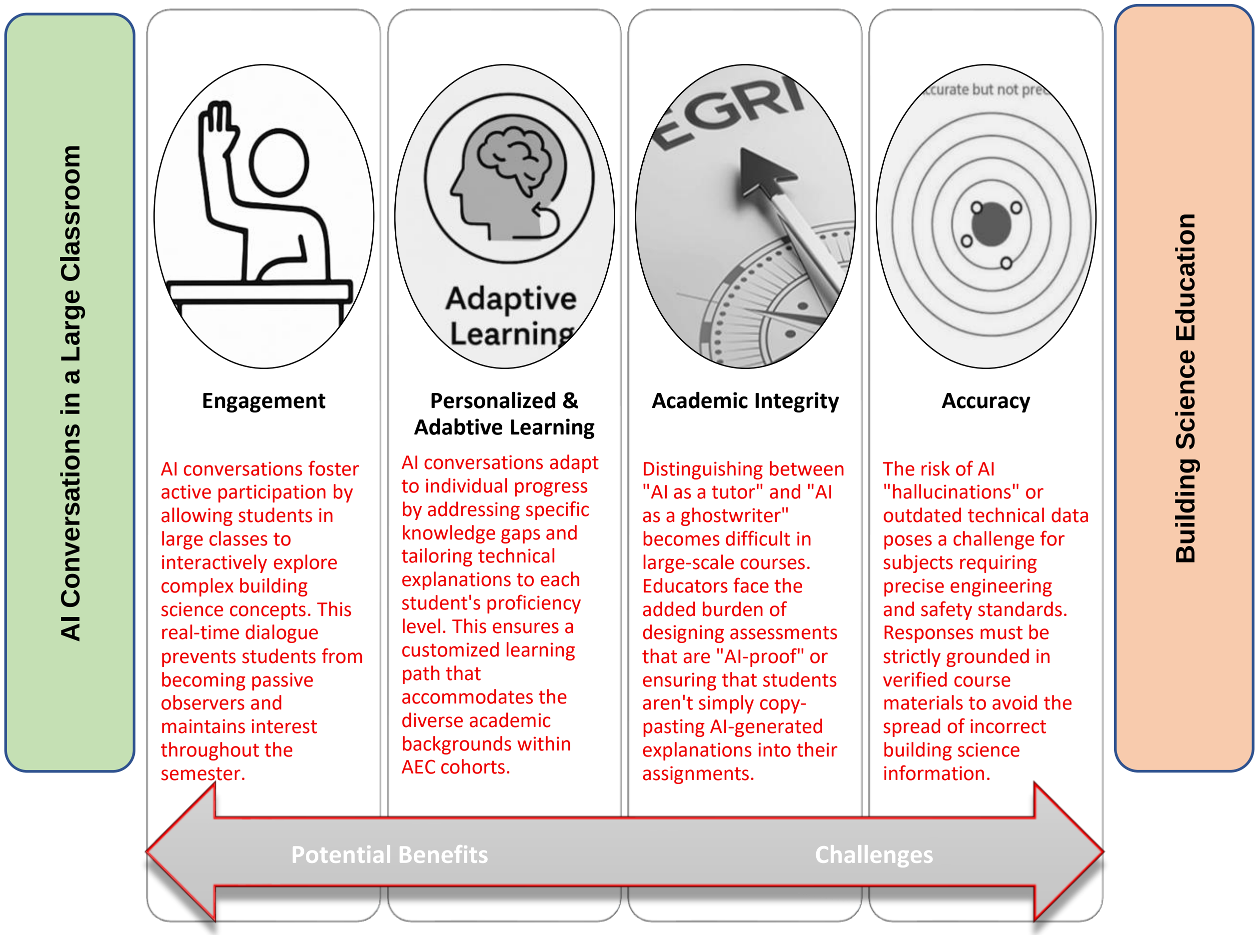

Figure 1. Key Potential Benefits and challenges of using AI conversations in a building systems large classroom setting (by authors)

The survey was administered and designed to capture both quantitative and qualitative dimensions of student experience. Survey questions included demographic information (academic major), prior exposure to AI-based learning tools, Likert-scale items measuring perceived usefulness, adaptability, engagement, and feedback effectiveness, as well as open-ended questions allowing students to elaborate on perceived benefits, limitations, and recommendations for improvement. This mixed-format structure enabled a comprehensive assessment of student perceptions while allowing participants to reflect critically on their learning experience.

