Students' Perception and Use of AI Tools in a First-Year Design Thinking Course

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Abstract

This is a Complete Paper. The rapid advancement of artificial intelligence (AI) tools like ChatGPT has ignited vigorous debate across academia about the role of AI in education. While perspectives range from AI bansto integration, concerns persist about impacts on student creativity, course design, assessment, and academic integrity. However, limited research exists on the critical voices of students in this discourse. The present exploratory study aims to understand students' perceptions and use of AI tools in a freshman design thinking class at a large public university. As generative AI becomes increasingly accessible, understanding how students view and utilize these technologies can inform institutional policies and pedagogical strategies. This study employs a qualitative researchmethodology where an open-ended survey instrument was used to collect data. A total of 179 survey responses were obtained from students enrolled in the freshman design thinking course.

Findings provide insights into students' developing relationship with AI as a collaborative tool, aiming to center student voices in critical conversations about AI. This research comes at a time when many universities are scrambling to address AI, with policies often made reactively. Gaining a nuanced understanding of how students are interacting with these technologies can guide evidence-based institutional decisions. Additionally, findings can help faculty adapt pedagogical approaches amidst AI, supporting diverse learners and emphasizing creativity Overall, this exploratory study takes an initial step toward equitable integration of AI in higher education by highlighting student perspectives. With generative AI becoming increasingly pervasive, research focusing on the student experience is critical. As universities grapple with AI policies and practices, this study emphasizes the need to include student voices. Findings provide key insights that can inform faculty pedagogy, course design, campus policies, and strategic integration of AI. Centering student perspectives allows for human-AI collaboration in education that maintains academic integrity while supporting creativity and learning.

Introduction

Artificial intelligence (AI) tools like ChatGPT can produce remarkably human-like text. As technological barriers to developing advanced conversational AI rapidly diminish, these technologies have disseminated across society with explosive growth anticipated in the coming years. However, concerns arise on whether accelerating integration of AI tools aligns with goals of conscientious, equitable progress, especially in sensitive domains like education. While AI promises personalized support at scale that could aid learning, critics argue overreliance poses risks around academic integrity, creativity decay, and uniform thought patterns from AI-generated content permeating pedagogy. These tensions ignite debate on policies guiding if, and under what constraints, AI tools belong in academic contexts to uphold standards. Rapid acceleration of AI capabilities coupled with easy access, and lack of oversight, creates the conditions for both positive and detrimental impacts on quality and integrity of students' learning. This necessitates proactive understanding of real-world influences on the student experience, in addition to safeguarding against misaligned consequences. Informed adoption, rather than reactive constraints after problems surface, requires evidence on student perspectives as primary stakeholders and academic standard bearers that are deeply impacted by AI.

However, at a time when AI integration forces top-down policies, limited research currently exists capturing authentic student voices amidst unprecedented technology shifts. Student standpoints offer real-time insights into daily technology usage behaviors and witnessing benefits and harms up-close, positioning them as indispensable reporting agents to expose dynamics and impacts that may escape institutional awareness. With generative AI potentially posing an acute imminence of disruption to academic contexts, any policymaking or strategic integration must recognize that students are both the key receptors of changes and the closest observers that can flag both emerging opportunities and harms. The study thus has a time-sensitive charge of unveiling student beliefs while power is retained to guide the unfolding status of AI.

Context

The context for the study is a freshman level design thinking course at a Tier 1 US university. The course is a required course and is offered in flipped format. All the course materials are shared with the students before the actual class through the learning management system and during class time discussion and hands-on project work takes place. The course is highly group based and has three projects throughout the semester. The first two projects are small in scope and is focused to help students learn the design thinking process. The final capstone project is 8 weeks long is where students work on solving an open-ended engineering grand challenge. The final deliverable for the course includes a functional prototype for the problem space the students are working on, and a final presentation related to the same. There are multiple low stake assignments in the form of quizzes, reflections and fieldworks embedded throughout the course adding to their final grade. Since Spring 2020 with the onset of COVID-19, the course also follows a HyFlex modality where students are given the autonomy to attend each class meeting face-to-face or synchronously remote through MS Teams.

