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Guided vs. Unguided AI Integration in Project Scheduling Class: An Exploratory Study with Construction Management Students

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Abstract

Artificial intelligence (AI) tools and chatbots have simultaneously introduced opportunities and challenges in the context of construction engineering and management (CEM) education. This study examined the integration of ScheduleAI, a specialized chatbot to support senior construction management (CM) students in a Project Scheduling course. The study designed and compared two pedagogical approaches: (1) one section (25 students, Group 1) received guided integration, in which Instructor A actively scaffolded chatbot use within in-class learning activities; (2) other parallel sections (76 students, Group 2) were taught by Instructor B, who provided access to the same AI tool without offering direct guidance on its use. All course sections were lab-based and delivered in a computer lab where students met once per week in a three-hour session.

This study aims to investigate how different instructor guidance levels relate to students' engagement with AI tools and their perceptions of learning in project scheduling. The research lies in instructional technologies in construction education, particularly the interaction between pedagogical scaffolding and student engagement in AI-integrated teaching and learning environments. In this project scheduling course, CM students developed competencies in areas such as work breakdown structure (WBS) development, activity duration estimation, and resource planning.

Pre- and post-course surveys were conducted to assess the role of AI chatbots in students' learning experiences. Results indicate that while both instructional approaches exhibited generally positive attitudes toward AI chatbots, guided integration was associated with higher perceived usefulness, more frequent and consistent chatbot use, and stronger perceptions of learning improvement. Unguided access to ScheduleAI was associated with relatively less substantial shifts in students' perceived learning benefits and greater variability in usage patterns. This work contributes empirical evidence that can inform more pedagogically grounded approaches to integrating AI into CEM education.

Introduction

Artificial intelligence (AI) and AI-based chatbots have become more common in engineering and construction education. The fact that students use these tools more frequently has changed how they work with technical and course materials. Previous studies showed that AI explanations and chatbot feedback help students understand ideas more clearly and keep their attention during difficult lessons [1], [2], [3],[4], [5]. Other research also pointed out that personalized AI tools can build students' confidence and support the development of basic technical skills across engineering fields [6].

Specialized chatbots have been designed and developed for construction engineering and management (CEM) application purposes. Examples include quantity takeoff helpers, safety-check bots, and scheduling support tools. These systems are potential to create more authentic learning activities and help students think more systematically about CEM problems [7]. Recent research indicated that using generative AI (GenAI) in a structured and guided way can help students plan projects and improve their reasoning skills in capstone courses. Students also present their ideas more clearly when they receive clear instructions. Therefore, AI tends to be most effective when instructors provide direct and consistent guidance [8].

Broader research in human-computer interaction showed that students need basic AI literacy. They must know how to interpret and evaluate AI outputs, instead of accepting automated answers without thinking [9]. Findings from programming-heavy courses also indicated that AI chatbots like ChatGPT can help students fix errors, but when they rely on the tool without guidance, their understanding becomes shallow and their performance becomes uneven [10]. These results highlight the two sides of AI support: very helpful with proper guidance, but potentially harmful when students use it without a solid understanding.

Research in educational technology further indicated that the efficacy of digital instruments is largely contingent upon their integration within pedagogical practices. As an illustration, cloud-based student response systems can foster heightened engagement and interaction within project management courses, particularly when employed in active and collaborative environments like SCALE-UP classrooms [11]. The advantages stem not from the technology itself, but rather from the manner in which educators structure activities that incorporate it. Similarly, research on technology-enhanced review systems indicates that learning improvements are contingent upon the alignment of activities with the tool's capabilities and the cognitive skills targeted by the course [12].

In sum, these observations confirm that the effectiveness of technology depends on how instructors are proactive and strategically plan its application. These factors are particularly important in the context of project scheduling, where students are required to undertake activities that demand high-level thinking. These activities encompass the development of work breakdown structures (WBS), the sequencing of project activities, the estimation of durations, and the verification of precedence logic [13]. Previous studies noted that the use of unstructured AI can lead to superficial reasoning or misinterpretation of technical constraints, thereby highlighting the need for structured support [14]. In addition, structured guidance plays a key role in stabilizing student attitudes and promoting more consistent AI use compared with unguided, self-directed adoption [15].

Overall, research on AI integration in education, including in the field of CEM, has expanded rapidly in recent years. Nevertheless, empirical evidence that directly compares guided and unguided approaches to AI use remains limited, leaving an important gap in understanding how different implementation strategies influence students' learning experiences and perceptions. The goal of this study is to address that gap by comparing these two implementation strategies for an AI scheduling chatbot (ScheduleAI) in an upper-level CEM project scheduling course. In addition, the study aims to characterize broader perceptions related to AI-supported learning to contextualize observed differences in usage and perceived benefits. By linking pedagogical scaffolding to chatbot-supported learning in a construction scheduling setting, this study advances ongoing efforts to align AI-based tools with effective instructional design in CEM.

Methodology

This study looked at how ScheduleAI, a chatbot developed by Instructor A, was brought into a senior Construction Management course. The tool was used to support learning project scheduling. The study used a comparative design with two different teaching approaches. The aim was to understand how the level of guidance affected the perceptions of students in learning project scheduling and chatbot usage.

ScheduleAI is a purpose-built scheduling support chatbot created using a Chatbot builder and aligned with the Project Scheduling course content. It was designed to function as a just-in-time learning aid, not a scheduling software replacement, by providing explanations, examples, and structured guidance while students worked on lab tasks. Key functions include helping students draft an activity list/WBS outline, clarify sequencing logic (predecessors/successors), and reflect on duration and resource assumptions. Because the tool relies on a large language model, responses may vary and can be imperfect; therefore, students were instructed to treat output as suggestions and verify them against course materials and their own calculations.

Group 1 (25 students) followed the guided approach. Instructor A explained the ScheduleAI tool directly, showed its main functions, and demonstrated its application in the weekly class sessions. Students learned and used the chatbot to support project scheduling related problems and/or check their work.

Group 2 (76 students) was the unguided cohort taught by Instructor B. Students were provided access to the same ScheduleAI chatbot and received a brief orientation describing its core functions (e.g., supporting activity/WBS drafting, sequencing logic, and duration reasoning) at the first week of the semester. However, ScheduleAI was not embedded into required assignments or in-class activities, and no structured training, scaffolded prompts, or follow-up coaching was provided. As a result, engagement with the chatbot was entirely student-initiated: students could choose whether to use it, when to use it, and for which tasks.

Both groups attended a 20-week program, meeting once per week in a computer lab for a three-hour session. The course focused on basic scheduling knowledge: setting the activities list, estimating activity durations, schedule logics and sequencing, defining resources, and calculating productivity. These skills were prepared for students to create resource-loaded schedules in scheduling software. Guided groups used both traditional approach of learning and practicing as well as the use of ScheduleAI in class sessions. The following describes some of in-class activities used in this course.

