Understanding Faculty and Student perceptions of ChatGPT

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Abstract

Throughout one year Generative Artificial Intelligence (GAI) has touched and changed the fabric of our world exceptionally fast and on a scale we have never seen before. Engineering educators have been quick to discuss this new technology amongst themselves. Some have begun integrating the technology into their classroom, while others are actively attempting to mitigate the effects of it on their courses. The rapid nature of the GAI disruption has led the authors of this work to explore how engineering faculty and students in higher education are perceiving this technology, particularly ChatGPT, in the context of engineering education. The authors of this paper developed a survey instrument and distributed it to faculty, staff, and students at Texas A&M University (TAMU), garnering over 1000 responses. The purpose of this work is to examine these responses, both quantitatively and qualitatively, to ascertain how students, faculty, and staff perceive ChatGPT as it is situated in the space of engineering education. Some basic statistical methods will be used to showcase various comparisons between the groups surveyed, and a conceptual framework developed by the authors in a different work is paired with that quantitative analysis to develop a narrative that will be presented to paint a story of how faculty and students are perceiving this GAI technology in their lives. The authors of this work believe it is important to not only share the perceptions of students and faculty at TAMU, but to also share a glimpse into the process of how this disruptive technology spurred organizational change at TAMU in hopes that it can be valuable for other university faculty facing the same now global issue of GAI.

Introduction

Generative Artificial Intelligence (GAI) has begun to saturate our world. In November of 2022, the wide release of Open AI's ChatGPT initiated a snowball effect of GAI implementation in many sectors. Simple online searches are now supplemented with Google's Bard AI and Microsoft Copilot. Open AI's ChatGPT chat bot began as a free service but now includes a myriad of additional paid functionalities, and more niche solutions are emerging from companies like Adobe in their creative suites and Microsoft in their office suite. GAI as a pervasive disruptive technology is far from full maturation, and it will continue to exist in our digitally influenced world indefinitely. In recent technological history, disruptions have been a hallmark of a healthy tech industry; however, those disruptions have had markedly less reach and have been comparatively much less rapid. GAI, however, seemed to storm major news feeds overnight, leaving the general population in awe and some in fear of the power AI may have soon.

This shift in society through GAI was felt at TAMU when faculty members in the College of Engineering began talking about the potential impacts ChatGPT might have on academic dishonesty. Faculty email threads discussed instances of how it was being used by their students in some cases and in some cases themselves. Shortly after the release, academic literature began to surface related

to GAI with some of the most notable pieces coming from very well-known and respected high research level institutions.

The authors of this work found it pertinent at the time to deeply understand the perceptions of faculty and students at TAMU to better address the issue locally. This was done through the development of a survey instrument that collected both quantitative and qualitative data from respondents [1]. This instrument was sent out to faculty and students at TAMU during the Spring 2023 semester, a few short months after the initial release of ChatGPT's free access version. This survey garnered 1083 responses during this survey period, 835 being students and 248 being faculty/staff at TAMU. Some basic analytics of this survey have been shared in a report [1]. However, this work examines those responses more intentionally and with the focus of understanding the differences between faculty and student perceptions of ChatGPT quantitatively with descriptive statistics. Additionally, the authors are interested in using a conceptual framework presented in another one of their works to frame the understanding and construct a narrative exploring student and faculty perceptions with the intention of bringing life to the many voices that participated in this survey.

Related Work

In the past few months there has been an exponential leap in the existing literature on the integration of GAI in higher education, in particular in engineering education have begun to glimpse different questions about how these technologies will impact this field [2].

In the context of engineering education, adapting to evolving technology and pedagogical methods is vital to keep pace with the latest technological advances and meet the changing needs and demands of the engineering industry and today's world. With the launch of ChatGPT, many questions have arisen about the impact this technology could have on education. Its ability to perform complex tasks in the field of education, such as writing essays, summarizing and explaining content, giving effective feedback, among others, has generated mixed feelings among educators, as this breakthrough AI model seems to revolutionize the traditional education system [2, 3].

