Exploring Students' Understanding and Expectations of Artificial Intelligence (AI): A Freshmen Perspective

Dr. Varun K Kasaraneni, Gannon University

Dr. Kasaraneni is associate professor of environmental engineering.

Dr. Lin Zhao, Gannon University

Lin Zhao received the Ph.D. degree in electrical engineering from the University of Western Ontario, London, ON, Canada in 2006. She received the B.Sc. and M.Sc. degrees in electrical engineering from Shandong University, Jinan, China, in 1993 and 1996 re

Longfei Zhou, Gannon University

Longfei Zhou, an Assistant Professor at Gannon University since May 2023, contributes to the BISE department and I-Hack CMT. His research spans smart manufacturing, scheduling, simulation, and AI. He received his Ph.D. from Beihang University in 2018 and conducted postdoctoral work at MIT CSAIL from January 2019, focusing on AI for industrial systems and serving as MIT Postdoc Association Fundraising Chair. In November 2020, he joined Duke University as a postdoc, specializing in AI algorithms for medical images. Dr. Zhou published 50+ papers with 1300+ citations, crafted a National Standard, holds two patents, and authored two books. He received the Outstanding Contribution Award at the IEEE UV2020 Conference. With roles on two editorial boards and as guest editor for Sensors, he also chaired sessions at multiple IEEE, ASME, and CIRP conferences.

Dr. Xiaoxu Ji, Gannon University

Exploring Students' Understanding and Expectations of Artificial Intelligence (AI): A Freshmen Perspective

Abstract

This paper is complete research. As AI technologies rapidly evolve and integrate into various industries, understanding how incoming college students perceive and use these tools is crucial for shaping educational strategies. This study examines freshmen in an Intro to Engineering and Computing course through pre- and post-surveys conducted around an AI-focused lecture and an AI-integrated assignment. The pre-survey assesses students' familiarity with AI tools like ChatGPT in academic and personal contexts. The post-survey evaluates changes in awareness, confidence, and interest after the lecture and assignment. Results provide insights into AI's impact on academic performance and efficiency, guiding curriculum development. Additionally, the cohort will be surveyed again in three years to assess their long-term AI experiences and career readiness.

1. Introduction

Artificial Intelligence (AI) traces its origins to the mid-20th century when researchers began exploring the possibility of creating machines capable of simulating human intelligence [1]. Early efforts focused on symbolic reasoning [2], problem-solving [3], and basic learning algorithms [4]. As computing power increased, data became more accessible, and algorithms advanced, the field experienced significant growth. Particularly, neural networks [5-7] inspired by the structure of the human brain led to modern machine learning and deep learning techniques. Today, AI spans diverse applications, including natural language processing [8], computer vision [9], robotics [10], and decision-making systems [11], profoundly impacting industries and everyday life.

Artificial Intelligence (AI) serves as a transformative tool in academia, revolutionizing learning, teaching, and research methodologies. In education, AI-powered platforms customize learning experiences by adjusting to individual students' needs [12], providing tailored lesson plans [13-14] and instant feedback [15]. Automated grading systems [16-17] and intelligent tutoring solutions [18-20] reduce administrative workloads for educators, allowing them to dedicate more time to interactive and personalized teaching. In the realm of research, AI expedites data analysis [21-23], enabling researchers to process extensive datasets, identify trends, and derive insights with unmatched speed and precision. Furthermore, AI enhances academic accessibility through tools like real-time language translation [24], speech-to-text software [25], and assistive technologies designed for students with disabilities [26-27]. By driving innovation and improving efficiency, AI is reshaping academic landscapes and empowering both educators and learners.

However, the adoption of AI in academia has introduced challenges, particularly concerning plagiarism [28] and academic integrity [29]. Advanced AI tools, such as generative language models, can produce essays, research papers, and other academic content that may be difficult to detect as non-original work. This raises concerns about students using AI to bypass learning and submit AI-generated material as their own. Beyond plagiarism, there is the challenge of ensuring that AI tools are used ethically [30], as improper use can undermine the educational process and devalue academic achievements. To address these issues, institutions must establish clear

guidelines for AI use, educate students and staff on ethical practices, and invest in technologies to identify and prevent misuse.

Besides, the adoption of AI in industry is revolutionizing business operations and driving innovation across sectors. Companies leverage AI to optimize processes [31], enhance decision-making [32], and improve customer experiences [33]. In manufacturing, AI-powered systems enable predictive maintenance [34], quality control [35], and supply chain efficiency [36]. In healthcare, AI supports diagnostics [37], drug discovery [38], and patient care management [39]. Thus, it crucial for students to be prepared in their freshman year, not just by understanding AI concepts but also by developing critical skills to thrive in an AI-integrated world. While many are excited about AI's potential to transform industries and drive innovation, others may feel overwhelmed by its complexity and uncertain about how it will impact their future careers. As newcomers to higher education, they may not fully recognize the pervasive role AI will play across fields such as healthcare, engineering, and technology. By offering foundational courses in AI, fostering problem-solving abilities, and emphasizing interdisciplinary applications, educational institutions can help freshmen gain the knowledge and confidence needed to navigate the rapidly changing landscape and leverage AI’s potential for their future success.

As faculty members, it is essential not only to teach students the technical aspects of AI but also to address its ethical implications, potential biases, and societal impact. Faculty should guide students in using AI tools responsibly, encouraging them to apply AI in ways that enhance human creativity, critical thinking, and problem-solving. Additionally, faculty should promote discussions on the ethical considerations of AI, including privacy, fairness, and transparency, ensuring that students are prepared to navigate the challenges and opportunities AI presents in both their academic and professional lives. By offering a balanced and informed perspective, faculty play a crucial role in shaping responsible AI users and future innovators, ensuring that students gain the knowledge and skills needed to use AI effectively.