Sample Activity 1. Create a List of Activities

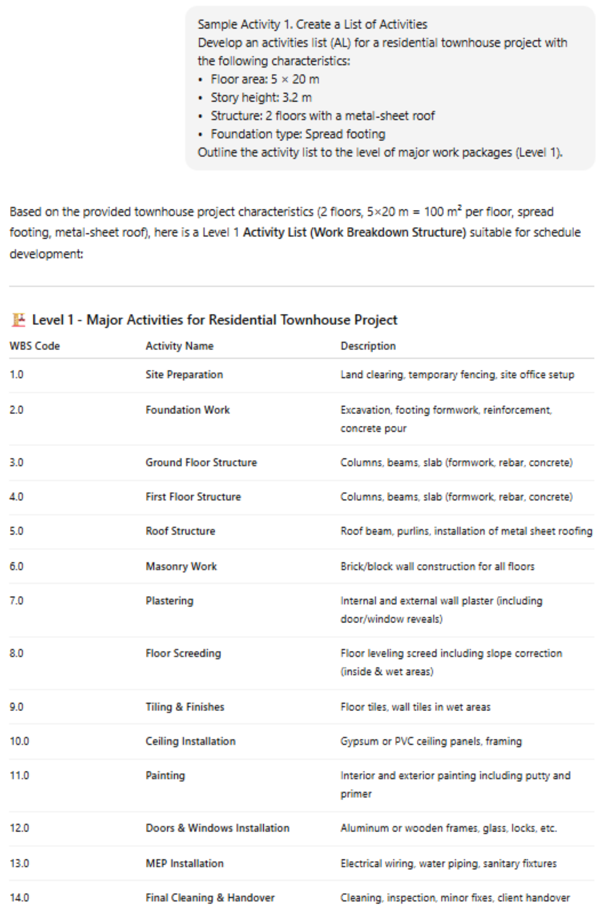
Develop an activities list (AL) for a residential townhouse project with the following characteristics:

- *Floor area: 5 × 20 m*
- *Story height: 3.2 m*
- *Structure: 2 floors with a metal-sheet roof*
- *Foundation type: Spread footing*

Outline the activity list to the level of major work packages (Level 1).

For Sample Example 1, students first read and developed an activity list individually on paper. After that, instructors then formed discussion groups of 4–6 students to encourage interaction and help each group reach a shared WBS structure and activities. Instructors occasionally invited some groups to present their work in front of class.

For guided group, after the small-group or whole-class discussion, Instructor A asked students to use ScheduleAI. Students compared their activity lists with the version produced from the chatbot (Figure 1). Students had opportunities to reflect on why the chatbot output was similar or different from their own work.


Sample Activity 1. Create a List of Activities
Develop an activities list (AL) for a residential townhouse project with the following characteristics:
- Floor area: 5 × 20 m
- Story height: 3.2 m
- Structure: 2 floors with a metal-sheet roof
- Foundation type: Spread footing

Outline the activity list to the level of major work packages (Level 1).

Based on the provided townhouse project characteristics (2 floors, 5×20 m = 100 m² per floor, spread footing, metal-sheet roof), here is a Level 1 **Activity List (Work Breakdown Structure)** suitable for schedule development:

Level 1 - Major Activities for Residential Townhouse Project

WBS Code	Activity Name	Description
1.0	Site Preparation	Land clearing, temporary fencing, site office setup
2.0	Foundation Work	Excavation, footing formwork, reinforcement, concrete pour
3.0	Ground Floor Structure	Columns, beams, slab (formwork, rebar, concrete)
4.0	First Floor Structure	Columns, beams, slab (formwork, rebar, concrete)
5.0	Roof Structure	Roof beam, purlins, installation of metal sheet roofing
6.0	Masonry Work	Brick/block wall construction for all floors
7.0	Plastering	Internal and external wall plaster (including door/window reveals)
8.0	Floor Screeding	Floor leveling screed including slope correction (inside & wet areas)
9.0	Tiling & Finishes	Floor tiles, wall tiles in wet areas
10.0	Ceiling Installation	Gypsum or PVC ceiling panels, framing
11.0	Painting	Interior and exterior painting including putty and primer
12.0	Doors & Windows Installation	Aluminum or wooden frames, glass, locks, etc.
13.0	MEP Installation	Electrical wiring, water piping, sanitary fixtures
14.0	Final Cleaning & Handover	Cleaning, inspection, minor fixes, client handover

Figure 1. A sample response from ScheduleAI in Sample Activity 1

In Sample Activity 2, students are asked to develop a schedule for the first-floor structural work (Figure 2). The scope included formwork, rebar installation, and concrete placement. The task durations were based on industry productivity data and shared with all students. Using a common data set ensured consistent assumptions and enabled straightforward comparison and checking of results across students and groups. With that, students are required to complete two questions, presented as follows.

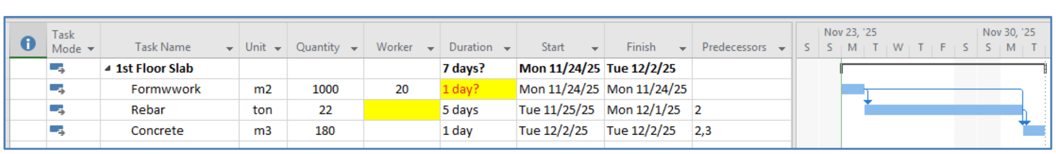

Task Mode	Task Name	Unit	Quantity	Worker	Duration	Start	Finish	Predecessors
	1st Floor Slab				7 days?	Mon 11/24/25	Tue 12/2/25	
	Formwwork	m2	1000	20	1 day?	Mon 11/24/25	Mon 11/24/25	
	Rebar	ton	22		5 days	Tue 11/25/25	Mon 12/1/25	2
	Concrete	m3	180		1 day	Tue 12/2/25	Tue 12/2/25	2,3

Figure 2. Sample Activity 2

Sample Activity 2 - Question 1. Determine Formwork Duration
For the 1st-floor slab, the contractor must install 1000 m² of formwork. At the time of planning, there are 20 workers available on site for this activity. The formwork is planned to start on Monday, November 24, 2025, with no work on Sundays and public holidays.
Calculate the required duration (in working days) for the formwork activity based only on the given quantity (1000 m²) and the available crew size (20 workers).

Sample Activity 2 - Question 2. Calculate Rebar Crew
For the 1st-floor slab, the total rebar quantity is 22 tons. The contractor wants the rebar installation (only) for this slab to be completed within 5 working days. Determine how many workers are required for the rebar activity so that the team can install 22 tons of rebar in 5 working days.