Perceptions regarding the use of AI in educational settings are divided in the literature. On the one hand, the increasing integration of AI in educational settings, including personalized tutoring and automation of administrative tasks, is highlighted [4]. The role of AI in improving learning outcomes and student engagement is discussed at length, with a focus on how institutions and educators are leveraging AI to address educational challenges [4]. On the other hand, there are also points of view that are more apprehensive about the ethical implications of using ChatGPT, especially with regard to academic integrity [5]. The importance of establishing clear guidelines on the acceptable use of ChatGPT in courses is crucial [6].

The exploration of faculty and student perceptions of ChatGPT at TAMU is an extension and enrichment of the ongoing academic debates in this area. This section reviews key papers and literature that provide a foundational understanding of the context, challenges, and opportunities presented by GAI in educational settings.

These works collectively provide a multi-faceted view of the challenges and opportunities presented

by AI in education, particularly in the context of engineering. They offer valuable perspectives to understand the current study's findings on the perceptions of ChatGPT among faculty and students at TAMU. The integration of AI in education, its impact on academic integrity, the evolution of teaching methodologies, and the adaptation of learning styles in response to new technologies are key themes that emerge from this literature, forming a critical backdrop for the present study.

An innovative conceptual framework for integrating AI into engineering education was proposed seeking to harmonize technical skills with intrinsic human qualities, such as creativity and ethical reasoning, essential in the context of Industry 5.0 [7]. This conceptual framework has been proposed with findings obtained from a comprehensive literature review and empirical data from the student and faculty responses also discussed in this paper. The work analyzes the potential of AI to foster these human-centered qualities. The framework suggests dynamic, interdisciplinary learning environments and personalized educational trajectories, emphasizing continuous adaptation, lifelong learning, and addressing the ethical issues of AI application. This approach modernizes engineering education to meet Industry 5.0's demands and promotes comprehensive, human-centered learning experiences, preparing technically competent engineers equipped with vital interpersonal skills. This framework is implemented in the narrative developed later in this work and guides the integration of the quantitative findings of this work with the work presented in the original work [7]. Figure 1 below shows the components of the conceptual framework.
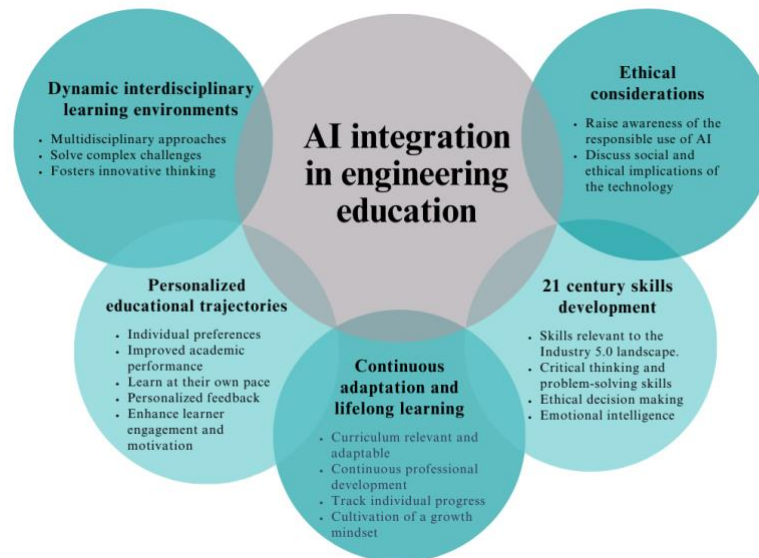

Figure 1: Conceptual framework for integrating AI into engineering education[7].

