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Meeting Students' Needs for Responsible AI: Engineering Student Perspectives from an HSI Public Institution

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Abstract

Providing personalized academic support is an effective way to improve student learning and promote equity and inclusion. However, instructors at Primary Undergraduate Institutions (PUIs) and Hispanic-Serving Institutions (HSIs) often face large class sizes and heavy teaching loads that limit their ability to provide individualized support. Large language models (LLMs) have emerged as widely used tools for real-time learning assistance that can be a potential supplement for individualized support, but their use raises concerns related to accuracy, bias, academic integrity, and over-reliance, particularly for underrepresented engineering students.

Missing from this discussion are student perspectives on whether and how LLMs can provide effective personalized instruction. This paper reports findings from an online survey and qualitative interviews with undergraduate engineering students at an urban PUI and HSI, to understand student experiences with AI tools, identify student needs, and generate actionable guidance to inform the iterative design and implementation of student-centered AI tools for personalized learning. **Interview results show that while students regularly use LLMs for support with their coursework, they are also regularly dissatisfied with the results. S**tudents described significant frustrations, including receiving responses that were misaligned with course content, insufficiently scaffolded explanations, and uncertainty about academic integrity. Students also expressed concerns about over-reliance and trust, and a desire for instructor-sanctioned AI tools.

Importantly, students articulated specific features they believed would better support their learning, including course-aligned explanations, guided problem-solving feedback, support for study skills and time management, and content drawn exclusively from instructor-provided materials. **Their perspectives point to the need for the development of AI teaching tools that are aligned with learning goals and designed for specific courses**. By centering student perspectives from an HSI/PUI context, this study contributes empirical insight into the limitations of current AI tools and offers actionable guidance for the future design of equity-oriented, student-centered AI learning supports in engineering education.

Introduction

Providing personalized help to students is an effective way to improve learning and to foster equity and inclusion, making sure students get the support they need, when they need it. However, delivering such individualized support remains challenging in many engineering programs, particularly at Primary Undergraduate Institutions (PUIs) and Hispanic Serving Institutions (HSIs), where large class sizes and heavy teaching loads limit the amount of time instructors can dedicate to each student [1]. These structural constraints disproportionately affect underrepresented students, who are less likely to seek help due to barriers such as stereotype threat, fear of judgment, stigma around help-seeking, and limited access to supportive academic networks [2]-[4].

Recent advances in generative Artificial Intelligence (AI), particularly large language models (LLMs), have generated significant interest in their potential to provide personalized, real-time

learning support [5]-[6] in general, and in STEM classes, where equity issues persist in student outcomes. Students increasingly use commercial AI tools such as ChatGPT and similar AI tutor platforms to assist with studying, homework, and concept clarification [7]-[11]. In theory, LLMs could help address gaps in instructional support by offering on-demand explanations and guidance, thereby supplementing limited faculty availability. However, alongside this promise, educators and researchers have raised substantial concerns about the use of LLMs in education, including the accuracy of AI-generated information, the presence of bias, risks to academic integrity, and the potential for student over-reliance that may undermine learning and critical thinking [12].

Importantly, students themselves share many of these concerns [13]. Despite the rapid adoption of LLMs for educational purposes [14], [15], there remains limited empirical research examining how engineering students experience these tools in practice, particularly in courses with complex technical content and in institutional contexts characterized by high teaching loads and large populations of underrepresented and first-generation students. Much of the existing literature has focused on technological capabilities or instructor perspectives, with comparatively less attention to students' lived experiences, perceptions, and concerns. This gap is especially consequential in PUI and HSI settings, where equitable access to academic support and alignment with inclusive pedagogical practices are central to student success.

Guided by these challenges, this study focuses on understanding engineering students' experiences with AI tools and the kinds of support they want from such systems. Drawing on a grant-funded research project at an urban, open-access HSI, we examine undergraduate engineering students' use of commercial LLMs for academic assistance, their perceptions of accessibility, reliability, helpfulness, and academic integrity, and their expectations for how AI tools should function in educational contexts. Rather than evaluating or introducing a new AI platform, this paper centers on student perspectives to better understand where current AI tools fall short as learning supports and what design considerations students believe are critical for supporting learning in equitable ways.

Specifically, the goals of the work reported in this paper are to:

- Understand student experiences with LLMs by exploring the challenges, benefits, and perceived limitations students encounter when using existing AI-based tutoring platforms.
- Identify student needs and design considerations for AI-enabled learning support in engineering courses, with particular attention to barriers to help-seeking and equity-related concerns in HSI/PUI contexts.
- Generate actionable guidance to inform the next steps of iterative design and implementation of student-centered AI tutoring tools, grounded in students' lived experiences and articulated needs.

By foregrounding the voices of engineering students at a PUI and HSI, this study contributes qualitative and descriptive evidence to ongoing conversations about the ethical, equitable, and pedagogically sound use of AI in engineering education. Understanding how students perceive and experience LLM-based learning support is a necessary step toward developing AI tools that enhance, rather than undermine, learning, trust, and inclusion for historically marginalized students. The perspectives of students from a PUI HSI institution add new dimensions to the AI

education literature and tell a more complete story of the shortcomings of LLMs in education. This data will support educational researchers who wish to capitalize on the potential of LLMs while designing more targeted and effective support for students.