In both groups, students calculated the number of working days (Figure 3) and the number of workers (Figure 4) based on the industry productivity data. Students do these calculations in Excel or with any software they prefer.

Sample Activity 2 - Question 1. Determine Formwork Duration
For the 1st-floor slab, the contractor must install 1000 m² of formwork. At the time of planning, there are 20 workers available on site for this activity. The formwork is planned to start on Monday, November 24, 2025, with no work on Sundays and public holidays.
Calculate the required duration (in working days) for the formwork activity based only on the given quantity (1000 m²) and the available crew size (20 workers).

No	Work Item	Unit	Standard Productivity per Day	Workers at Site	Total Daily Output with Workers	Quantity	Total Working Days Required
Structural Work							
1	Formwork	m2	6	20	120	1000	8,33
Result							
Required Duration (Round up)			9				

Dell:
Total working = Quantity/Total Daily

Figure 3. Formwork Duration Determined for Sample Activity 2

Sample Activity 2 - Question 2. Calculate Rebar Crew
For the 1st-floor slab, the total rebar quantity is 22 tons. The contractor wants the rebar installation (only) for this slab to be completed within 5 working days. Determine how many workers are required for the rebar activity so that the team can install 22 tons of rebar in 5 working days.

No	Work Item	Unit	Standard Productivity per Day	Workers at Site	Total Daily Output with Workers	Quantity	Total Working Days Required
Structural Work							
1	Rebar Works	ton	0,4	11	55	22	5
				Worker required = Total Daily/Total Working			
Result					Total Daily = Quatity/Standard Productivity		
Worker required (Round up)			11				

Figure 4. Crew Size Determined for Sample Activity 2

After that, students used scheduling software to create the schedule for the first-floor activities (Figure 5). Students had opportunities to compare and discuss their results with each other.

Task Mode	Task Name	Unit	Quantity	Worker	Duration	Start	Finish	Predecessors
	1st Floor Slab				15 days	Mon 11/24/25	Wed 12/10/25	
	Formwwork	m2	1000	20	9 days	Mon 11/24/25	Wed 12/3/25	
	Rebar	ton	22	11	5 days	Thu 12/4/25	Tue 12/9/25	2
	Concrete	m3	180		1 day	Wed 12/10/25	Wed 12/10/25	2,3

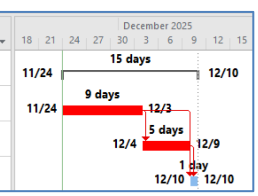
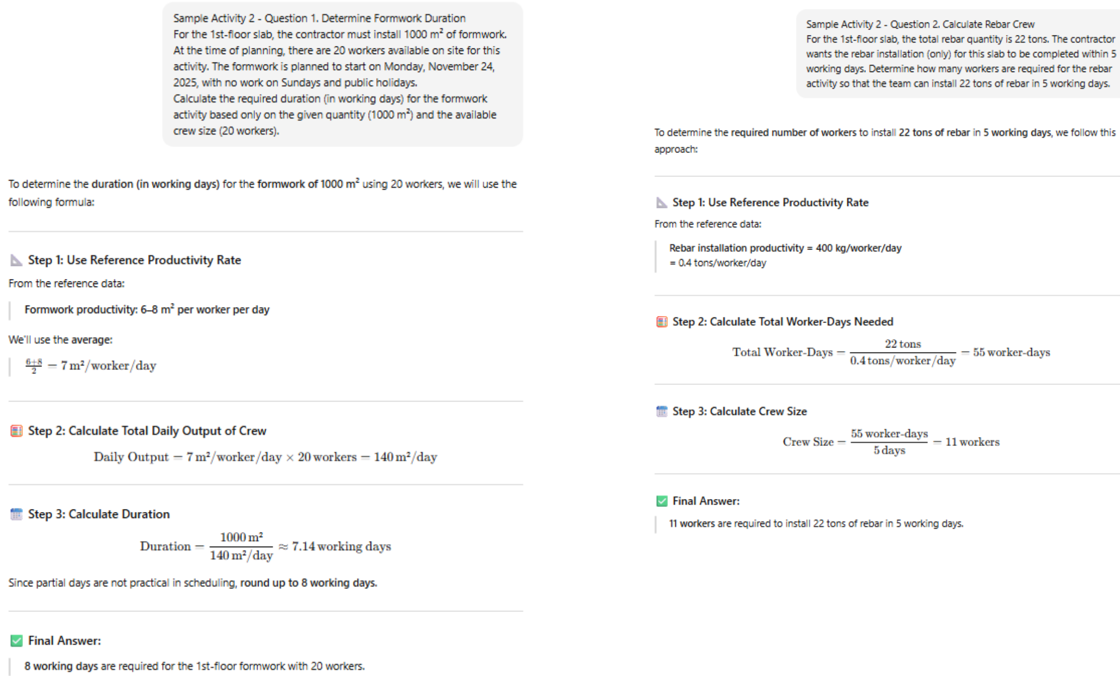


Figure 5. Sample 1st Floor Schedule

For the guided group, Instructor A asked students to use ScheduleAI chatbot to verify their results. Figure 6 illustrates a sample output of ScheduleAI for Sample Activity 2.



(a) Activity Duration (b) Crew Size

Figure 6. Sample ScheduleAI Responses to Sample Activity 2

Students may revise their first-floor schedule if needed (Figure 7). The intent is to help them see the differences between the two methods, understand their strengths, and get a deeper understanding of how a construction schedule is created.

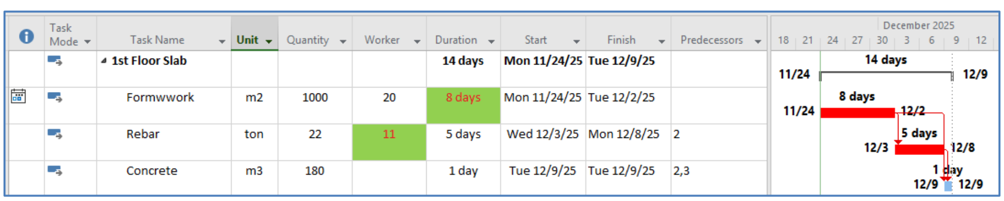


Figure 7. Sample 1st Floor Schedule Revised Version

Structured pre- and post-course surveys for both groups were conducted to gather student perceptions and behaviors regarding the use of GenAI and ScheduleAI during a construction planning and scheduling course. Pre- and post-course surveys were administered at two time points: the pre-survey was completed during the first lab meeting, and the post-survey was completed during the final lab meeting after students had opportunities to use the tool throughout the semester. The pre-course survey collected initial readiness levels, including familiarity with AI, use of chatbots for learning, and comfort levels with integrating AI into the lesson. The post-course survey focused on outcomes throughout the course, including frequency of use, perceived usefulness, perceived learning improvement, and related perceptions such as confidence and intention to apply in the future. Both surveys utilized Likert-scale items and open-ended responses to enable the collection of quantitative trends and qualitative viewpoints.