In this context, we surveyed freshman engineering and computing students about their use of ChatGPT and provided guidance on how to effectively use AI to refine their assignments. This paper presents the results of the surveys, analyzing students' initial perceptions, expectations, and experiences with AI tools, as well as the strategies they employed to enhance their interactions with ChatGPT during a structured assignment

2. Methods

This study utilized a survey-based approach to examine the understanding, expectations, and perceived applications of artificial intelligence (AI) among first-year engineering and computing students. The survey was designed to capture the students’ initial perceptions prior to any formal lecture on AI tools and their perspectives after engaging with the lecture content.

The study included participants enrolled in an "Introduction to Engineering and Computing" course at xxxxxx University. Prior to full deployment, the survey underwent a face validity assessment with a faculty panel to ensure clarity and relevance. All participants in the study were traditional undergraduate students, primarily aged 18-19, with the majority being domestic students. Approximately 15-20% of the respondents were international students. Unfortunately, socioeconomic background information was not available at the individual level.

The surveys were administered in two stages: a pre-survey (AI use and student perceptions survey; deployed four weeks into the semester) conducted at the beginning of the semester, prior to an AI-focused lecture, and a post-survey (AI use reflection survey) conducted three to five weeks after the lecture. The lecture provided students with an introduction to AI concepts, practical demonstrations of AI tools such as ChatGPT, and discussions on ethical considerations in AI development and use. Prior to full deployment, the survey underwent a face validity assessment with a panel of faculty to ensure clarity and relevance.

The post-survey was conducted to assess students' experiences and strategies after using ChatGPT for an assignment. The survey included questions designed to evaluate how effectively students communicated with ChatGPT, the challenges they faced, and the insights they gained. Students reported the frequency of prompts provided to ChatGPT, whether they needed to rephrase or clarify their requests, and their ability to communicate effectively with the tool. Ratings were used to measure ChatGPT's helpfulness in generating and summarizing information, as well as its ability to offer unique insights on the "Spirit of Engineering." Originally, the "Spirit of Engineering" assignment required students to write a reflection on their understanding of engineering, motivations, career goals, and expected lifestyle in their chosen engineering field—without using AI tools—to ensure authentic, independent insights. After the AI lecture, students revisited the same assignment using ChatGPT, allowing them to experience personalized, AI-assisted writing. This exercise enabled a direct comparison between their original reflections and AI-generated responses, highlighting AI's ability to refine ideas.

Students also reflected on strategies they used to enhance ChatGPT's responses, such as rephrasing questions, providing additional context, or asking for specific clarifications. Open-ended responses allowed students to elaborate on challenges and their reasoning for difficulties encountered. This survey provided qualitative and quantitative data on the usability and effectiveness of AI in facilitating learning and problem-solving in the context of engineering education.

The survey questions covered multiple aspects of AI understanding and application:

- *Awareness and Use of AI Tools:*
  Questions assessed the frequency and types of AI tools students had used prior to the survey and their familiarity with specific AI applications in engineering and computing.
- *Perceived Benefits and Risks of AI:*
  Students were asked about their perceptions of the potential advantages of AI in professional settings, as well as any risks or ethical concerns they associated with AI.
- *Skills and Knowledge Expectations:*
  The surveys explored students' expectations regarding the skills and knowledge they believed were necessary to effectively use AI in their field.
- *Confidence and Preparedness:*
  Participants rated their confidence in applying AI to solve engineering or computing problems and their sense of preparedness for AI-integrated workplaces.

3. Results and Discussion

The course enrolled a total of 88 freshman students from various engineering and computing majors, including Mechanical Engineering, Electrical Engineering, Computer Science, Software Engineering, and Environmental Engineering. The pre-survey received a response rate of 95.5%, reflecting the students' initial perceptions and familiarity with AI tools. The post-survey, conducted after completing an AI-enhanced assignment, garnered a response rate of 88.6%, providing insights into students' experiences and strategies for effectively using ChatGPT in their coursework. Every student who answered “yes” provided written responses with a follow-up question. The responses were typically concise, averaging 15–20 words. Our content analysis was conducted collaboratively by all authors, who used a combination of inductive and deductive approaches to identify themes.

3.1 AI use and student perceptions survey results

In the pre-survey, students demonstrated a range of familiarity with AI tools, with a majority indicating limited prior experience (Figure 1). Many students were aware of AI tools like ChatGPT but had not extensively explored their applications.

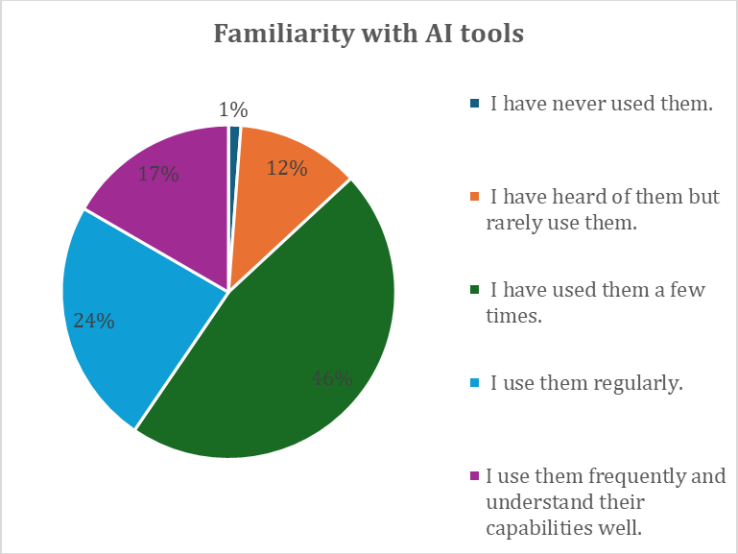

Figure 1: Students responses to question regarding familiarity with AI tools.