Our data reveal that although students often attempt to use commercial LLMs for academic assistance, they report some negative experiences and unhelpful interactions. Students identified several areas where LLMs could be improved. On a broad level, students expressed concerns that echo faculty concerns:

- Students worry about academic dishonesty, overreliance, learning loss, and lack of trust;
- Students experienced frustration with LLMs because they provided answers that were outside the scope of the student's course; they prefer a tool sanctioned by their instructor;
- Students experienced frustration when LLMs provided answers without explanation or scaffolding.

More specifically, students identified features they believed would help them, including: overviews of course organization; guided homework feedback; and examples and lessons drawn only from their courses.

Methods

Participants and Recruitment

Participants were undergraduate engineering students enrolled in civil, mechanical, computer, and electrical engineering programs. During Spring 2025, an online survey was distributed through the engineering departmental communication channels. A total of 65 students completed the survey. At the end of the survey, students were invited to volunteer for a follow-up interview.

From this pool, 13 students participated in semi-structured interviews conducted in Summer 2025. Interview participants represented multiple engineering majors and academic levels. Students who completed interviews received a $50 gift card as compensation for their time. All participants provided informed consent in accordance with Institutional Review Board (IRB) approved procedures.

Survey Instrument

The online survey was designed to capture students' prior exposure to and use of AI tools for academic purposes, as well as their perceptions related to effectiveness, access, equity, and academic integrity. The survey was descriptive in nature and did not evaluate a specific AI platform. The full survey instrument is provided in the **Appendix**.

Interview Protocol and Data Collection

Semi-structured interviews were conducted via Zoom and lasted approximately one hour. Interview questions were designed to explore students' lived experiences using commercial LLMs as learning supports, including perceptions of reliability, trust, accessibility, help-seeking, academic integrity, and desired features of AI tutoring tools. Interviews were audio-recorded and transcribed using Zoom's transcription service. The complete interview questions and participants are included in the **Appendix**.

We analyzed interviews using the transcripts provided by Zoom. Codes were developed from the interview questions: positive interactions; bias and hallucinations; desired features; overreliance; academic integrity. The research team read the transcripts, and used Dedoose coding software to analyze them. We uploaded the transcript files, and applied codes to segments of data to create themes and identify patterns. Using Dedoose, we highlighted excerpts from transcripts and assigned all applicable codes; this allowed for an iterative analysis where we could compare codes across and within the transcripts. We then made separate documents for each code with all the excerpts that were tagged with that code. This allowed us to compare responses clustered by code but from different participants, giving us insight into similarities and differences in participants' perspectives. Transcripts and code documents were read closely to identify recurring themes, patterns, and points of tension across interviews. Analysis was inductive, supporting deeper interpretation of participants' experiences and perspectives. Quotes for inclusion in this paper were chosen because they were representative of broad themes in the interview data as a whole while allowing readers to see the specificities of particular students' experiences.

Transcripts were lightly edited for readability while maintaining the ethos and students' voices.

Results and Discussion

To establish a baseline context for undergraduate engineering students' interactions with AI tutoring tools, we administered an online survey during Spring 2025. The survey was designed to capture students' eligibility and prior exposure to AI tools, their experiences using AI for learning support, and their perceptions related to accessibility, equity, and academic integrity. Rather than evaluating a specific AI platform, the survey aimed to document students' existing practices, concerns, and expectations surrounding AI in engineering education. The results provide descriptive insights into how students currently engage with AI tools and highlight areas of ambiguity and tension that informed the design of subsequent qualitative interviews.

The results of the interviews we conducted provide more detailed insights into how students engage with AI tools, and how they think -- and worry -- about AI use in the context of their education. The areas of ambiguity and tension that surfaced in the survey are fleshed out in these interviews, and point to the need for more carefully designed AI tools that are focused on specific content areas and courses to facilitate student learning and build both their capacity to learn from AI tools and their trust in them. Our findings suggest that students recognize the utility of AI tools, but that perceived effectiveness is not universal, aligning with reported concerns about accuracy, context, and instructional alignment. Both survey and interviews suggest that current AI tools are not meeting student needs.

Participant Demographics and AI tool adoption

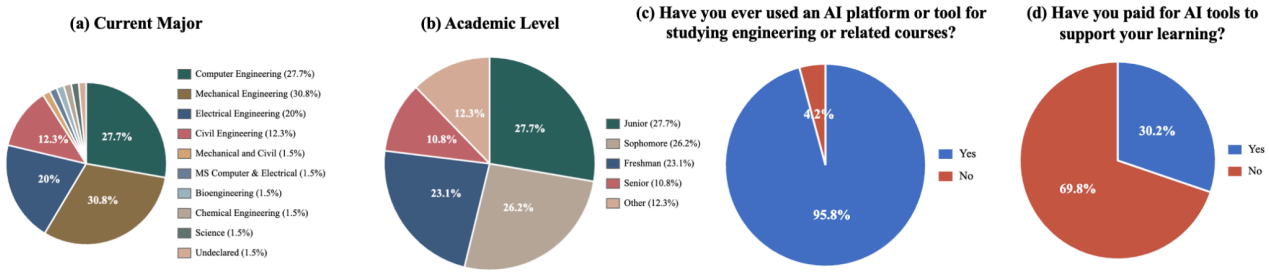

Figure 1: Survey respondent demographics and AI tool adoption (N=65).