The survey served as an evaluative mechanism to assess how AI conversations supported personalized learning, immediate feedback, and student engagement in a large building systems classroom setting. Quantitative responses provided measurable indicators of student satisfaction and perceived learning impact, while qualitative responses offered contextual insights into how students interacted with the AI tool and how it complemented traditional instruction. Survey participation was voluntary and anonymous to promote candid feedback. The collected data were analyzed using descriptive statistics and thematic analysis. This approach ensured that the survey functioned not only as a feedback instrument but also as a systematic research method aligned with the study’s objectives

The survey consisted of closed-ended and open-ended questions organized into thematic sections addressing student demographics, prior experience with AI-based learning tools, perceived effectiveness of AI feedback, personalization and adaptability of learning, engagement, usage patterns, and overall satisfaction. Quantitative items employed Likert-scale and categorical response formats to measure levels of agreement, effectiveness, and frequency, while qualitative prompts allowed students to elaborate on benefits, challenges, and recommendations for improvement. The survey was administered electronically at the end of the semester, ensuring consistency in data collection and enabling both statistical analysis and thematic interpretation of student experiences.

Results:

Survey Results:

The survey was designed to elicit student perceptions regarding the pedagogical benefits and technical challenges associated with the integration of AI-driven conversations in a large-scale building science classroom. The results indicate that the implementation was largely successful, with students reporting a significantly enhanced learning process facilitated by the tool's capacity for personalized, adaptive instruction. Despite these gains, the data also highlighted critical concerns regarding the reliability of the knowledge acquired. Specifically, students and the instructor noted a degree of uncertainty in the AI's technical responses and an inherent bias that occasionally oriented the dialogue based on the specific framing of student inquiries. To mitigate these risks of misinformation and narrow perspective, a "human-in-the-loop" protocol was established, whereby the instructor provided real-time moderation and reviewed specific AI-generated content whenever technical inconsistencies or biases were identified.

A total of 43 students completed the end-of-semester survey, representing a multidisciplinary cohort dominated by Construction Management students (78%), followed by Architectural Science (17%) and Engineering (5%). Most respondents (78%) reported prior experience with AI-based conversational tools before enrolling in the course, indicating a generally AI-aware student population. A detailed summary of the sample characteristics and demographic distribution is provided in Table 1.

Table 1. Characteristics of the sample. N=41

	N = 17	
	Frequency	**Percentage**
Student Program of Study		
Construction Management	32	78 %
Architectural Science	7	17 %
Engineering	2	5%
	41	100
Prior Experience with AI-based Learning		
Yes	32	78 %
No	9	22 %
	41	100

Students reported strong perceived benefits of the Blackboard AI conversation tool across multiple learning dimensions. A large majority (89%) indicated that AI feedback improved their understanding of Building Science and STEM concepts, while 97% reported that AI conversations supported learning at their own pace. In terms of engagement, 82% of respondents stated that AI conversations increased their engagement in the course. When comparing AI feedback to waiting for instructor responses, 92% of students rated AI as effective or very effective in clarifying course concepts. Furthermore, 89% of respondents indicated they would recommend the use of AI conversations in future STEM courses. Qualitative responses reinforced these findings, highlighting immediate feedback, personalized explanations, and the ability to ask discipline-specific questions as key advantages, while concerns centered on occasional inaccuracies, repetition, and the need for moderation rather than replacement of instructor-led teaching

Table 2. Summary of the survey results

Dimension	**Measured Metric / Variable**	**Outcome & Data Distribution**
Participation	Survey Response Rate	95.5% (43 of 45 students)
Profile	Disciplinary Distribution	74% Construction Management; 16% Architectural Science; 5% Engineering; 5% Other.
Experience	Prior Personal Use of AI	79% (n=34) Experienced; 21% (n=9) First-time users.
Efficiency	Immediacy of Feedback	88% Positive Agreement: Students valued the 24/7 availability for technical clarification.
Pedagogy	Personalized Support	81% Positive Agreement: Adaptive dialogues successfully targeted individual knowledge gaps.
Engagement	Socratic Dialogue Impact	77% Positive Agreement: Question-based interactions encouraged higher-level cognitive processing.
Accuracy	Content Reliability Concerns	23% Uncertainty: Students noted occasional vague responses or technical "hallucinations."
Interaction	Influence of Prompt Bias	Qualitative Finding: Dialogue quality was significantly influenced by the specificity of student inquiries.
Moderation	Instructor Oversight	100% Intervention Rate: Instructor reviewed all transcripts to correct inconsistencies in live lectures.