3.1.1 Academic use

In the pre-survey, 82% of students reported using AI tools for academic purposes, while 18% indicated that they had not yet utilized these tools. This highlights a significant majority of students actively engaging with AI in their studies, though their familiarity and confidence with these tools varied widely. Many expressed curiosity and a willingness to explore AI's potential, while others were more cautious, reflecting concerns about ethical use and reliance.

When followed up with If yes, briefly describe how you used AI for an academic task. Students provided detailed responses describing how they used AI for academic tasks, revealing both practical applications and the frequency of usage across different areas. Idea generation emerged

as the most common use, with approximately 40% of students relying on AI to brainstorm topics for essays, research papers, and assignments (figure 2). They used AI to develop starting points, structure their work, and generate ideas for further expansion. For example, one student mentioned using AI to "generate ideas for research topics," while another highlighted it helped to "get starting ideas and design" for essays. Many clarified that AI served as inspiration, but they built upon its suggestions to produce original work.

Problem-solving and clarifications were also significant, with roughly 30% of students reporting AI's role in tackling challenging subjects like mathematics, programming, and science. Students used AI to solve complex problems, provide step-by-step explanations, and double-check answers. For instance, one student shared, "Whenever I got stuck in a problem, I used AI to understand the solution and learn to solve similar problems," while others highlighted its usefulness for "solving calculus problems" and debugging code. AI was particularly helpful in computer programming, where students used it to grasp concepts such as classes and manipulate data for projects.

Improving writing quality was another key area, cited by about 20% of students, who frequently turned to AI for grammar checks, proofreading, and refining their essays. Students described using AI to fix grammatical errors, improve clarity, and ensure their writing was polished. One student noted, "I use AI to check my essays and improve wording," while another shared, "It helped me correct grammatical and punctuation errors." AI tools also provided structural feedback, allowing students to produce higher-quality assignments.

In addition to idea generation and problem-solving, research support accounted for 10% of responses. Students used AI to summarize articles, clarify difficult concepts, and plan their research papers. One respondent mentioned using AI to "plan out my paper and give feedback on my progression," while another shared its value in "researching public databases" and structuring annotated bibliographies. AI was particularly beneficial for international students, who used it to better understand academic topics and improve their language proficiency.

A smaller group of students (<5%) reported more creative or unique uses of AI, such as generating book summaries, organizing study notes, and preparing for exams. One student shared, "I used AI to summarize my class notes to make them easier to memorize," while another used AI to create notes and explore curiosity-driven topics, like networking. Overall, students used AI as a multifunctional tool to enhance their productivity, learning, and writing skills.

Students demonstrated varied behaviors and perceptions regarding the use of AI tools for academic purposes, reflecting a balanced mix of reliance and skepticism. When asked if they cross-check information provided by AI tools, 45% of students responded "Yes, always," showing a strong commitment to verifying the outputs of AI tools. Another 40% stated "Yes, sometimes," indicating that while they use AI as a resource, they do not blindly trust the information provided. This means that a combined 85% of students engage in some level of verification, demonstrating a critical approach to AI use. In contrast, only 15% reported cross-checking "Rarely" or not at all, highlighting a smaller group that uses AI tools without rigorous fact-checking.

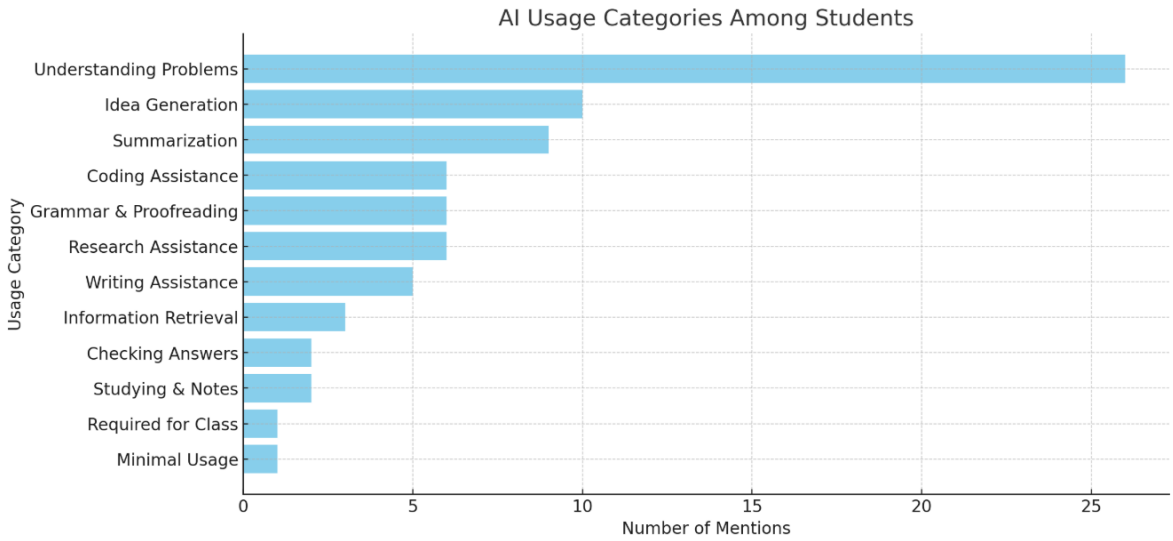

Figure 2: Survey responses to “describe how you used AI for an academic task”.

On a scale of 1 to 5, the helpfulness of AI tools received an impressive average rating of 4.2, with many students describing AI as a valuable aid for tasks like generating ideas, solving problems, and improving the quality of their work. This high score reflects AI’s perceived ability to streamline academic efforts and make learning more efficient.