As shown in Figure 1, AI tool use is nearly ubiquitous among respondents. The majority of students (95.8%) reported having used an AI platform (e.g., ChatGPT or similar tools) to support their learning in engineering or related courses. While most students relied on free versions of AI tools, 30.2% reported paying for AI-based learning resources. This variation in access suggests that cost may influence how students engage with AI tutoring tools, an issue that warrants further attention in equity-focused research at HSIs and PUIs.

Experiences with AI

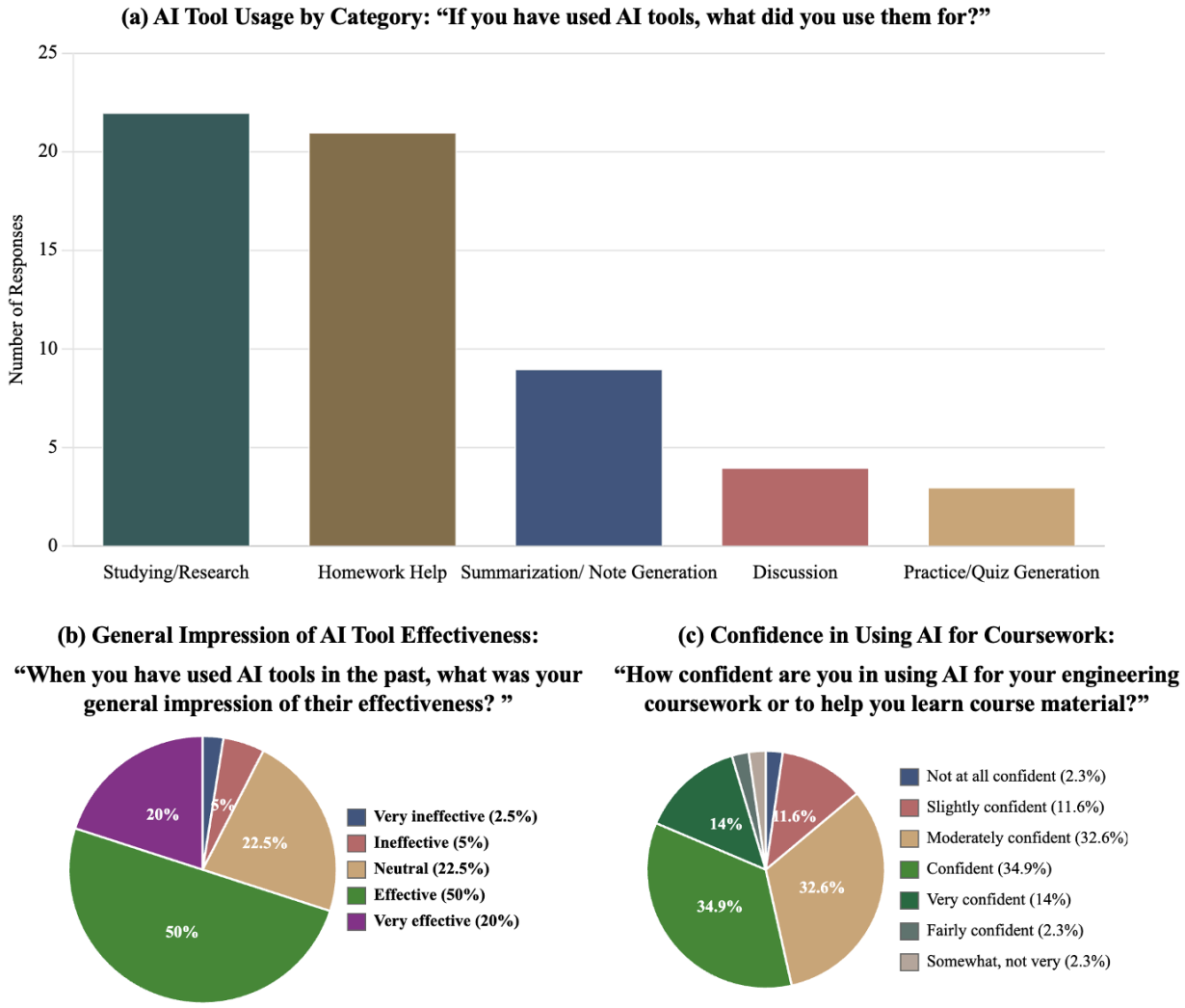

Figure 2: Survey responses on AI tool usage patterns and perceptions.