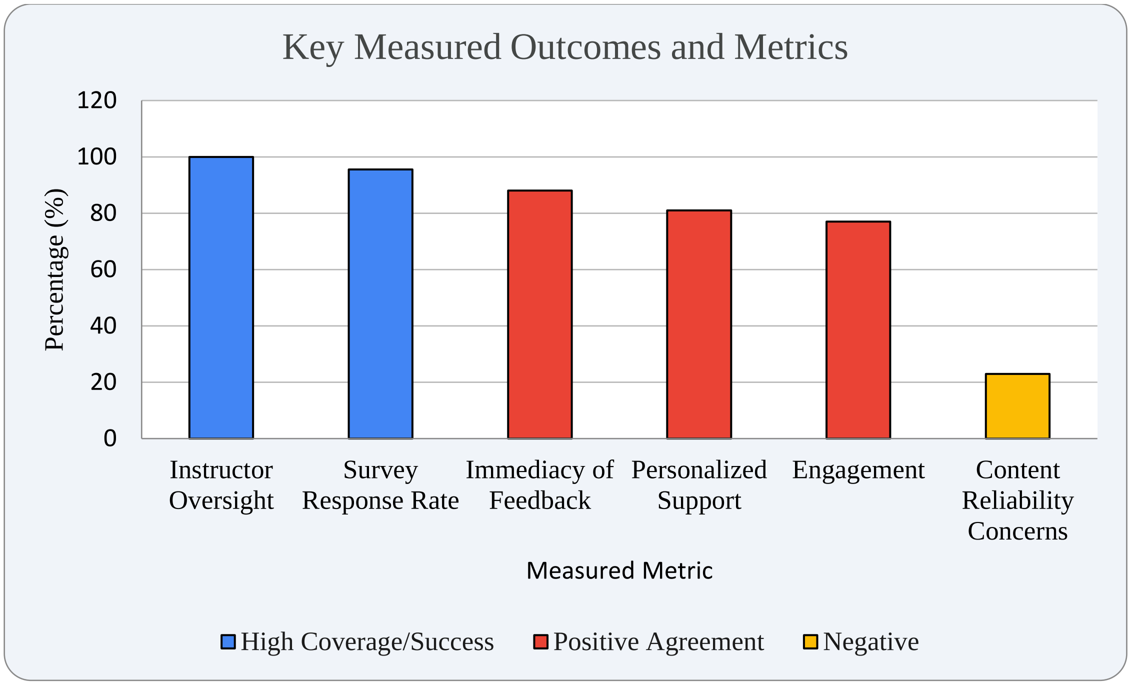

Figure 2. Key measured outcomes and metrics

Instructor Observations:

Consistent with the quantitative survey results, the instructor's qualitative observations indicate that the AI-based conversation tool functioned as a meaningful pedagogical enhancement within the Building Systems course. Throughout the semester, students actively engaged with the AI conversations during class sessions, which contributed to a noticeable shift in classroom dynamics. Students arrived at discussions with more refined technical questions, suggesting that real-time interaction with the AI persona helped clarify foundational concepts as they were being introduced. This, in turn, allowed in-class dialogue to advance more quickly toward higher-level considerations of structural loading, system coordination, and mechanical integration. Additionally, the instructor observed that the tool helped address common challenges in large-enrollment courses by giving students an accessible way to ask questions and practice professional AEC terminology during class. While the instructor remained the primary authority for validating complex building code interpretations, the AI tool effectively supplemented instructional support during live sessions, helping students stay engaged and supported as they worked through course material.

Conclusion:

This study explored the potential of the Blackboard AI conversation tool as a supplemental instructional strategy in a large, multidisciplinary Building Science course. The findings indicate that AI-driven conversations can play a meaningful role in enhancing student learning and engagement in technically complex AEC educational settings. Students reported strong perceived benefits related to immediate feedback, improved conceptual understanding, support for self-paced learning, and increased engagement with course material. The high level of student willingness to recommend AI conversations for future STEM courses further suggests broad acceptance of this instructional approach when thoughtfully integrated into course design.