Similarly, the accuracy of AI tools was rated at an average of 3.9, indicating that students generally trust AI to provide correct information, though there are occasional doubts or inconsistencies. Some students expressed that AI outputs often require further refinement or elaboration to meet their academic needs fully. Reliability, however, received a slightly lower average rating of 3.8, suggesting that while many students find AI tools dependable, some remain cautious and selective about their usage. This slight dip in reliability scores underscores lingering concerns about AI's limitations, such as incomplete or contextually inaccurate responses. Despite these reservations, students' responses indicate a growing reliance on AI in academic settings. Most students view AI as a supportive tool rather than a perfect solution, actively verifying its outputs and integrating its suggestions thoughtfully into their work.

3.1.2 Non-academic use

Students reported diverse uses of AI tools for non-academic purposes, with 60% using AI occasionally (once or twice a week) and about 25% using it frequently (3-5 times a week), reflecting its growing role in their daily lives. Only 15% of students reported rare or no usage. The most common applications include planning and productivity, where students rely on AI to create schedules, brainstorm ideas, or organize tasks, such as “planning an event” or “making a timetable.” AI is also used extensively for creative purposes, such as generating images, music, or art designs. Examples include students using AI for “creating pictures from a description” or “designing tattoo ideas.” For entertainment and leisure, AI serves as a tool for gaming strategies, personal hobbies, and chatting, with one student noting they use it to “check NFL player stats” or “chat when bored.”

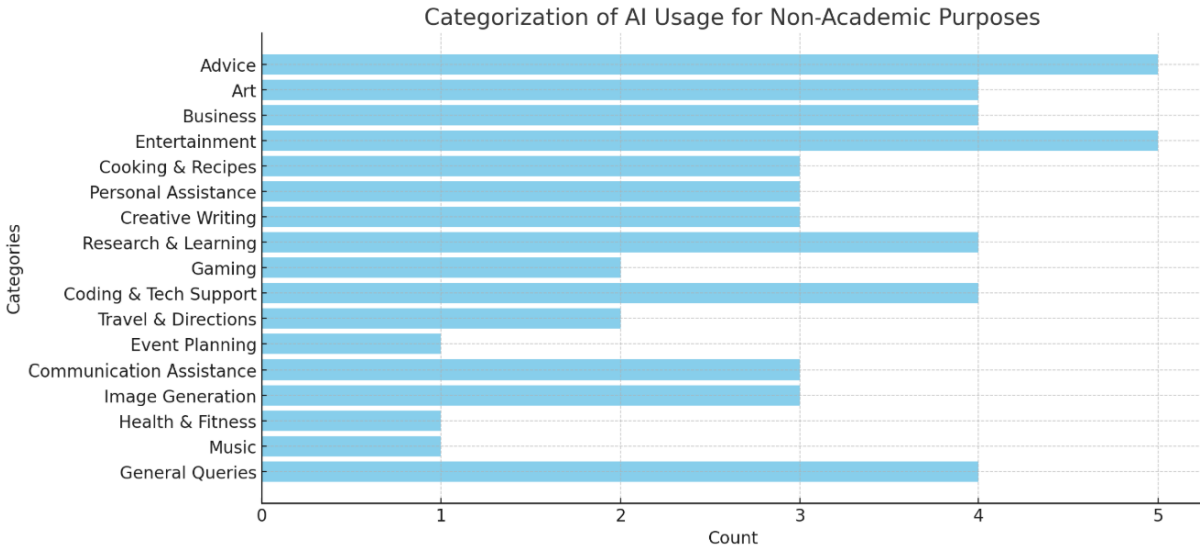

Figure 3: Summary of students responses to survey question “provide examples of how you used AI for a non-academic purpose”.

In addition, AI is used for problem-solving and personal assistance, such as troubleshooting code, solving math problems, or seeking advice on personal issues. Students highlighted its utility for tasks like “troubleshooting code for a personal project” or asking for “recommendations in a new country.” On a scale of 1 to 5, students expressed significant interest in learning about AI and its applications in engineering and computing, with an average interest rating of 4.1 and approximately 50% rating their interest as 5 (Very Interested). When asked about their expectations, students foresee AI tools evolving to become more human-like, capable of understanding tones, providing emotional responses, and offering highly accurate, personalized answers. Practical applications, such as solving complex problems, improving productivity, and generating creative outputs like text, videos, or designs, were frequently mentioned (figure 3). Overall, students view AI as a versatile tool that enhances their productivity, creativity, and daily decision-making.

Students expressed a clear understanding of how AI will influence their chosen fields over the next 5-10 years, highlighting both opportunities and challenges. The most common expectation, mentioned by 45% of respondents, is that AI will significantly increase efficiency and productivity, streamlining workflows and enhancing output. Similarly, 35% believe AI will automate routine tasks, freeing time for more creative and complex activities, while about 30% see AI driving improved innovation and creativity. AI’s role in enhancing decision-making through data-driven insights was noted by 20%, and 25% foresee a transformation of job roles, requiring new skills and approaches. Additionally, around 15% mentioned AI-driven research advancements as a key benefit, while 10% raised concerns about job displacement due to AI adoption. Roughly 20% of students anticipate increased collaboration with AI systems, viewing it as a complementary tool that will support human skills. However, around 10% expressed uncertainty about AI's impact, indicating the complexity of its future role.

When asked about the importance of understanding AI tools for career success, students rated it an average of 4.3 out of 5, demonstrating strong consensus on its significance. Half of the respondents (50%) rated it as "extremely important", while another 30% considered it "very

important". A smaller group (15%) viewed it as moderately important, with only a few students (5%) assigning minimal importance to AI proficiency. Overall, students recognize AI as a transformative force that will enhance productivity, innovation, and decision-making, while also raising concerns about job changes and displacement. This underscores the need for students to develop AI-related skills and adapt to its evolving role as both a collaborative tool and a driver of change in their future careers.