As shown in Figure 2, students primarily use AI tools for studying/research and homework help, with substantially fewer students using AI for discussion, practice, or quiz generation (Fig. 2a). This pattern suggests that students currently rely on AI tools as on-demand academic support rather than as structured learning or assessment tools. The limited use of AI for practice or quiz generation further indicates an opportunity for more pedagogically guided AI supports that emphasize formative learning rather than answer provision.

Students' perceptions of AI tool effectiveness were mixed, but generally positive (Fig. 2b). Half of the respondents rated AI tools as effective, and an additional 20% rated them as very effective, while approximately one quarter expressed neutral perceptions. Very few students reported that AI tools were ineffective.

LLMs create risks regarding academic integrity and overreliance

Despite these positive views, however, students also recounted several concerns that mirror faculty concerns about LLMs in educational contexts. Although use is high, and all students report using commercial AI tools such as ChatGPT for school work at least some of the time, students express many of the same negative perceptions and issues that their teachers worry about: inaccurate responses, an overriding of their thinking and problem-solving, the threat of overreliance and erosion of critical thinking skills, academic integrity and honesty.

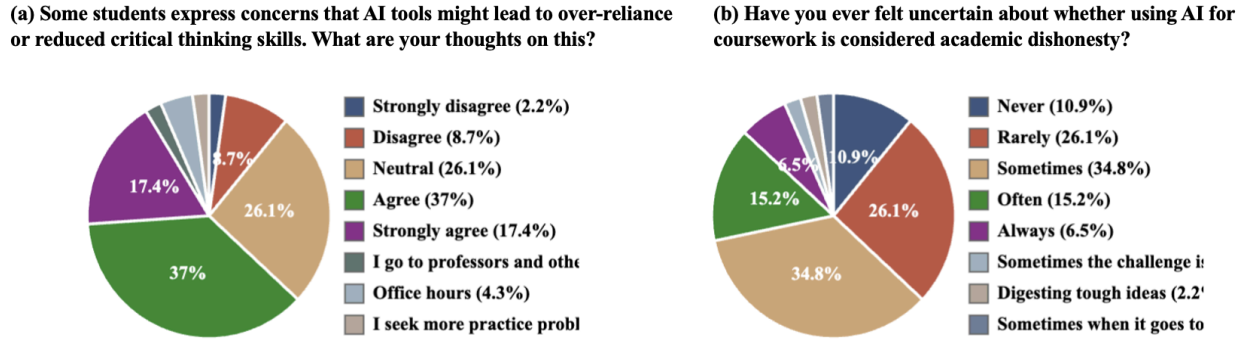

Figure 3: Student perspectives on AI tool risks and academic integrity concerns.

Figure 3 illustrates students' perceptions of over-reliance on AI tools and their uncertainty regarding academic integrity. As shown in Fig. 3a, a majority of respondents expressed concern that AI tools may lead to over-reliance or reduced critical thinking. Specifically, 37.0% of students agreed, and 17.4% strongly agreed with this concern, while 26.1% reported neutral views. Only a small proportion of students disagreed or strongly disagreed. These results suggest that concerns about cognitive dependency are widespread among students themselves, not solely among instructors.

In addition to recognizing these risks, some students indicated that they actively seek alternative forms of support when concerned about over-reliance, including consulting professors, peers, or office hours, or seeking additional practice problems. This pattern suggests that students are negotiating AI use alongside traditional help-seeking strategies, rather than replacing them entirely. As shown in Fig. 3b. While 10.9% of students reported never feeling uncertain about whether AI use constitutes academic dishonesty, the majority indicated at least occasional uncertainty. Over one-third of respondents (34.8%) reported sometimes feeling unsure, and an additional 21.7% reported feeling uncertain often or always. These findings point to ambiguity in students' understanding of acceptable AI use, likely shaped by inconsistent or unclear instructional guidance.

Many of the students we interviewed expressed concerns about over-relying on AI or becoming too dependent on it. For example, Sofia, a computer engineering major entering her senior year, worried about being tempted to use ChatGPT merely because she is stressed or out of time, a

common problem among students at HSIs where students often juggle multiple responsibilities. She connected this concern to worries about academic integrity, and described her worries about what her teachers will think, suggesting a double bind for students: on the one hand, they hesitate to reach out to faculty for support due to stereotype threat; at the same time, they worry that their efforts to use LLMs for that support will cause faculty to view them negatively, or even to assume they are cheating: *I do catch myself sometimes I'm like, Oh, I got stressed over school other classes, other courses, and have to, you know, make up work for another class. And so that's where you know it does come and play that it is academic. dishonesty….I found that some of my friends have said, like, you know, even with like the SFSU Chatgvt collaboration. I think there are some people that were like, no, I don't think I'm not gonna use it because they're [instructors] gonna they're gonna I don't know, try to use it against me in you know future courses or future homeworks. I remember a lot of students, you know, became kind of like scared, even right? Because Chatgpt or AI tools can be seen as cheating, and you know it is up to the discretion of the Professor that you're you know you're in the class with.*