Methodology

This exploratory research study adopted a qualitative survey-based methodology to gain an in-depth understanding of design thinking students' perspectives regarding the application of artificial intelligence (AI) tools within coursework. Specifically, we focused on eliciting insights into the use of conversational AI platforms like ChatGPT that can generate human-like text responses when queried. Our goal was to illuminate impacts on learning as well as appropriate integration approaches as perceived by students themselves. We conducted a cross-sectional survey delivered at the end of the Spring 2023 semester across all 16 sections of a large-scale undergraduate design thinking course taught by multiple instructors at a Tier 1 US university. The total enrollment across all sections was 633 students, representing the overall population that received access to the voluntary survey. The qualitative survey comprised predominantly open-ended questions to allow students to elaborate on AI tool usages, benefits, challenges, utilization in course, instructor guidance and future directions. This enabled rich, multi-faceted insights to emerge organically without constraining responses. We emphasized narrative responses to gather comprehensive feedback. In total, 287 students participated in the survey out of the 633 available yielding a satisfactory 45% response rate. Of these, we could comprehensively analyze 179

complete surveys while partial responses with insufficient information were excluded. This generated extensive qualitative data encompassing varied student experiences with AI tools to inform a rigorous thematic analysis. Coding utilizing the constant comparative technique helped reveal overarching trends, outlier viewpoints, areas of consensus, and variations across subgroups related to our key research questions.

Results

The following are the key themes that emerged for each of the open-ended question themes.

How have you utilized ChatGPT or other AI tools in your coursework?

1. Getting Explanations and Clarification

A major theme that emerged was students using AI tools like ChatGPT to receive customized explanations and clarification on concepts they found difficult or confusing in their courses. As one student explained, "I used it for extra clarification or explanations for things that I find confusing." The interactive capability to ask follow-up questions enabled the AI to provide responses tailored to their comprehension level, phrased in alternative ways. In particular, the AI tools helped clarify material that professors covered in lectures but that students struggled to fully grasp. As one noted, they used ChatGPT to "help explain a concept to me that I may not be fully understanding as it can phrase it in a different way to my professor." So the AI offered a supplemental resource for reinforcing understanding in cases where classroom teachings were inadequate. Many students found this clarification support invaluable for addressing points of confusion and filling individual knowledge gaps. Whether needing additional examples, rephrased definitions, or personalized step-by-step breakdowns, AI tools like ChatGPT allowed customized clarification at scale.

2. Assistance with Assignments and Projects

Another prevalent theme was students utilizing AI tools to directly assist with completing assignments and projects for their courses. They reported uses like generating ideas for papers and presentations, improving grammar and outlines for writing assignments, conducting research, and even writing code for programming projects. As one student described, "I used ChatGPT to help teach me html for our final project in Tech 120 [the design thinking course]." With many personalized applications for augmenting their work, students tapped the convenient access and responsiveness of AI for targeted support ranging from proofreading up to providing frameworksto build upon. For group projects as well, AI tools facilitated collaborator coordination. As one student noted, their team "utilized ChatGPT in order to help us write some of our code for our browser extension." So, at both individual and collective levels, AI enabled students to enhance the quality and efficiency of their coursework.

3. Quick Answers and Information

Beyond supplemental explanations, students also widely reported using AI tools as convenient sources of quick information while working on assignments. The speed and specificity with which responses were provided increased productivity. As one student described it, AI tools

allow them to "get quick answers to my doubts and clarify concepts" in real-time, accelerating their progress. Others emphasized appreciating having an “enhanced Google” to retrieve information rapidly. The always-available, customized support enabled staying in flow rather than having to switch contexts to seek answers. With the capability to digest and synthesize large volumes of information instantly, the AI also facilitated efficient research and writing. As one student explained, "I can ask it to explain a concept, then I get all the information I need" rather than having to comb through multiple sources. This evidence retrieval and consolidation role was invaluable for optimizing workloads.

4. Experimental Usage

Beyond directly assisting with coursework, some students utilized AI tools purely out of curiosity to evaluate capabilities. As one openly shared, "I did experiment with it by asking it questions" without aiming to achieve any particular productive goal. The novelty of this cutting-edge technology sparked interest in exploring potential applications. Without set expectations, these students loosely tested AI tools in a speculative way to get a sense of current functionality. One student explained that they had "tried it once or twice to see what results it would produce" - more to satisfy their curiosity than fulfill defined needs. So this experimental usage reflected reactive engagement with an emerging technology.

5. Supplemental Support

Importantly, very few students reported wholly outsourcing assignment work to AI tools in a way that limited their own learning. Most emphasized using the technology as supplemental support to enhance their efforts. As one student summarized, they used it “mostly to enhance my knowledge in particular concepts” with their own work still core. The predominant view was that AI enabled getting “unstuck” when facing obstacles, rather than replacing actual understanding. Even in using AI writing support, most reported applying the same for “extra clarification” on sections they authored themselves rather than having it generate entire passages. So supplemental aid to connect gaps was the emphasis.