3.2 AI use reflection survey results

The AI Reflection section explores students' experiences using ChatGPT, focusing on their interaction patterns, the number of prompts provided, and the need to refine their input to achieve satisfactory responses for the assignment. When asked how many times they engaged with ChatGPT during the assignment, the majority of students (50%) reported using the tool 3-4 times, while 28% used it 1-2 times. A smaller group, 18%, interacted with the AI 5-10 times, and 4 % reported using it more than 10 times. These findings indicate that most students iterated multiple times with ChatGPT, leveraging its functionality to refine their outputs. The responses to follow up question “Did you need to provide more information, or rephrase your request before you reached a final, satisfactory response?” Most students (78%) had to clarify their requests sometimes to get a satisfactory response, while a smaller portion (15%) frequently experienced this need. Only a minority of respondents (7%) found their queries resolved without any additional clarification.

When asked why they believed the need for refinement arose, students provided a variety of explanations. Many highlighted that their initial prompts lacked clarity or sufficient context, leading to vague or incomplete responses from ChatGPT (figure 4). Others noted that the tool's responses sometimes required tailoring to meet specific assignment objectives, prompting them to refine their queries. Many students emphasized that providing clear, detailed, and specific prompts was essential to achieving a satisfactory answer from ChatGPT. They recognize that the AI performs better when the questions are straightforward or detailed. Ambiguous or broad questions often yield less accurate results. These insights suggest that while ChatGPT is a powerful tool, its effectiveness is closely tied to the user's ability to communicate their needs effectively and adapt their approach during the interaction**.**

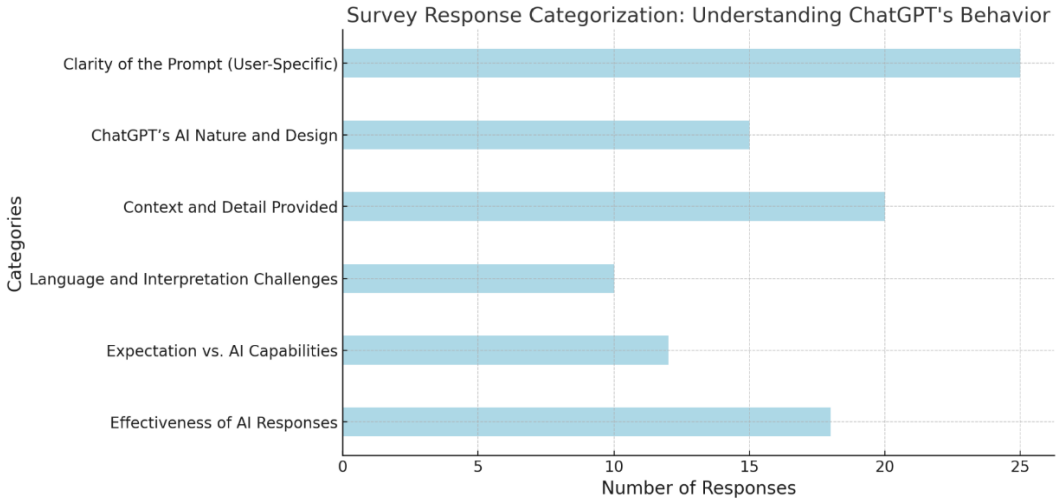

Figure 4: Students responses to survey question “Why do you think this happened” as a follow-up to “Did ChatGPT understand your questions and requests clearly, or did you have to significantly refine how you asked?”.

The survey responses indicate that students generally found ChatGPT to be a valuable tool for generating and summarizing information. On a scale of 1 to 5 (1 = Not so helpful, 5 = Very helpful), the majority of students rated ChatGPT highly, with 43% selecting a 5 (Very helpful) and 47% selecting a 4. Only 10% rated it a 3, and no students rated it below 3, highlighting its overall effectiveness. When asked whether ChatGPT offered unique insights or new ways of thinking about the "Spirit of Engineering," 58% of students responded "Yes," while 32% chose "Maybe," reflecting a broad perception that the tool encouraged new perspectives. Only 8% answered "No," and 2% were unsure, indicating that most students found ChatGPT beneficial in fostering innovative thinking about the topic.

When the students were asked the question “What strategies did you use to improve ChatGPT’s responses?”, Providing additional background information or examples was the most frequently mentioned strategy (30%). This reflects the importance of offering context to help ChatGPT generate more accurate and tailored answers. Rephrasing the question closely followed, being used in 25% responses. Rephrasing allows users to clarify or simplify questions, which improves AI comprehension. Asking ChatGPT to focus on specific aspects and asking for deeper explanation were also highly utilized strategies, suggesting users rely on iterative refinements to achieve better responses. The “Other” category appeared in only 4% responses, indicating most users rely on the core strategies provided.

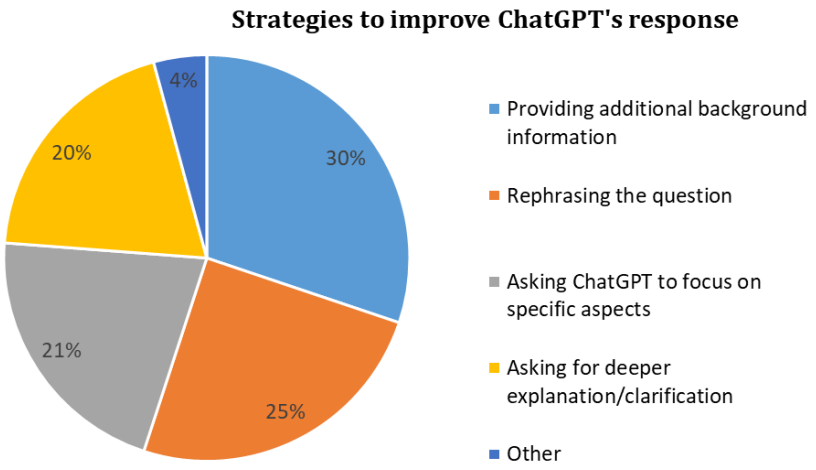

Figure 5: Summary of student responses to strategies used to improve ChatGPT responses