LLMs contribute to learning loss

Several students also worried about how AI was affecting their ability to learn. Sofia, for example, expressed concerns about research showing that AI use could harm her ability to learn and think for herself: *I think it's already been proven actually, that AI does make you dumber if you use it too much. I guess if you're not honest with yourself and use AI for everything, then, yeah, you'll end up going down a horrible road where you can't think for yourself. Really.*

Owen, a first year student majoring in mechanical engineering, commented on similar concerns about the effects of AI on cognition: *It is really easy to just input some prompts and gather a bunch of thoughts from AI instead of coming up with those thoughts yourself.*

Another student, Jessica, a senior majoring in mechanical and civil engineering, also feared overreliance and loss of her own capacity: *I try to stay away from it more because I'm all like I'm already heavily relied on textbooks and everything, and I don't really wanna be stuck in that [GenAI], too*. However, Jessica also felt that lack of time and her own exhaustion required, and justified, use of LLMs: *But at the same time, sometimes I think it's necessary cause I don't wanna be more more drained out myself then I need to be so if it's like like absolutely necessary, and I'm just too tired… I think it's like it's okay to take a little break from trying to do everything by myself.*

LLM outputs are not trustworthy

Other students' expressed concerns relating to a lack of trust in the output of LLMs**.** Michael, a first-year computer engineering student, expressed frustration with GenAI's lack of trustworthiness and propensity to confidently hallucinate. Problems with hallucinations meant GenAI created more, not less, work for him: *And then, because it you know, it normally talk very confidently about everything, even if it didn't have the correct answer. So that just kind of makes it even harder for me to gauge whether, you know, it's lying to me or not just because if it was unsure and seemed shaky, or I could tell that it didn't know what it was talking about, it'd be easier to Fact Check. But the fact that I'd have to fact check every single thing it said made it basically like may as well just use Google on my own at that point.*

Andrew, a junior, expressed frustration with the quality of LLM output, and noted that lack of quality undermined users' ability to learn something they were not already familiar with. *I've noticed, at least for some of the larger models where it's either free to access or even the chatGPT for our Csu Edu accounts, it kind of limits your context window like you'll just I could implement something that's not really that large. And then it only really covers part of it, even if I ask it to like, take longer. And it just is giving like unreliable answers or information, or it can't even remember like past responses, even if that's enabled. ... I think it's just better to understand something initially, because engineering is really difficult. I think it's just [not helpful] like that initial time that you're learning something for the 1st time.*

For some students, simple limitations caused frustration and undermined their sense of the utility of LLMs. Daniel commented that even though he could see that LLMs may be helpful, he worried that minor problems led to misuse. As an example, he discussed ChatGPT's tendency to make rounding errors and skip steps: *Yeah, I think it's a little misused. chat gpt tends to round incorrectly, occasionally. It, and sometimes it will, I guess. Skip steps. I've only had that happen once where I like it skipped a step that I needed to know. But most of the time it's just incorrect rounding, so it'll round too early or but yeah, it's mostly just rounding too early.*

LLMs don't scaffold learning and are misaligned with course materials

The survey results indicate that, while students generally perceive AI tools as useful for supporting their learning, they also encounter notable challenges that limit their effectiveness (see Figure 4a below). The most frequently reported issues include inaccurate or hallucinated responses and a lack of context awareness, with additional concerns around inconsistent outputs and difficulty interpreting visual content. At the same time, students express a strong need for structured support, particularly step-by-step explanations, course-aligned summaries, and practice opportunities, highlighting a gap between current AI capabilities and the pedagogical scaffolding required for engineering coursework (see Figure 4b below).

In the survey, students were asked: Can you describe a time when AI tools helped you understand a concept better? Responses were generally positive (see below):

- *"Many times when i was learning about programming"*
- *"When doing Calculus homework AI is really good at explaining concepts, like derivatives"*
- *"Recently I missed a couple of classes in circuits regarding impedance and admittance. So I was confused but by asking AI how things related to eachother it cleared up in my head."*
- *"when i was learning implicit differentiation, the lectures and labs just left me more confused so i used ai to help slow it down and explain it to me, i now understand implicit differentiation."*
- *"It helped me to understand Matlab while doing my robotics project a lot I became more efficient in using it after using AI. It helped me in understanding my mistakes, where did I went wrong , what happened due to my error and it helped me and explained what happens if I do the changes AI suggested"*
- *"Yes, there was a time when I was struggling to understand how convolutional neural networks (CNNs) work, especially the role of filters and how feature maps are generated."*