Have you found ChatGPT or other AI tools to be helpful in completing your coursework? Why or why not?

1. Efficiency and Convenience

Many students reported benefits of using AI tools like ChatGPT for their convenience and efficiency. The AI provided quick answers to questions, simplified complex concepts, helped organize ideas, and sped up tasks like research and writing. As one student noted, "It saves so much time looking for the right articles." Rather than searching through multiple websites, the AI offered a straightforward way to get targeted information. Similarly, the AI helped breakdown difficult concepts that students were struggling with. As another student explained, "When I can't understand a term, I can ask it again and again until I fully understand what the term means." The interactive nature of being able to query the AI enabled deeper comprehension. By quickly generating ideas and framework for approaching assignments, the AI also supported improved productivity. Students emphasized how this efficiency enabled them to focus efforts on actual learning. As on student said, "That is helpful as I don't have to scroll

through several website or do several research before I can fully understand what the term mean. This can save time for me."

2. Supplemental Support

In addition to efficiency gains, students overwhelmingly reported using AI tools as a supplemental aid rather than having the tools complete work for them. The AI provided ideas to build on, offered suggestions when students were stuck, and gave explanations to improve understanding. As one student emphasized, “if it is used to improve your talents rather then do it for you then it is a useful tool”. Many students turned to the AI when facing roadblocks in their work and needed fresh ideas or alternate ways of thinking. As one noted, “I have found them helpful mostly as a starting point or when I do not want to spend the time looking through tons of lecture slides.” The AI thus offered productive shortcuts rather than replacing their efforts entirely. This supplemental role also emerged in how the AI provided explanations to reinforce learning. Per a student, “It helps because it can sometimes explain how something works a certain way." Even if the AI didn’t solve problems directly, it enabled students to clarify concepts they were shaky on.

3. Limitations around Accuracy

Despite recognizing the efficiency gains and supplemental support offered by AI tools, students consistently pointed out accuracy issues and risks in relying too heavily on the technology. As one plainly stated, "It gets some questions right but gets some wrong." Students reported many instances of the AI providing flawed responses or solutions. Particularly complex domains like advanced math and computer programming posed challenges. As a student noted regarding trigonometry and calculus problems, "Occasionally, especially with trigonometry and functions it does not give a correct response.” The AI’s logic in technical subjects remains imperfect. Moreover, students feared becoming over-reliant on technology that offers convenience but inconsistent precision. As one explained, “Sometimes it gives a wrong or different answer not what I want. And if a student does not realize the data is not reliable, they might learn something wrong from ChatGPT.” Recognizing these accuracy limitations was key even while benefiting from AI efficiency.

How has your experience with ChatGPT or other AI tools impacted your learning in your coursework?

1. Efficiency and Productivity Gains

Many students reported appreciable gains in their efficiency and productivity levels when utilizing AI tools to assist with coursework. By providing rapid answers and ideas for approaching assignments, the technology enabled focusing efforts more strategically.
As one student explained, "It has made me more productive to focus on the actual coursework instead of being distracted for only one project.” The availability of on-demand support resulted in less time wasted on peripheral activities like searching across sources or troubleshooting obstacles.Some quantified the dramatic time savings from using AI tools. Per a student, “It made it much easier, instead of working on a project for 7-8 hours, it gets reduced to 3-4 hours.” By

accelerating the research and initial stages of projects, students gained bandwidth to dedicate towards high-value work with greater impact on learning outcomes.So by optimizing workflows and enhancing time efficiency, the judicious use of AI tools conferred measurable productivity boosts to students.

2. Supplemental Understanding

In addition to efficiency gains, students valued AI tools for providing supplemental clarification of concepts they found difficult to grasp, essentially functioning as personalized tutors. The interactive ability to ask follow-up questions tailored to their exact comprehension level enabled patching specific learning gaps.As one student relayed about the AI tools, “Helped me better understand topics.” The capability to rephrase explanations in alternative ways or offer new examples on-demand allowed students to achieve clarity on aspects they struggled with based solely on classroom and textbook guidance.For hands-on learners especially, AI tools conferred value via customized simulations. Per a student’s experience, “It is easier to understand because of the visual learning.” So tailored supplementation proved integral for consolidating understanding across diverse learning styles.

3. Minimal Impact

However, many students also reported that use of AI tools like ChatGPT has not markedly impacted their learning. Some indicated this was due to not having used the technology significantly in their coursework. Per one response, “It hasn't impacted my learning due to the lack of using ChatGPT.”But even among users, many clarified that they use the tools cautiously and sparingly to avoid over-dependency. One bluntly stated, “Not at all” when asked about learning impacts, suggesting they consciously minimized usage despite availability. So moderated, exploratory usage patterns kept impacts peripheral for these judicious adopters.