Methods

Survey Data Collection

Two surveys were developed to gather data regarding the perceptions of faculty/staff and students at TAMU, one distinctly for students and another for faculty. These surveys were distributed through a bulk mail service at TAMU across the entire institution and can be found in a technical paper published by the authors [1]. Not every question was identical between the two surveys as the authors determined it necessary to target topics for measurement between the populations. This work

will examine the questions most similar between the survey instruments with a few exceptions. The following selected questions will be used to assess differences between faculty and student perceptions with identical items and scales:

1. *How familiar are you with ChatGPT?* (5-point Likert Scale)
2. *ChatGPT will enable academically dishonest behaviors* (5-point Likert scale)
3. *Students should be allowed to utilize resources not provided by the instructor of a course* (5-point Likert scale)

A comparison will also be made with a faculty only question and student only question that examines the perception of how comfortable a faculty would be with their students using ChatGPT in their course and an item assessing the perception of students for what extent using ChatGPT is ethical/appropriate for coursework.

A qualitative free response question was used to close out the survey for both groups, asking the following: *How do you think AI tools like ChatGPT will impact the future of your discipline?* This question was used by the authors in another study [7] to propose a conceptual framework for integrating AI into engineering education, with a holistic approach that seeks to balance technical competence with the cultivation of human-centered qualities, such as ethical reasoning, emotional intelligence, and ongoing personal and professional development. This question was also examined briefly in the technical paper published by the authors [1].

Quantitative Methods

Descriptive statistics were used to analyze responses for these instruments, and visualizations were developed for those responses. For question one related to the familiarity of the respondents with ChatGPT a 1-tailed 2-sample homoscedastic t-test was used to indicate any difference between the groups. For question two regarding whether ChatGPT will enable academically dishonest behaviors, a paired 1 tallied t-test was used to indicate differences between populations. For the disjointed questions related to faculty perceived comfort with student use of ChatGPT and student perception of the extent for which ChatGPT is ethical/appropriate for their coursework, only descriptive statistics will be explored with their appropriate visualizations of that data.

Qualitative Methods

The conceptual framework mentioned above will be used to set the stage for a qualitative examination of this instrument's quantitative responses. This work will expand upon this by using the conceptual framework to construct a narrative that explains the perceptions of faculty and students at TAMU. This narrative will take inspiration from the quantitative results of the Likert style questions above and what was found in that under review work to develop the framework [7].

Results/Discussion

Quantitative

There were 1083 responses, with 248 and 835 responses from faculty and students, respectively, therefore significant populations for most statistical methods to be considered valid. For the faculty/staff instrument 58.61% were staff and 41.39% were faculty; however, 88.73% work within

the College of Engineering at TAMU. The student responses were also overwhelmingly from the College of Engineering at TAMU with 85.7% of respondents.