- *"When I was trying to understand what a 7 bit carry ripple adder…."*

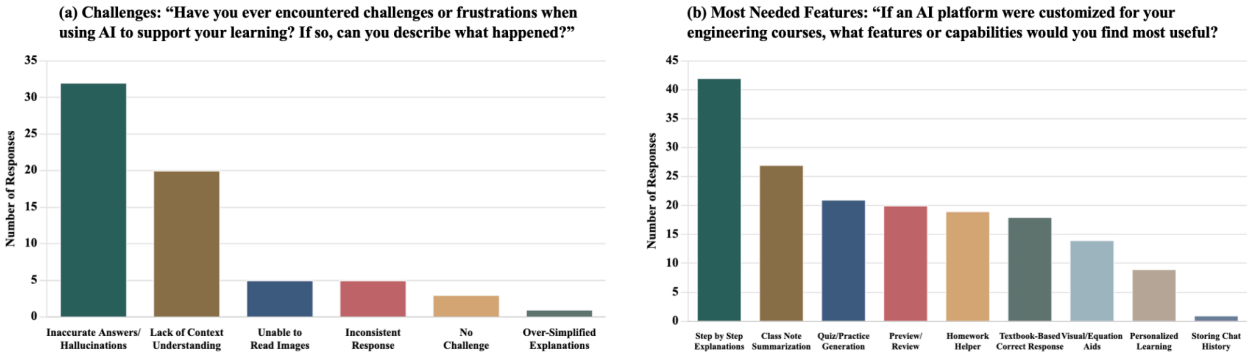

Figure 4: Challenges encountered and desired features when using AI tools for engineering coursework.

In interviews, however, a more complex view emerged. For example, some students equated their lack of trust of LLM outputs with their perception that LLMs were misaligned with their instructor's approach, goals, or materials. Students worried that the output differed from the information or steps preferred by their instructors, or that the output contained information beyond the scope of the course they were taking. They worried that LLMs gave them a different set of process steps than those used in class materials.

Sofia described how confusing she found LLM outputs when they were different from instruction provided by the textbook: *So when it comes to like literally the little steps of like divide and multiply, and all that stuff, and seeing it in chat, how it kind of gives the format. It kind of really shows the difference compared to like a textbook where it kind of just gives upi from one step all the way to like the 5th step. And I'm like, I'm so confused.*

Sofia described herself as a relational learner who preferred help from professors and peers even when their instruction was imperfect or didn't fully meet her needs: *I learned best in person. So I would say, like, okay, I guess it also depends right? Because it depends on how helpful your professor and peers are. But I would still rank them as being better than AI for sure textbooks.*

Emily, a junior majoring in computer engineering linked the problem of outputs beyond the scope of the course to her inability to trust AI outputs: *when you have a model that actually has data that's specific to, let's say, engineering specific to chemistry specific to English, then you have something that's more credible and reliable, and especially like, if you put research papers into it by professionals, right? by people who, you know, have Phds. But also people have continued to work in that field right [so it's] professor-backed.*

Kevin, a junior majoring in electrical engineering, explained that he would use and trust LLMs more if they were preloaded with course material: *having the ability to like preload in like course, material. So like. I guess if the professor already has notes set up already, has specific parts of the textbook, they can say, Okay, go through these specific parts of the textbook. Here are my notes.Take note of all of this. If a student ever has a question, they can reference the whole database to answer that students question, instead of just reaching pulling from the Internet, which sometimes isn't accurate to what's being taught in class. I already use it a lot, so I guess it wouldn't make too much of a difference, but I feel like it would probably make me feel*

better about it, because if it's coming directly from the school, there's less question of like. less ethical concern. And it's just, I imagine, be easier than having to like, do workarounds, to get specific bits of like information or specific answers or specific responses.

Together, these results suggest that while students feel capable of engaging with AI tools, confidence does not necessarily equate to trust or satisfaction—an important distinction explored further in the interview findings.

The LLMs -- and learning opportunities -- students want

A final, important finding from our survey and interviews: students's desire for AI tools that were more targeted toward their learning, were vetted by faculty or experts, and were restrained, responding only with course material or trusted material provided by instructors. While students are frustrated by inaccuracies and lack of contextual understanding, they articulate a strong preference for AI tutors that emphasize scaffolded explanations, course alignment, and structured practice—features that support learning processes rather than answer generation.

Emily noted that she preferred professors and tutors to GenAI because the former provide hints and questions, rather than answers: *So it kind of like I mean a good tutor, I found, or a good professor kind of starts asking you questions and starts trying to figure out like, if you can solve this on your own. They give you hints, maybe right. But ultimately it's up to you to figure out, how do you actually solve this problem or get the correct answer right?...So like I mean a good tutor, I found, or a good professor kind of starts asking you questions and starts trying to figure out like, if you can solve this on your own. They give you hints, maybe right. But ultimately it's up to you to figure out, how do you actually solve this problem or get the correct answer right? And like engineering, it's so broad. And I think there's a lot of flexibility in the way that you can answer these questions. Or at least like when you're working with client. Right? So I think that would be the biggest help for me.*

Another student, Luis, felt that humans were more responsive and experienced when he had questions: *it feels like it's more responsive to talk to classmates or talk to my professor about subjects when I'm having difficulty, and I think they would have more experience with the topics that I'm struggling with, and so I think they might have more trusted resources available at hand.*