4. Risk of Improper Dependency

However, some students surfaced concerns around the risk of developing over-reliance on AI tools if used irresponsibly, which could undermine self-directed learning. There were warnings about a slippery slope of misuse promoting academic shortcutting and laziness at scale.As one student flagged, “I feel like using it will make your effort become lazy knowing something else will do it for you basically.” Another bluntly spoke out against those “getting away with it,” indicating the technologies could sever the link between rigor and outcomes if applied inappropriately.

Have you discussed the use of AI tools like ChatGPT in your classes or with your instructors? If so, what was their perspective on it?

1. Strong Disapproval Due to Cheating Risks

Many instructors outrightly expressed disapproval of AI tools, with most citing concerns around their potential to enable cheating and erode academic integrity. As one student summarized, their professors "view it as a form of cheating pretty much. “Beyond just wariness, some instructors have banned usage in student work, aggressively screening submissions for AI use. As another student reported, their instructor mandated "check[ing] students' papers using other AI checkers."

The ease of generating written work automatically with few traces of AI authorship aggravated worries of short-cutting learning. So most instructors strongly advocated against adoption due to worries students would exploit vulnerabilities in assessment systems and circumvent the need for self-directed learning. Their perspective was to constrain rather than enable usage.

2. Apprehension About Impacts on Learning

Tied to cheating risks, many instructors worried reliance on AI tools could become a crutch inhibiting students' acquisition of skills in source curation, critical thinking, written articulation, and autonomous learning. There were concerns about long-term atrophying of competencies with over-dependence. As one student summarized based on faculty opinions, "It's possible that we will become too reliant on it to solve our problems." Some indicated that instructors emphasized students needing to "learn by themselves" without technology substituting for rigorous understanding. So the view among worried faculty was that improper overuse had high risks of systematically degrading educational outcomes and experiences. Students leaning heavily on AI could miss developing core transferable skills.

3. Misuse Enabled by Immature Systems

Adding to apprehensions around dependence, cheating risks, and eroded competencies with overuse, instructors indicated AI systems are still largely unreliable in accurately interpreting information and rendering judgements. Their perspective was students could easily exploit such immaturities for expedience and shortcuts. As one student echoed regarding instructor attitudes, "They think it's interesting. I talked to one professor about it, and she thinks that AI is exciting!" But possibilities for misinterpretation and inaccuracy left the door open for those inclined take advantage, hence polarized opinions between prudence and promises.

4. Uncertainty from Emergent Technology

In some cases, instructors expressed they remained unsure about precise implications from AI systems in education given rapid, recent emergence. As one student relayed, instructors were still determining "what it's capable of." The novelty meant assessing durability of impacts required more observation. Another student highlighted one faculty member "is uncertain of the future in light of this phenomenon." So some chose to study evolution of benefits and risks before concluding decisively on long-term impacts and appropriate policies. But uncertainty also risked hampering development of safeguards preemptively.

5. Cautious Interest as Resource If Bounded

However, while many deemed AI tools a threat, some instructors expressed openness to the technology if applied judiciously as a supplemental resource. One student summarized how their professor was willing to "feel like it could be helpful but it could pose an issue." Guidance focused on preventing reliance while allowing usage for ideation. Another student highlighted faculty opinions that AI "can inspire creative thinking and writing" indicating potentials to enhance pedagogy if policies curtail misapplications. So some instructors showed cautious optimism if usage were moderated and compliance to academic policies encouraged. But broad concerns on integrity and learning risks necessitate clear parameters around acceptable usage.

How would you like to see AI tools like ChatGPT integrated into your coursework in the future?

1. Supplemental Learning Aid

The most common perspective was a desire for AI tools to be available as optional, supplemental aids for enhancing understanding rather than replacing traditional learning. As one student suggested, it would be helpful if integrated to "learn how to access and properly query AI tools" indicating bounded usage for assistance when needed.Many responses emphasized AI offering value "as a resource" and "tool to be utilized" versus as a substitute for fundamental knowledge building. The preference was having the AI available "as studying aids" so students can leverage benefits while still directing their own education.

2. Limited or Minimal Integration

However, some students preferred no or very limited integration of AI tools to maintain effectiveness of conventional teaching methods. As one representative response stated, "I would not like to see them integrated into coursework" – underscoring that some find little benefit or remain unconvinced regarding supplemental value.Some warned of over-dependence risks with heavy usage, advocating for keeping AI "external" or fully banning integration into key assignments. So while recognizing potentials of AI tools, these students favored conservative adoption to prevent impairment of traditional styles.