For the first question regarding familiarity, there is little difference between the obvious shapes of the distributions between faculty and students; however, when examined with a 1-tailed 2-sample homoscedastic t-test, an alpha of 0.036 was found. This indicates there is a slight shift in the distributions with students being more familiar than the faculty at the point in time this survey was conducted. The visualization for this question can be seen in Figure 2. The mean and standard deviations of these distributions are 3.43 and 1.15 for students and 3.26 and 1.29 for faculty, respectively.
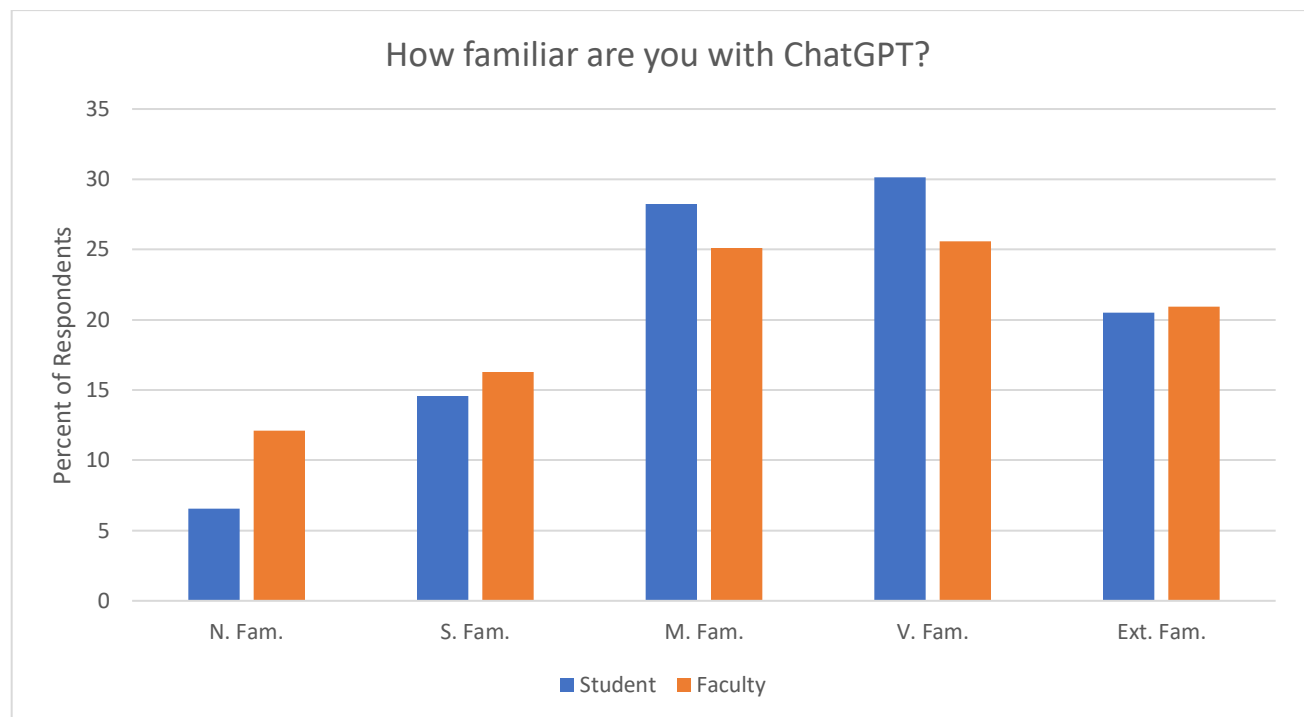