Students generally trusted the information and learning they gained from the professors, but turned to LLMs when they felt their teachers didn't have time or patience to help them. Alex, a senior majoring in mechanical engineering, summed up this issue: *I, normally, I try to go to my professors first, st but it's always difficult to catch them in their office hours, or sometimes they'll just say, Oh, you should know that already, or things like that. They'll be dismissive to my concerns. So either, then I seek out online sources. Maybe that's maybe that's Chat Gpt and the ais. Maybe that's a Random Forum post that somebody made 10 years ago. I'll try and see if somebody out there is willing to what makes it helpful is that the AI is willing to I guess, willing to explain it slowly. ...That's what made it more helpful over, say, going to a textbook or trying to go to a professor. And you know the professors are busy. They explain it once and hopefully. It was good enough. The AI makes it, I guess. student, friendly or friendlier than a lot of other sources.*

When asked how AI compares to textbooks, tutors, and professors, Alex said nonetheless said that AI was worse; he turned to it only because of the above issues: *Usually it is worse because the AI has to think up problems on its own like, if you're actually going to it for study Help whenever it does think up a good problem, then it's it typically works out. It's on the same level of quality as in like a worked out example in your textbook, or something like that. Maybe you can ask it for some clarification. But that's that's about the only edge that it has over going to a professor going to a textbook, or even just a study group that you may have on campus. A lot of these professors are super busy, and it's a little hard to with my schedule.*

In general, students wanted AI to act as guided helpers, not answer-givers. They preferred AI tools that walk them through problems step-by-step, offering hints or intermediate steps rather than final answers. This approach supports deeper learning and helps students avoid academic dishonesty or overreliance. Many compared ideal AI behavior to a good tutor or professor—someone who encourages problem-solving rather than shortcutting learning. They often noted that they preferred professors and tutors, but struggled to find time, or recognized that professors were already overloaded with students. Some didn't want to disrupt class with questions, so felt that an AI tutor would be useful.

Sofia, for example, pointed out that although some people learn just by *seeing the problem and kind of be like, oh, you know what I I understand it*, she needed more step-by-step, modeled instruction. *like me… I really struggle with it. Sometimes, like we struggle with school, sometimes I think seeing the examples, and, like I said, kind of step, by steps of how and where they got from a point A to Point B, that's where that's where it's really helpful.*

In both the survey and interviews, students emphasized that AI t should draw on verifiable, course-specific materials like class notes, textbooks, slides, and peer-reviewed research, rather than generic internet sources. They expressed interest in AI tools that could integrate with their specific course materials (e.g., Canvas, instructor-provided notes), generate personalized practice problems or quizzes, adapt to individual learning styles (including neurodiverse needs), and offer flexible formats like flashcards, visual walkthroughs, and example problems. For example, Luis commented *Yeah, if there was like a way that it could connect, maybe to the class, and it could use the notes and like the textbook that are provided by the class and generate stuff from that data, because we know that from that class is already very accredited, you know, useful, trustworthy. That would be something useful, I think, if there was some way to connect the AI to the class*

Similarly, students felt like summaries of class notes, class previews of the syllabus before the term started, and support for organizing content for studying (especially before exams) would be helpful. Daniel, like many students we interviewed, wanted an AI tool that would *summarize class recordings and summarize notes and documents that the teachers post and stuff that would be really helpful because engineering courses kind of, you know, classes can be a bit long.* However, he also noted that this may discourage class attendance or reduce motivation to take one's own notes, leading to misuse.

We believe that students' experiences and perspectives point to the need for more carefully designed LLMs that are more narrow in focus and targeted toward learning. Students told us that AI tools for classrooms, unlike commercial LLMs, should provide features such as:

- *Step*-by-step walkthroughs of example problems
- overviews of course organization and support for time management/study skills
- Personalized practice quizzes and flashcards that could adapt to diverse learning styles
- Summarization of lecture notes and course materials
- Homework feedback and self-grading support that used the same terms their teachers used, rather than introducing new, unfamiliar, or potentially inaccurate methods and processes
- offer flexible formats like flashcards, visual walkthroughs, and example problems
- Previews of upcoming content (e.g., a "syllabus before the syllabus")
- Visual aids or uploads (e.g., diagrams, scanned problems)

These features would increase trust, decrease worries and overreliance and learning loss, and calm fears about academic dishonesty.

Conclusion

This study foregrounded the perspectives of undergraduate engineering students at an urban PUI/HSI to understand how commercial LLMs are used and experienced as learning supports. Although LLM use is widespread, students reported recurring problems that limit these tools' utility for engineering learning: inaccurate or confidently incorrect outputs, misalignment with course content and instructor methods, lack of explanatory scaffolding, and persistent uncertainty about academic integrity. Together, these issues erode trust and raise concerns about over-reliance and potential learning loss.

From a design standpoint, students' accounts point to four practical priorities for responsible AI tutoring in engineering education. First, AI tutors should be explicitly course-aligned (trained or constrained to instructor-provided materials) and instructor-sanctioned to increase perceived credibility. Second, they should prioritize scaffolding and guided reasoning (hints, intermediate steps, diagnostic questions) over answer delivery to support learning processes rather than shortcuts. Third, transparency features (e.g., uncertainty signals, provenance or citations to course materials) should be built in to help students evaluate outputs. Fourth, equity-conscious affordances (free baseline access, study-skill supports, multiple representational formats) are needed to avoid amplifying access gaps and to support diverse learners common in HSI/PUI contexts.