Table 1 summarizes the number of survey responses at each data-collection point. In the guided section, 25 students completed the pre-course survey and 23 completed the post-course survey.

In the unguided sections, 64 students completed the pre-course survey and 74 completed the post-course survey. Both groups consisted mostly of male students.

Table 1. Number of Responses across Survey Stages

Survey stage	Pre-course	Post-course
Guided	25	23
Unguided	64	74

Results

Comfort Levels from Previous Use of GenAI

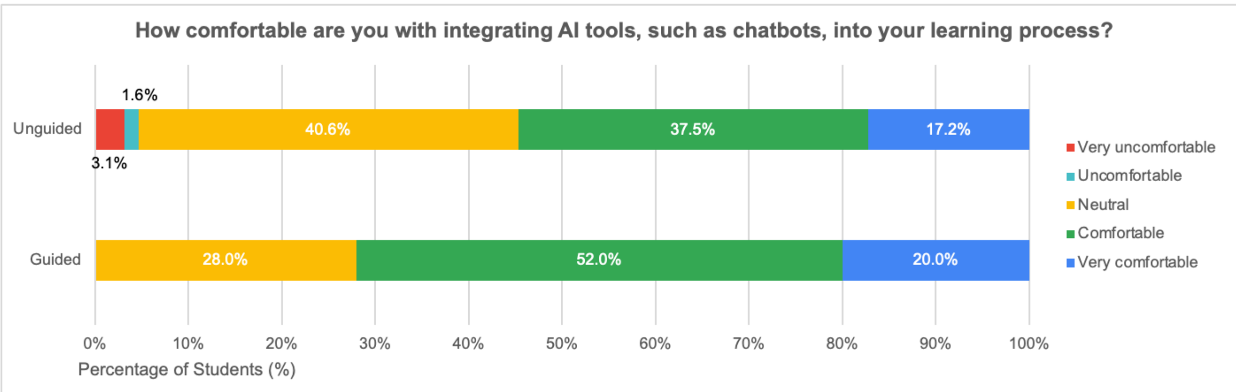


Figure 8. AI Chatbot Comfort Levels before Intervention

Before the course began, students in the Guided section showed noticeably higher comfort with integrating AI tools into their learning process compared with the Unguided section (Figure 8). In the Guided group, 52% of students reported feeling "comfortable" and 20% reported feeling "very comfortable," both higher than their peers in the Unguided group (37.5% and 17.2% respectively). This suggests that the Guided cohort entered the course with more positive expectations and greater readiness to experiment with AI-supported learning.

The Unguided section showed more uncertainty and hesitation. 40.6% selected "neutral," which is 12% higher than the Guided cohort (28%). Their distribution also contains more negative responses: about 5% of students reported being "uncomfortable" or "very uncomfortable," and the proportion selecting "uncomfortable" was double that of "very uncomfortable." This pattern indicates that a subset of Unguided students began the course unsure or skeptical about how AI tools would fit into their learning process.

These baseline differences help contextualize later finding whether meaningful gains in comfort, usefulness, and learning outcomes would be more likely when students start with openness and receive explicit guidance on how to integrate AI tools effectively.

Comparison of Student Perceptions Before and After Intervention

Familiarity with AI

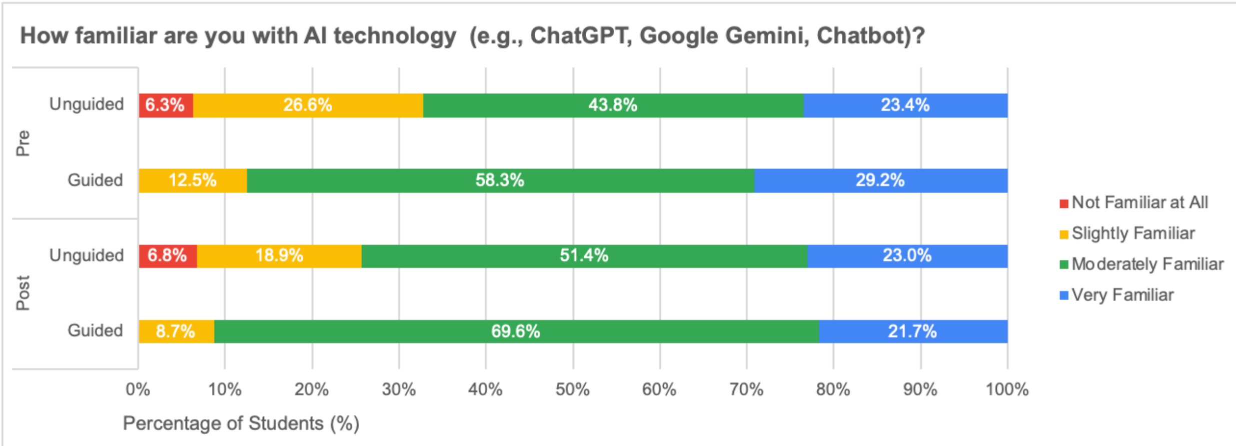


Figure 9. Perceived AI Familiarity

Before the course began, students in the Guided section already showed higher familiarity with AI tools, with roughly 90% reporting they were moderately to very familiar (Figure 9). The Unguided section started lower, with about 67% in the same familiarity range and 6.3% reporting no familiarity at all. After the course, both groups showed upward shifts, but the gains were stronger for the Guided group. In the Guided class, the share of students who were moderately familiar increased from 58.3% to 69.6% (+11.3 points), and the "slightly familiar" category dropped from 12.5% to 8.7%. This suggested clearer movement toward higher AI familiarity levels although there was a slight drop in the "very familiar" category (29.2% to 21.7%).

For the Unguided class, familiarity improved but more modestly. The proportion of moderately familiar students rose from 43.8% to 51.4% (+7.6 points). The majority of the Unguided group still shifted upward from "slightly familiar" to "moderately familiar."

When comparing the two instructional conditions directly, the Guided group consistently showed higher familiarity at both time points. At the start of the course, 58.3% of Guided students were moderately familiar with AI tools compared with 43.8% in the Unguided group, a 14.5-point gap. This difference widened slightly after the course: 69.6% of the Guided group reached the moderately familiar level versus 51.4% of the Unguided group, creating an 18.2-point gap. These between-group patterns reinforce the descriptive trend that guidance leads to stronger familiarity outcomes. Even though both groups improved, the Guided section maintained and slightly expanded its advantage by the end of the course.