Providing background information and examples emerged as the most effective way to improve responses. Students recognized that ChatGPT performs better when given specific and relevant context. Many students employed a trial-and-error approach, rephrasing questions and narrowing down the focus iteratively to achieve the desired output. Asking ChatGPT to focus on specific aspects indicates that students understand how to guide the model effectively toward a particular angle or detail. Asking for deeper explanations reflects students’ attempts to push ChatGPT beyond surface-level responses, especially for complex topics.

These strategies were often combined, highlighting users' reliance on an iterative process to refine prompts and clarify expectations. The responses demonstrate that users are learning to interact effectively with AI by providing context, restructuring questions, and seeking depth in responses.

3.2.1. Qualitative Reflections on ChatGPT Usage

The responses from students about their experiences using ChatGPT revealed valuable insights into their perceptions of the tool's capabilities, limitations, and the factors influencing its effectiveness. Below are some key themes that emerged from their reflections, highlighting the nature and capability of AI, the effort made by users, the complexity of the questions posed, and the differences between human and AI thinking.

Clarity and Specificity of Prompts: Many students emphasized that providing clear, detailed, and specific prompts was essential to achieving a satisfactory answer from ChatGPT. They recognize that the AI performs better when the questions are straightforward or detailed. Ambiguous or broad questions often yield less accurate results.

Nature and Capability of AI: Students frequently mentioned ChatGPT's design, algorithms, and its ability to learn and adapt. They credit the AI's foundational structure (trained models, algorithms) for understanding their requests and delivering meaningful answers. However, some also acknowledged its limitations, particularly in mimicking human-like thought.

Effort Made by Users: A portion of students highlighted the user's role in formulating questions effectively, adding context, and iterating when necessary. They realized that their ability to rephrase, clarify, or provide additional context influenced the quality of responses.

Complexity of the Question: Students indicated that simpler questions tended to yield more accurate and focused answers, while complex or vague questions led to misunderstandings. They perceived that ChatGPT's responses improve with simpler, well-structured prompts.

Human vs AI Thinking: Students noted differences between human thought processes and AI responses, suggesting that the AI required precise inputs to function effectively. This highlights students' awareness of ChatGPT's current limitations, such as its inability to fully replicate human intuition or emotional understanding.

Limitations of AI Understanding: A segment of students cited ChatGPT's limitations, including incomplete understanding, generalized responses, and challenges interpreting certain terms or tones. Students identified areas where ChatGPT struggles, such as handling ambiguity, lacking real-time data, or interpreting nuanced human communication.

3.3 Observations of pre- vs post- survey results

The comparison between the pre- and post-survey results reveals shifts in how students perceive and interact with AI tools. Initially, many students expressed curiosity about AI but lacked clarity on its potential applications, both academically and personally. The pre-survey indicated that only a small portion of students regularly used AI tools like ChatGPT, with most utilizing them sporadically or for simple tasks such as basic idea generation or grammar corrections. Post-survey results showed a marked increase in both the frequency and depth of AI usage. Students reported feeling more confident navigating AI tools and applying them to a broader range of academic tasks, from solving complex engineering problems to drafting and refining technical

reports. Interestingly, the post-survey highlighted a greater willingness among students to experiment with iterative techniques, such as rephrasing prompts or providing additional context to achieve better results from AI tools. This behavior points to an enhanced understanding of how to communicate effectively with AI. Another key observation was the growth in students' appreciation of AI's role in fostering creativity and efficiency. While the pre-survey responses often framed AI as a functional tool, the post-survey revealed that students began to view it as a collaborative partner capable of enhancing problem-solving and decision-making. Additionally, concerns about reliability and ethical considerations remained steady, underscoring the importance of integrating discussions about responsible AI use into the curriculum.

3.4 Future Impact of AI on Careers and the Importance of AI Proficiency

In the fields of engineering and computing, AI is emerging as a transformative technology, revolutionizing workflows, innovation, and decision-making. AI's ability to enhance efficiency and automate routine tasks is enabling engineers and computer scientists to focus on more complex and creative problem-solving activities. For example, in software development, AI tools are streamlining coding, debugging, and testing processes, while in engineering, AI is optimizing design workflows, predictive maintenance, and simulation tasks. These advancements are reducing time-to-market for products and improving overall productivity in technical domains.

AI is also driving innovation and creativity in engineering and computing. Through machine learning models, engineers can develop smarter systems, while AI-powered tools in computing are advancing fields such as natural language processing, computer vision, and robotics. The integration of AI into decision-making processes is transforming the way engineers and computing professionals design systems and analyze data, with AI providing actionable insights that improve the accuracy and efficiency of outcomes. Furthermore, AI-driven research advancements are pushing the boundaries of technology, enabling breakthroughs in areas such as renewable energy, autonomous vehicles, and cybersecurity.

The adoption of AI is reshaping job roles within these fields, requiring professionals to adapt by developing new skill sets, such as proficiency in machine learning algorithms, data analysis, and AI ethics. While automation and AI-driven systems are expected to replace some repetitive tasks, they also create opportunities for collaboration between humans and AI, where engineers and computing professionals can leverage AI as a tool to enhance their capabilities. However, the increasing reliance on AI has raised concerns about job displacement, particularly in roles where routine tasks are predominant.