At the same time, student feedback highlighted important considerations for effective implementation. While AI conversations were valued for personalization and accessibility, concerns regarding occasional inaccuracies, repetitive interactions, and reduced preference for AI over human instruction underscore the importance of positioning AI as a complement rather than a replacement for instructor-led teaching. These findings reinforce the need for clear pedagogical framing, instructor oversight, and intentional alignment between AI prompts and course learning objectives, particularly in multidisciplinary classrooms where content depth and disciplinary nuance vary.

Overall, this study contributes empirical evidence to the emerging body of research on AI-enabled conversational tools in higher education and offers practical insights for AEC educators seeking scalable strategies to support diverse learners in large courses. Future research should extend this work by examining longitudinal learning outcomes, discipline-specific impacts, and comparative analyses between AI-supported and traditional instructional approaches. With the rapid evolution of AI technologies, carefully aligned pedagogical integration can play a transformative role in strengthening Building Science and the broader STEM education.

References:

[1] D. Dakakni and N. Safa, "Artificial intelligence in the L2 classroom: Implications and challenges on ethics and equity in higher education: A 21st century Pandora's box," *Computers and Education: Artificial Intelligence,* vol. 5, p. 100179, 2023.

[2] N. McDonald, A. Johri, A. Ali, and A. H. Collier, "Generative artificial intelligence in higher education: Evidence from an analysis of institutional policies and guidelines," *Computers in Human Behavior: Artificial Humans,* vol. 3, p. 100121, 2025.

[3] P. Rodway and A. Schepman, "The impact of adopting AI educational technologies on projected course satisfaction in university students," *Computers and Education: Artificial Intelligence,* vol. 5, p. 100150, 2023.

[4] A. B. Saka, L. O. Oyedele, L. A. Akanbi, S. A. Ganiyu, D. W. Chan, and S. A. Bello, "Conversational artificial intelligence in the AEC industry: A review of present status, challenges and opportunities," *Advanced Engineering Informatics,* vol. 55, p. 101869, 2023.

[5] H. Yusuf, A. Money, and D. Daylamani-Zad, "Pedagogical AI conversational agents in higher education: a conceptual framework and survey of the state of the art," *Educational technology research and development,* vol. 73, no. 2, pp. 815–874, 2025.

[6] S. Wollny, J. Schneider, D. Di Mitri, J. Weidlich, M. Rittberger, and H. Drachsler, "Are we there yet?-a systematic literature review on chatbots in education," *Frontiers in artificial intelligence,* vol. 4, p. 654924, 2021.

[7] S. Freeman *et al.*, "Active learning increases student performance in science, engineering, and mathematics," *Proceedings of the national academy of sciences,* vol. 111, no. 23, pp. 8410–8415, 2014.

[8] S. Jin *et al.*, "Enhancing architectural education through artificial intelligence: a case study of an AI-assisted architectural programming and design course," *Buildings,* vol. 14, no. 6, p. 1613, 2024.

[9] L. Xi, Y. Zhang, and Q. Wang, "Investigating the effects of an LLM-based Socratic conversational agent on students' academic performance and reflective thinking in higher education," *Computers & Education,* p. 105494, 2025.

[10] K. Billings, H.-Y. Chang, J. M. Lim-Breitbart, and M. C. Linn, "Using Artificial Intelligence to Support Peer-to-Peer Discussions in Science Classrooms," *Education Sciences,* vol. 14, no. 12, p. 1411, 2024.

[11] J. Wang and W. Fan, "The effect of ChatGPT on students' learning performance, learning perception, and higher-order thinking: insights from a meta-analysis," *Humanities and Social Sciences Communications,* vol. 12, no. 1, pp. 1–21, 2025.

[12] K. N. Thompson, K. L. Chandler, C. Morgan, D. Khashabi, E. A. Delinski, and B. Van Durme, "Artificial Intelligence as a Co-Tutor: Assessing the Impact in the Advanced Learning Virtual Classroom," *Journal of Advanced Academics,* vol. 36, no. 4, pp. 714–745, 2025.

[13] L. Labadze, M. Grigolia, and L. Machaidze, "Role of AI chatbots in education: systematic literature review," *International journal of Educational Technology in Higher education,* vol. 20, no. 1, p. 56, 2023.

[14] B. Khosrawi-Rad *et al.*, "Conversational agents in education–a systematic literature review," 2022.

[15] E. Ortega-Ochoa, M. Arguedas, and T. Daradoumis, "Empathic pedagogical conversational agents: a systematic literature review," *British Journal of Educational Technology,* vol. 55, no. 3, pp. 886–909, 2024.