Overall, both groups benefited from exposure to AI tools, but the Guided section consistently showed larger gains. The pattern supports the study's premise that structured instructional guidance helps students build confidence and familiarity with AI more effectively than Unguided exploration.

AI Chatbot Usefulness

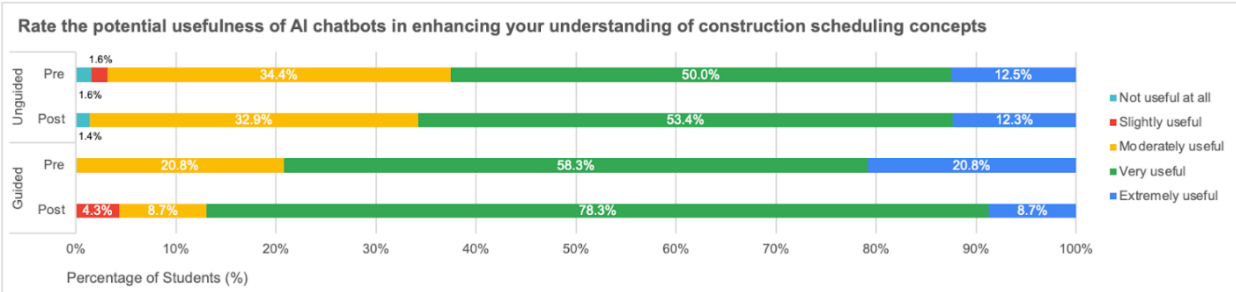


Figure 10. Perceived Usefulness of AI Chatbots

Across both instructional conditions, most students believed that AI chatbots were useful for enhancing their understanding of construction scheduling concepts (Figure 10). When collapsing the five-point scale into the desirable upper range (moderately useful, very useful, and extremely useful), the Unguided section began the course with 84.4% students rating the chatbot as very useful and moderately useful, slightly higher than the Guided section at 79.1%. While the Guided group started lower in “moderately useful” category, they had a larger share in upper categories: 58.3% rated the chatbot as “very useful” compared with 50.0% in the Unguided group, and 20.8% selected “extremely useful” versus 12.5% in the Unguided group. This suggests that the Guided cohort may have entered the course with stronger expectations about the potential of AI tools.

After the course, the Unguided section showed only modest shifts. The proportion of students selecting “not useful at all” decreased from 1.6% to 1.4%, which is negligible but directionally positive. The distribution shifted slightly within the middle categories: “moderately useful” declined from 34.4% to 32.9%, and “extremely useful” decreased from 12.5% to 12.3%, while “very useful” increased by 3.4%. The overall pattern suggests that without structured guidance, students’ perception of AI usefulness remains relatively stable, with some movement but no strong upward shift.

The Guided section showed a more noticeable change. The share of students rating the chatbot as “very useful” increased by 20 percentage points, rising from 58.3% to 78.3%, which is the most substantial change across both groups. This upward movement appears to come primarily from students who previously selected “moderately useful” moving into the higher category. At the same time, “extremely useful” ratings decreased from 20.8% to 8.7%, and a small number of students moved into the lower categories, with “slightly useful” increasing from 0% to 4.3%. This pattern suggests that while guidance significantly strengthened students’ belief that AI is “very useful,” it also led a few students to recalibrate their expectations as they gained a more realistic sense of the tool’s limitations within construction scheduling concepts.

Overall, the pattern supports the premise that guided AI integration helps students form stronger and more grounded beliefs about AI’s usefulness in mastering complex scheduling concepts, whereas unguided exposure yields flatter differentiated perceptions.

Improved Learning Outcomes

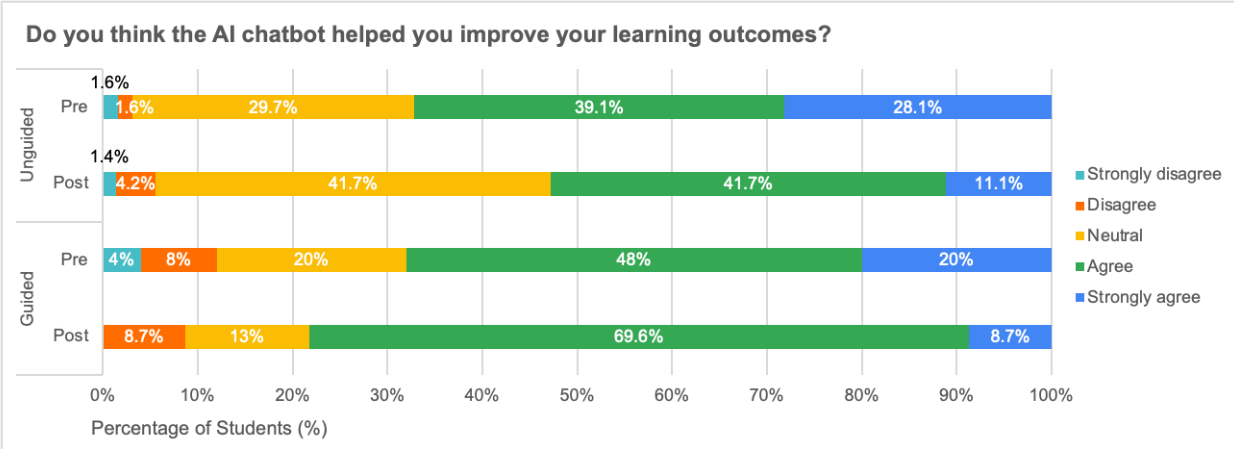


Figure 11. Perceived Learning Improvement

Across sections, most students entered the course with generally positive expectations about how AI chatbots might support their learning outcomes (Figure 11). In the Unguided section, 96.8% of students rated the chatbot between "neutral" and "strongly agree" at the beginning of the course. However, without structured guidance, shifts over time were modest and trended slightly downward. The share of students who strongly agreed that the chatbot improved their learning dropped by 17 percentage points, while disagree responses rose from 1.6% to 4.2% (+2.6 points). The increase in "agree" (+2.6 points) was offset by a migration of students into the "neutral" and "disagree" categories, suggesting that exposure alone did not strengthen students' perceived learning benefits of AI tools and may have produced a more ambivalent distribution of reactions.

The Guided section showed a different pattern. Before the course, 48% of students agreed that AI chatbots improved their learning, with strong agreement at 20% and some initial skepticism (8% disagree, 4% strongly disagree). After receiving structured guidance, the proportion who agreed increased substantially to 69.6%, a gain of over 20 percentage points. This upward shift indicates that guided integration played a strong role in helping students recognize the instructional value of AI tools. While "strongly agree" declined from 20% to 8.7%, this change appears to reflect a recalibration: students moved away from the most optimistic rating toward the more moderate but still positive "agree" category. The share of students who disagreed decreased slightly overall, and the students who began in the "strongly disagree" category all shifted upward into more positive categories after the guided experience.