As industries embrace AI, proficiency in AI tools and technologies is becoming essential for engineers and computing professionals to remain competitive. Organizations are prioritizing AI literacy and integrating it into educational and training programs to prepare the workforce for a future that heavily relies on AI. These trends highlight the growing role of AI as a disruptor and enabler in engineering and computing, driving both innovation and challenges that require proactive adaptation to its evolving influence.

3.5 Students' perception

Based on survey questions about how students perceive the influence of AI in their chosen fields and its importance for future career success, several insights emerged that align with, and in some cases diverge from, industry trends. Students expressed a clear understanding of how AI will influence their chosen fields over the next 5-10 years, highlighting both opportunities and

challenges. The most common expectation mentioned by 45% of respondents, is that AI will significantly increase efficiency and productivity, streamlining workflows and enhancing output. Similarly, 35% believe AI will automate routine tasks, freeing time for more creative and complex activities, while about 30% see AI driving improved innovation and creativity. AI's role in enhancing decision-making through data-driven insights was noted by 20%, and 25% foresee a transformation of job roles, requiring new skills and approaches. Additionally, around 15% mentioned AI-driven research advancements as a key benefit, while 10% raised concerns about job displacement due to AI adoption. Roughly 20% of students anticipate increased collaboration with AI systems, viewing it as a complementary tool that will support human skills. However, around 10% expressed uncertainty about AI's impact, indicating the complexity of its future role.

When asked about the importance of understanding AI tools for career success, students rated it an average of 4.3 out of 5, demonstrating strong consensus on its significance. Half of the respondents (50%) rated it as "extremely important", while another 30% considered it "very important". A smaller group (15%) viewed it as moderately important, with only a few students (5%) assigning minimal importance to AI proficiency. Overall, students recognize AI as a transformative force that will enhance productivity, innovation, and decision-making, while also raising concerns about job changes and displacement. This underscores the need for students to develop AI-related skills and adapt to its evolving role as both a collaborative tool and a driver of change in their future careers.

4. Conclusion

This study shows how freshman students perceive and engage with AI tools, illustrating both the opportunities and challenges associated with integrating such technologies into early engineering and computing education. The findings underscore the transformative potential of AI in enhancing learning experiences, fostering creativity, and improving efficiency. By providing a structured introduction to AI through lectures and assignments, we observed meaningful shifts in students' confidence, awareness, and strategic use of these tools. Importantly, the study highlights the necessity of framing AI as more than a functional resource. Students must learn to view AI as a tool for collaboration and innovation, capable of complementing human creativity and analytical thinking. Equally vital is the need for ongoing dialogue about the ethical implications of AI, ensuring that students approach its use with a critical and responsible mindset. Looking ahead, these insights will inform curriculum development, with plans to integrate AI-focused modules across multiple courses and revisit this cohort's experiences in three years. The longitudinal aspect of this research will help gauge how early exposure to AI shapes students' readiness to tackle complex challenges in their academic and professional journeys. By equipping students with both technical skills and ethical awareness, we aim to prepare them for an AI-driven future where adaptability and innovation are paramount.

References

1. A. M. Turing. (1950). Computing Machinery and Intelligence. *Mind*. Vol LIX (236), 433-460. https://doi.org/10.1093/mind/LIX.236.433
2. Prentzas, N., Nicolaides, A., Kyriacou, E., Kakas, A., & Pattichis, C. (2019, October). Integrating machine learning with symbolic reasoning to build an explainable AI model

for stroke prediction. In *2019 IEEE 19th International Conference on Bioinformatics and Bioengineering (BIBE)* (pp. 817-821). IEEE.
3. Xu, Y., Shieh, C. H., van Esch, P., & Ling, I. L. (2020). AI customer service: Task complexity, problem-solving ability, and usage intention. *Australasian marketing journal*, *28*(4), 189-199.
4. Bengio, Y., & LeCun, Y. (2007). Scaling learning algorithms toward AI.
5. Abiodun, O. I., Jantan, A., Omolara, A. E., Dada, K. V., Mohamed, N. A., & Arshad, H. (2018). State-of-the-art in artificial neural network applications: A survey. *Heliyon*, *4*(11).
6. Kaveh, A. (2024). Applications of artificial neural networks and machine learning in civil engineering. *Studies in computational intelligence*, *1168*, 472.
7. Wu, B., Xu, J., Zhang, Y., Liu, B., Gong, Y., & Huang, J. (2024). Integration of computer networks and artificial neural networks for an AI-based network operator. *arXiv preprint arXiv:2407.01541*.
8. Fanni, S. C., Febi, M., Aghakhanyan, G., & Neri, E. (2023). Natural language processing. In *Introduction to Artificial Intelligence* (pp. 87-99). Cham: Springer International Publishing.
9. Khan, A. A., Laghari, A. A., & Awan, S. A. (2021). Machine learning in computer vision: a review. *EAI Endorsed Transactions on Scalable Information Systems*, *8*(32).
10. Akpuokwe, C. U., Adeniyi, A. O., & Bakare, S. S. (2024). Legal challenges of artificial intelligence and robotics: a comprehensive review. *Computer Science & IT Research Journal*, *5*(3), 544-561.
11. Osasona, F., Amoo, O. O., Atadoga, A., Abrahams, T. O., Farayola, O. A., & Ayinla, B. S. (2024). Reviewing the ethical implications of AI in decision making processes. *International Journal of Management & Entrepreneurship Research*, *6*(2), 322-335.
12. Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T. (2023). Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success. *Information Systems Frontiers*, *25*(1), 161-182.
13. van den Berg, G., & du Plessis, E. (2023). ChatGPT and generative AI: Possibilities for its contribution to lesson planning, critical thinking and openness in teacher education. *Education Sciences*, *13*(10), 998.
14. Lin, P., & Van Brummelen, J. (2021, May). Engaging teachers to co-design integrated AI curriculum for K-12 classrooms. In *Proceedings of the 2021 CHI conference on human factors in computing systems* (pp. 1-12).
15. Chen, C. M., Li, M. C., Chang, W. C., & Chen, X. X. (2021). Developing a topic analysis instant feedback system to facilitate asynchronous online discussion effectiveness. *Computers & Education*, *163*, 104095.
16. Ramesh, D., & Sanampudi, S. K. (2022). An automated essay scoring systems: a systematic literature review. *Artificial Intelligence Review*, *55*(3), 2495-2527.
17. Chen, X., Ryan, T., & Wang, H. (2022). Exploring AI in Education: Personalized Learning, Automated Grading, and Classroom Management. *MZ Computing Journal*, *3*(1).
18. Lin, C. C., Huang, A. Y., & Lu, O. H. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. *Smart Learning Environments*, *10*(1), 41.