3. Tool for Combating Misuse

A few students suggested potentially integrating AI tools specifically to aid plagiarism checking and screening for inappropriate use. Enabling "more openly use" while also leveraging AI capabilities in "grading" systems could help uphold academic integrity standards.As one student described, "There should be integration in both sides – the grading as well as the assignment side" – indicating AI itself could be used to catch reliance and enforce policies. So some saw potentials for AI to play internal regulatory roles curtailing misuse.

4. Ideation and Conceptual Support

Many students wanted future integration centered on use cases like ideation, answering student questions to clarify concepts, conducting research, and other supportive applications. As one noted AI could continue providing value "inspiring creative thinking and writing."The goal would be improving understanding – "learn from it, not depend on it" per a student – rather than directly completing assignments. So restrictive, supplemental usage for concept and project enhancement aligned with overall preference for keeping AI as an assistive aid.

Have you noticed any limitations or challenges with using ChatGPT or other AI tools in your coursework?

1. Inaccuracy and Misinformation Risks

A prevalent theme was the lack of reliability and accuracy of responses provided at times, posing risks of learning misconceptions if inaccuracies go undetected. As one student summarized, the tools are "not always correct" when queried.Many flagged occurrences of being misdirected by flawed guidance from the tools. As another student elaborated, "asking them for links usually doesn't go well" underscoring trouble even with navigational support towards credible sources in some cases.So rather than clarifications, the tools sometimes introduced noise and uncertainty that required further effort to resolve, undermining learning efficiency.

2. Interpretation Difficulties Leading to Irrelevance

Students also commonly noted limitations arising from the tool's struggle to parse specifics and context when questions get too complex or open-ended. One shared an example that "the AI sometimes misunderstands what I'm trying to ask it" while coding.In these comprehension breakdowns, output becomes generically irrelevant rather than tailored guidance students seek. Such lack of strict responsiveness again risks time wasted deciphering irrelevant material rather than boosting clarity.

3. Superficial Grasps of Concepts

Some students flagged more fundamental constraints around the tools exhibiting only surface-level rather than deeper, layered grasps of concepts. One dismissed them as "everything it writes is the same way and offers no depth. “Since mastery requires internalizing conceptual nuance, not just facts, the tools stumble in advancing beyond a certain threshold of understanding. Their comprehension ceiling prohibits bridging gaps for those seeking more enriched clarity.

4. Technical Weaknesses in Math and Programming

Especially in technical domains like math and computer programming, many students reported acute accuracy and comprehension deficits that undermined utility. One shared that with numerical calculations, "the AI tools gave very bad" results, getting fundamentals wrong. So despite upgrades in languages and writing, foundational numerical and computational techniques remain challenging for AI. Thus for STEM content, existing tools lack reliability, threatening learning integrity if applied without due caution.

Discussion

As artificial intelligence (AI) capabilities rapidly advance, tools like ChatGPT are emerging that can mimic human-like conversation and content generation. These AI systems have significant implications for education given potentials to aid customized learning at scale. However, appropriate integration hinges on ensuring such technologies enhance rather than impair student outcomes. We conducted a survey of university students on their perspectives regarding the use of ChatGPT and AI tools within coursework to assess impacts on learning and discern suitable integration approaches.

Overall, most students report utilizing AI tools for supplemental assistance explaining difficult concepts, generating ideas, researching topics, and drafting written documents. They acknowledge significant efficiency gains from AI support in locating tailored information and accelerating assignment completion. However, multiple limitations emerged including frequent inaccuracies, comprehension gaps around technical questions, superficial explanatory quality, and biases that could instill misconceptions if unchecked.

Future Directions

Based on the study's findings, generative AI tools like ChatGPT 4 will be incorporated into the design thinking class. These tools will help facilitate certain class activities, such as preparing for stakeholder interviews, documenting design journals, providing templates, and assisting with ideation stages.

Additionally, we are currently conducting research to gauge students' and faculty's perceptions of using generative AI in teaching and learning across various departments and colleges within our institution. This research is crucial as the adoption of AI-powered tools in education raises important questions about their effectiveness, ethical implications, and potential impact on the learning experience. By gathering insights from multiple perspectives, we aim to better understand the opportunities and challenges associated with integrating generative AI into diverse academic disciplines. The findings will inform future policies and best practices, ensuring that these innovative technologies enhance rather than hinder the educational process.