The patterns reinforce that unguided AI use may generate inconsistent or shallow benefits, whereas guided integration helps students better understand how AI tools fit into learning tasks and how to leverage them effectively.

Comparison of Student Perceptions Between Groups after Intervention

Frequency of AI Chatbot Use

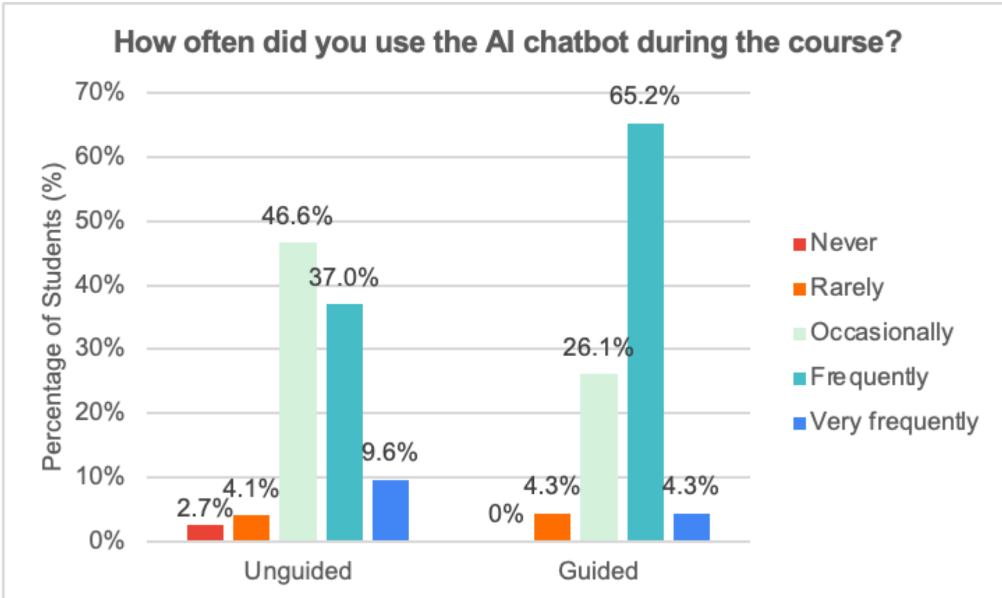


Figure 12. Frequency of AI Chatbot Use

This question captures how frequently students actually used the AI chatbot during the course (Figure 12). Clear differences emerge between the Guided and Unguided sections. In the Unguided group, 2.7% of students reported never using the chatbot during the course, whereas no students in the Guided group selected "never," suggesting that structured guidance helped ensure at least minimal engagement with the AI tool.

Usage intensity also differed across groups. In the Unguided section, the most common response was "occasionally" (46.6%), indicating task-specific use rather than consistent integration into coursework. By contrast, the Guided section showed a strong shift toward higher-frequency use: 65.2% of students reported using the chatbot frequently, compared with 37% in the Unguided group. This suggests that guidance did not merely encourage trial use, but helped normalize AI as a regular part of the learning workflow.

These patterns reinforce that guidance shapes not just toward AI, but actual usage behavior. Unguided students tended to use chatbot inconsistently, with many engaging only occasionally and a small minority using it very heavily. In contrast, guided instruction led to more uniform and sustained use across students, supporting the argument that structured integration is key to embedding AI tools meaningfully into learning processes rather than leaving adoption to individual initiative alone.

Engagement in Class

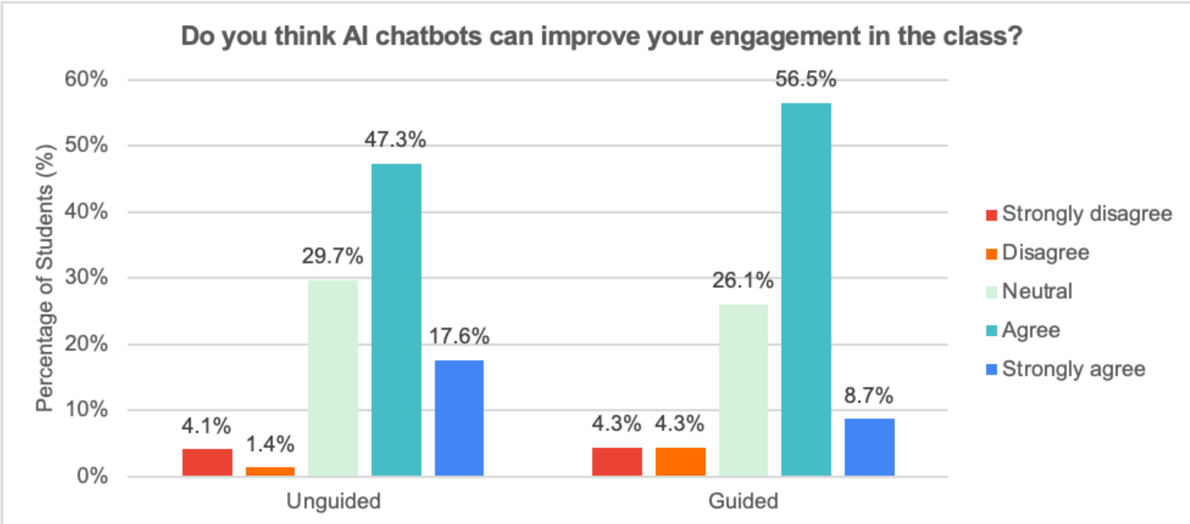


Figure 13. Perceived Class Engagement with AI Chatbot

This post-course question examined whether students believed AI chatbots could improve their engagement in the class. Overall, students in both instructional conditions expressed generally positive views, with roughly two-thirds of each group selecting "agree" or "strongly agree" (Figure 13). In the Guided section, 56.5% of students selected "agree" and 8.7% selected "strongly agree," meaning 65.2% of the cohort leaned toward a positive assessment of AI's role in improving engagement. This concentration in the "agree" category suggests a shared perception that AI chatbots contributed positively to classroom engagement when used within a guided instructional structure.

The Unguided section showed a slightly different distribution across the positive categories. While the combined share of "agree" and "strongly agree" responses was similar in magnitude (approximately ⅔ of the class), the balance shifted across categories. The Unguided group had a lower proportion selecting "agree" (47.3%) but a higher proportion selecting "strongly agree" (17.6%) compared with the Guided group. Neutral responses were more common in the Unguided group (29.7%) compared with the Guided group (26.1%), indicating somewhat greater uncertainty about the effect of AI chatbots on engagement.