19. Mousavinasab, E., Zarifsanaiey, N., R. Niakan Kalhori, S., Rakhshan, M., Keikha, L., & Ghazi Saeedi, M. (2021). Intelligent tutoring systems: a systematic review of characteristics, applications, and evaluation methods. *Interactive Learning Environments*, *29*(1), 142-163.
20. Alam, A. (2023). Harnessing the Power of AI to Create Intelligent Tutoring Systems for Enhanced Classroom Experience and Improved Learning Outcomes. In Intelligent Communication Technologies and Virtual Mobile Networks (pp. 571-591). Singapore: Springer Nature Singapore.
21. Odenkirk, M. T., Reif, D. M., & Baker, E. S. (2021). Multiomic big data analysis challenges: increasing confidence in the interpretation of artificial intelligence assessments. *Analytical chemistry*, *93*(22), 7763-7773.
22. Sahu, M., Gupta, R., Ambasta, R. K., & Kumar, P. (2022). Artificial intelligence and machine learning in precision medicine: A paradigm shift in big data analysis. *Progress in molecular biology and translational science*, *190*(1), 57-100.
23. Perumalsamy, J., Althati, C., & Shanmugam, L. (2022). Advanced AI and machine learning techniques for predictive analytics in annuity products: Enhancing risk assessment and pricing accuracy. *Journal of Artificial Intelligence Research*, *2*(2), 51-82.
24. Gayam, S. R. (2021). Artificial Intelligence for Natural Language Processing: Techniques for Sentiment Analysis, Language Translation, and Conversational Agents. *Journal of Artificial Intelligence Research and Applications*, *1*(1), 175-216.
25. Kumar, Y., Koul, A., & Singh, C. (2023). A deep learning approaches in text-to-speech system: a systematic review and recent research perspective. *Multimedia Tools and Applications*, *82*(10), 15171-15197.
26. Zdravkova, K., Krasniqi, V., Dalipi, F., & Ferati, M. (2022). Cutting-edge communication and learning assistive technologies for disabled children: An artificial intelligence perspective. *Frontiers in artificial intelligence*, *5*, 970430.
27. Svensson, I., Nordström, T., Lindeblad, E., Gustafson, S., Björn, M., Sand, C., ... & Nilsson, S. (2021). Effects of assistive technology for students with reading and writing disabilities. *Disability and Rehabilitation: Assistive Technology*, *16*(2), 196-208.
28. Elali, F. R., & Rachid, L. N. (2023). AI-generated research paper fabrication and plagiarism in the scientific community. *Patterns*, *4*(3).
29. Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2024). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in education and teaching international*, *61*(2), 228-239.
30. Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, *1*, 61-65.
31. Ribeiro, J., Lima, R., Eckhardt, T., & Paiva, S. (2021). Robotic process automation and artificial intelligence in industry 4.0–a literature review. *Procedia Computer Science*, *181*, 51-58.
32. Belhadi, A., Kamble, S., Fosso Wamba, S., & Queiroz, M. M. (2022). Building supply-chain resilience: an artificial intelligence-based technique and decision-making framework. *International Journal of Production Research*, *60*(14), 4487-4507.
33. Ameen, N., Tarhini, A., Reppel, A., & Anand, A. (2021). Customer experiences in the age of artificial intelligence. *Computers in human behavior*, *114*, 106548.

34. Ayvaz, S., & Alpay, K. (2021). Predictive maintenance system for production lines in manufacturing: A machine learning approach using IoT data in real-time. *Expert Systems with Applications*, *173*, 114598.
35. Senoner, J., Netland, T., & Feuerriegel, S. (2022). Using explainable artificial intelligence to improve process quality: evidence from semiconductor manufacturing. *Management Science*, *68*(8), 5704-5723.
36. Belhadi, A., Mani, V., Kamble, S. S., Khan, S. A. R., & Verma, S. (2024). Artificial intelligence-driven innovation for enhancing supply chain resilience and performance under the effect of supply chain dynamism: an empirical investigation. *Annals of Operations Research*, *333*(2), 627-652.
37. Mirbabaie, M., Stieglitz, S., & Frick, N. R. (2021). Artificial intelligence in disease diagnostics: A critical review and classification on the current state of research guiding future direction. *Health and Technology*, *11*(4), 693-731.
38. Blanco-Gonzalez, A., Cabezon, A., Seco-Gonzalez, A., Conde-Torres, D., Antelo-Riveiro, P., Pineiro, A., & Garcia-Fandino, R. (2023). The role of AI in drug discovery: challenges, opportunities, and strategies. *Pharmaceuticals*, *16*(6), 891.
39. Pattyam, S. P. (2021). Artificial intelligence for healthcare diagnostics: techniques for disease prediction, personalized treatment, and patient monitoring. *Journal of Bioinformatics and Artificial Intelligence*, *1*(1), 309-343.