For instructors and institutions, these findings imply that adopting AI responsibly will require curricular integration, clear policies about acceptable use, and communication with students about tool limitations. Instructor involvement in configuring or vetting AI content, coupled with classroom practices that emphasize active problem solving, can help align AI use with learning goals and reduce both integrity concerns and dependency risks.

Acknowledgment

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Appendix

Table 1 Interview Participant

Pseudonym	Gender	Major	Academic Level
Ben Smith Michael Torres ♂	male	Computer Engineering	Freshman
Daniel Kim ♂	male	Mechanical Engineering	Freshman
Ryan Park ♂	male	Mechanical Engineering	Sophomore
Luis Hernandez ♂	male	Computer Engineering	Junior
Emily Nguyen ♀	female	Computer Engineering	Junior
James Lee ♂	male	Computer Engineering	Junior
Andrew Patel ♂	male	Computer Engineering	Junior
Kevin Chen ♂	male	Electrical Engineering	Junior
Sofia Martinez ♀	female	Computer Engineering	Senior
Carlos Martinez ♂	male	Mechanical Engineering	Junior
Jessica Lopez ♀	female	Mechanical and Civil	Senior
Alex Rivera ♂	male	Mechanical Engineering	Senior
Maria Rodriguez ♀	female	Mechanical Engineering	Senior

Online Survey Questions

Section 1: Participant Eligibility

1. What is your current academic level?
2. What is your major?
3. Are you at least 18 years old?
4. Have you ever used an AI platform or tool (e.g., ChatGPT, Khan Academy AI, or similar) for studying engineering or related courses?

Section 2: Experience with AI Tutoring Tools

5. If you have used AI tools, what did you use them for?
6. When you have used AI tools in the past, what was your general impression of their effectiveness?
7. How confident are you in using AI for your engineering coursework or to help you learn course material?
8. Can you describe a time when AI tools helped you understand a concept better? What made that experience helpful?
9. Have you ever encountered challenges or frustrations when using AI to support your learning? If so, can you describe what happened?
10. If an AI platform were customized for your engineering courses, what features or capabilities would you find most useful? Please consider features like: Class Preview and Review, Class Note Summarization, Quiz/Practice Generation, Step-by-Step Problem Solving, Homework Grading, etc.

Section 3: Accessibility and Equity in AI Tutoring

11. Have you paid for AI tools to support your learning?
12. What makes you decide whether it's worth paying for them or not?
13. Have you ever experienced bias or incorrect information when using AI for learning? If so, what was your response?
14. In what ways do you think AI platforms could be improved to support you in engineering classes?

Section 4: Academic Integrity and AI Tutoring

15. Some students express concerns that AI tools might lead to over-reliance or reduced critical thinking skills. What are your thoughts on this?
16. Have you ever felt uncertain about whether using AI for coursework is considered academic dishonesty?
17. What would make an AI more trustworthy and effective for engineering education?

Interview Questions

Section 1: Background Information
1. Can you tell me a little about your academic background (e.g., major, year in school, prior experience with AI tools)?
2. Have you used AI tools like ChatGPT, Khan Academy AI, or similar platforms before? If so, how often and for what purposes?
3. What motivates you to seek help in engineering courses? (e.g., understanding difficult concepts, preparing for exams, improving problem-solving skills, etc.)

Section 2: Experience with AI Tutoring Tools
4. When you have used AI tools in the past, what was your general impression of their effectiveness?
5. Can you describe a time when AI tools helped you understand a concept better? What made that experience helpful?
6. Have you ever encountered challenges or frustrations when using AI to support your learning? If so, can you describe what happened?
7. How do AI tools compare to other resources you use for studying (e.g., textbooks, professors, peer study groups)?

Section 3: Accessibility and Equity in AI Tutoring
8. Have you paid for AI tools to support your learning, or do you stick to the free versions?
9. What makes you decide whether it's worth paying for them or not?
10. Have you ever experienced bias or incorrect information when using AI for learning? If so, what was your response?
11. In what ways do you think AI platforms could be improved to support you in engineering classes?

Section 4: Academic Integrity and AI Tutoring
12. Some students express concerns that AI tools might lead to over-reliance or reduced critical thinking skills. What are your thoughts on this?
13. Have you ever felt uncertain about whether using AI for coursework is considered academic dishonesty? If so, how did you navigate that situation?
14. What would make an AI more trustworthy and effective for engineering education?

Section 5: Looking Ahead – AI in Your Education
15. If an AI platform were customized for your engineering courses, what features or capabilities would you find most useful? (We can prompt the student: Please consider features like: Class Preview and Review, Class Note Summarization, Quiz/Practice Generation, Step-by-Step Problem Solving, Homework Grading, etc.)
16. How comfortable would you be using AI as a regular part of your coursework? Why or why not?
17. Do you have any final thoughts on how AI tools could better support students like you in engineering?