Negative responses were minimal across both groups. Fewer than 5% of students in either selection selected "disagree" or "strongly disagree," indicating that most students did not perceive AI chatbots as reducing engagement in the class. Overall, the results show that students in both Guided and Unguided sections generally viewed AI chatbots as supportive of engagement, with differences primarily in how strongly that support was expressed across response categories.

AI Chatbot Impact on Learning Outcomes

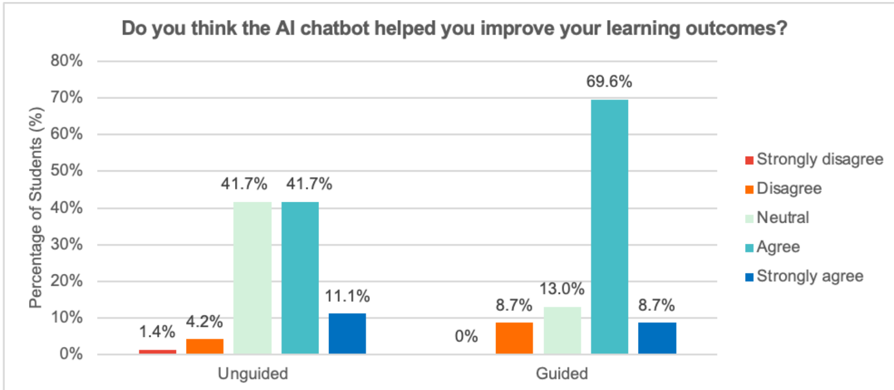


Figure 14. Learning Outcome Improvement after Intervention

After the course, students in the Guided section reported more positive perceptions of whether the AI chatbot helped improve their learning outcomes compared with the Unguided section (Figure 14). In the Guided group, roughly 70% of students selected "agree" and an additional 8.7% selected "strongly agree," indicating that most students viewed the chatbot as beneficial to their learning. No students selected "strongly disagree," and only 8.7% reported "disagree," suggesting limited opposition to the use of AI in supporting learning outcomes in the guided condition.

The Unguided section showed a more mixed pattern. Responses were evenly split between "agree" (41.7%) and "neutral" (41.7%), indicating greater uncertainty about the chatbot's impact. In addition, 5.6% of students selected "disagree" or "strongly disagree," reflecting a small subset of students who did not perceive chatbots as helpful for improving learning outcomes. Compared with the Guided section, a larger proportion of Unguided students remained neutral, suggesting less clarity in evaluating the role of AI in their learning experience.

These post-course patterns highlight differences in how students evaluated the educational impact of AI chatbots across instructional conditions. While most students in both sections expressed some level of agreement, the Guided section showed a stronger concentration of positive responses and fewer neutral or negative selections. These differences provide context for understanding how instructional structure may influence students' ability to recognize and articulate the learning benefits of AI-supported tools.

Intention to Use the AI Chatbot in Future Classes

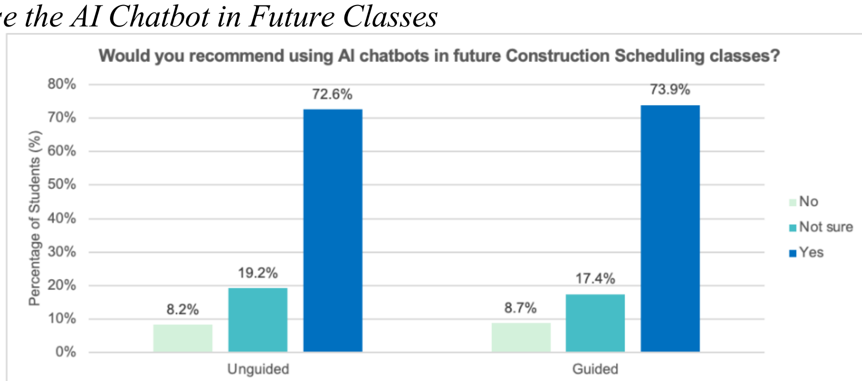


Figure 15. Intention for Future Use of AI Chatbots

This post-course question examined whether students would recommend using AI chatbots in future construction scheduling classes. Overall, students in both instructional conditions expressed strong support for continued AI integration (Figure 15). In the Unguided section, 72.6% of students responded "yes," while 19.2% reported being "not sure" and 8.2% responded "no." the Guided section showed a very similar pattern, with 73.9% recommending AI chatbots, 17.4% indicating uncertainty, and 8.7% responding "no."

While the differences between groups are small, the Guided section shows a slightly higher level of endorsement, with a 1.3 percentage point increase in "yes" responses compared with the Unguided section. At the same time, the proportion of students who remained "not sure" was modestly lower in the Guided group (17.4% versus 19.2%), suggesting slightly greater clarity in evaluating whether AI chatbots should be used in future courses. The share of students responding "no" was low and comparable across both conditions.

These results indicate that most students, regardless of instructional approach, view AI chatbot integration in construction scheduling courses favorably. The similarity between groups suggests that exposure alone may be sufficient for students to recognize the general value of AI tools at a curricular level. At the same time, the slightly higher endorsement and lower uncertainty observed in the Guided section aligns with the broader pattern seen throughout the study, where structured guidance is associated with more consistent and confident student evaluations of AI-supported learning.

Confidence in Planning Concepts

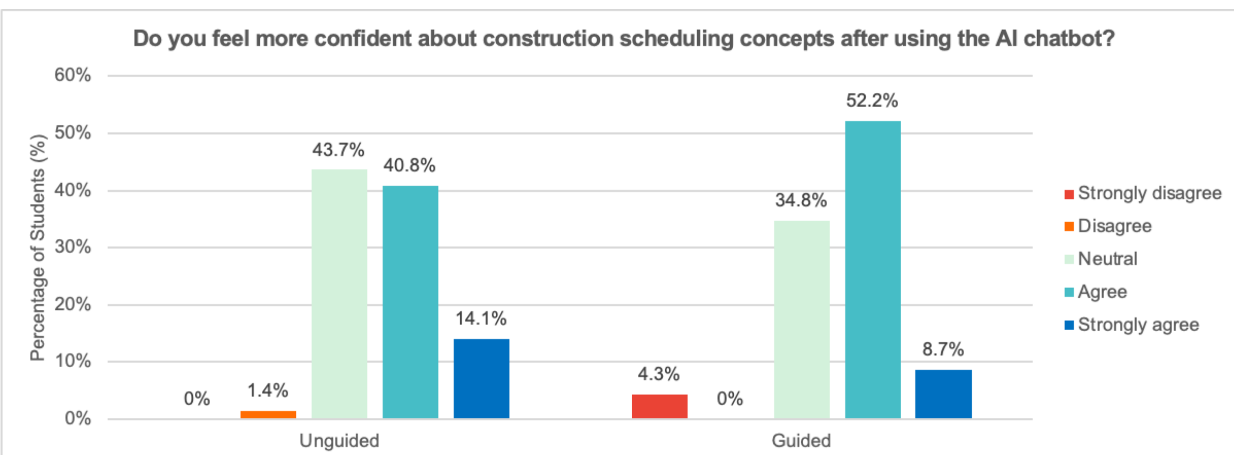


Figure 16. Perceived Confidence in Construction Planning with AI-Supported Learning

This post-course question examined whether students felt more confident about construction scheduling concepts after using the AI chatbot. Overall, students in both instructional conditions reported increased confidence, with the Guided section showing a slightly stronger positive skew (Figure 16). In the Guided group, 60.9% of students selected "agree" or "strongly agree," compared with 54.9% in the Unguided group. This difference suggests that a larger share of students in the Guided section felt confident in their understanding after engaging with the AI tool.

Neutral responses were more common in the Unguided section, where 43.7% of students selected "neutral," compared with 34.8% in the Guided section. This indicates that a substantial portion of Unguided students remained unsure about whether the chatbot meaningfully increased their confidence. In contrast, the Guided section shows a clearer shift toward agreement, with 52.2% selecting "agree," compared with 40.8% in the Unguided group.

Negative responses were limited in both groups. In the Unguided section, 1.4% of students selected "disagree," and no students selected "strongly disagree." In the Guided section, no students selected "disagree," although 4.3% selected "strongly disagree." This small subset may reflect students who, after structured interaction with the chatbot, became more aware of the tool's limitations or felt that AI support did not directly translate into increased personal confidence.

The results indicate that most students reported feeling more confident after using the AI chatbot, with confidence levels more strongly concentrated in the Guided condition. The lower share of neutral responses and higher agreement in the Guided group aligns with the broader pattern observed across the study, where structured instructional guidance is associated with clearer and more affirmative student perceptions of AI-supported learning.

Discussion

The results suggest that instructional guidance is associated with differences in how effectively students use an AI chatbot for learning construction scheduling, while broader attitudes toward AI appear less sensitive to instructional variation once access is provided. Only modest differences were observed between guided and unguided instruction in students' familiarity with AI chatbots, perceived engagement, and recommendations for future AI use in construction scheduling. A possible explanation is that these aspects reflect broad perceptions and baseline acceptance rather than learning effectiveness. A previous literature review on ChatGPT perceptions in engineering education reports that since ChatGPT's public release, the tool has quickly become visible and widely discussed across engineering education contexts [16]. Therefore, students often enter courses with pre-existing awareness and generally positive or at least curious attitudes about GenAI, which can make familiarity and confidence less sensitive to differences in instructional approach once students have access to a chatbot [16].

In contrast, more pronounced differences emerged between guided and unguided instruction in perceived usefulness, frequency of chatbot use, and perceived learning improvement. This study explored students' responses in two open-ended questions: *What was the most helpful feature of the AI chatbot?"* and *"What challenges did you face while using the AI chatbot during this course?"* Students in both guided and unguided conditions pointed to a similar core benefit: the chatbot was most useful as a fast way to look up course-related information and get quick learning support. The challenges, however, differed by condition. Guided students reported fewer barriers overall, which aligns with the fact that they received structured guidance on how to use the tool. When they did note difficulties, they were more likely to describe limitations on more advanced or specialized topics, where answers required deeper technical nuance. In contrast, unguided students described more frequent and more fundamental frustrations with response quality. They commonly mentioned that the information was not always accurate, that answers were not aligned with what they were expecting, and that responses could feel rambling or off-topic. Taken together, these comments suggest that while both groups valued the chatbot for quick access to course information, guided use reduced basic usability and quality-control issues, whereas unguided use left students spending more effort filtering, verifying, and steering the tool's outputs.

Literature suggests that GenAI tools can help learning only under conditions that reduce error risk, clarify expectations, and scaffold students' interactions. ChatGPT can generate useful questions and answers, but it also produces incorrect mathematical solutions and content-quality issues that can confuse students and negatively impact learning if used uncritically [17]. Amouri et al. [18] emphasized that perceived usefulness is the strongest predictor of AI acceptability together with such contributors as ease of use, voluntariness, and subjective norms. Importantly, acceptance increased when AI improved efficiency and when institutional support was present [18]. Within the context of this study, guided instruction appears to have functioned as an institutional and pedagogical support that aligns with higher reported use frequency and stronger perceived learning improvement.

These findings highlight several practical lessons regarding the integration of AI chatbots into engineering and construction management courses. Simply providing students with access to chatbots can help them become familiar with AI and view it as a common tool, but access alone does not guarantee better learning. To reap real benefits, instructors need to be proactive about how AI is used in the course.

In particular, the findings suggest that guided integration plays an important role in supporting effective AI use. When instructors integrate chatbot use into specific planning activities and require students to verify the AI's output (e.g., comparing it to their calculations and scheduling software), students are more likely to see the tool as useful and use it consistently. This also helps manage common risks such as inaccurate technical answers, misinformation, and students becoming overly reliant on AI.

Conclusion

This study examined associations between guided versus unguided integration of an AI-based scheduling chatbot in an upper-level construction management project scheduling course. By comparing two instructional approaches that differ primarily in the level of instructor guidance, the study provides exploratory evidence on how pedagogical scaffolding shapes students' perceptions and self-reported engagement with AI tools in supporting learning.

Students in the guided instructional condition reported higher perceived usefulness, more frequent chatbot use, and stronger perceptions of learning improvement. The guided group was more likely to integrate the chatbot consistently into core scheduling tasks, such as activity development and duration estimation. Taken together, these findings suggest that the educational value of AI chatbots is not inherent to the technology itself but depends on how instructors frame, scaffold, and align AI use with course objectives. This study reinforces an important distinction between AI adoption and AI-supported learning effectiveness, emphasizing that deliberate instructional design is critical for translating AI access into meaningful learning outcomes in CEM education.

This study has several limitations worth noting. The sample size is small, particularly in the guided group. The findings may not be representative of a broader student population. In addition, as the study only considered one intervention within a single course and one academic institution, the findings may not apply well to other courses or different learning situations. The analysis is descriptive in nature and thus it does not explain why the changes occurred more in depth. Another notable limitation stems from the instructor factor. The two groups had different instructors with different teaching styles which could influence how students approached the chatbot. The guided group received more direct support, but much of that support depended on the instructor's teaching methods and how they guided the assignments. Additionally, the reported findings reflect students' perceived competence/confidence rather than directly measured learning outcomes, demonstrated performance or actual learning. Therefore, the observed differences should be interpreted cautiously, as the influence of chatbot guidance cannot be fully separated from instructor-specific teaching practices.

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