Figure 2: Faculty/Student familiarity with ChatGPT

The perception of faculty and students regarding their perception of ChatGPT enabling academically dishonest behaviors was the subject of question two. This is a topic that was under significant discussion early into the release of ChatGPT and continues to be a hot topic for faculty to discuss amongst themselves. What we see when comparing faculty and students in this question is a very similar distribution between faculty and students. Figure 3 visualizes this distribution where it is obvious that most students and faculty, 63.2% and 58.8% respectively, either strongly agree or somewhat agree that ChatGPT will indeed enable academically dishonest behavior. The mean and standard deviations for these distributions are 3.59 and 1.19 for students and 3.61 and 1.09 for faculty, respectively. Using a 1-tailed 2-sample homoscedastic t-test reports an alpha of 0.427, indicating that there was no significant difference between the two distributions in the case of this question.
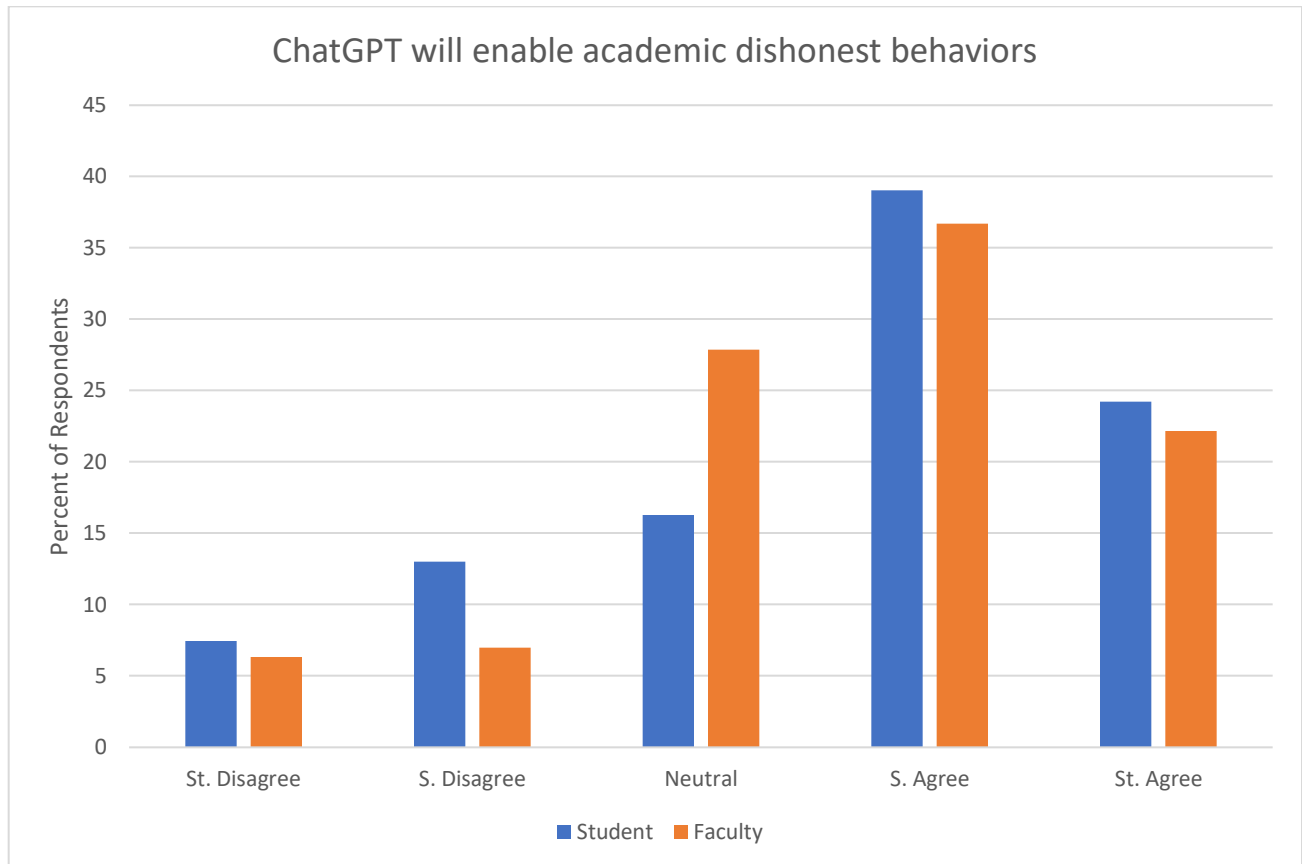
Figure 3: Faculty/Student perceptions of whether ChatGPT will enable academically dishonest behaviors.

The final direct comparison question between faculty and students considers whether students should be allowed to utilize resources not provided by the instructor of a course. Overwhelmingly both students and faculty either strongly or somewhat agreed, 80.3% and 62.7% respectively, that students should be allowed outside resources. The mean and standard deviations for these distributions are 4.06 and 1.08 for students and 3.62 and 1.24 for faculty respectively. Using a 1-tailed 2-sample homoscedastic t-test with this set of data reports an alpha of 2.58E-6; it is obvious that faculty and students have a very different response to this question regardless of both groups overall agreeing with the statement. This data can be seen in Figure 4 where it is evident that students overall agree that they should be able to utilize outside resources for their coursework. This is supported additionally with the widespread growth of the homework help industry in higher education, along with free and open-source websites hosting a plethora of educational information for students to access. The supply exists at a large scale, so there must be a comparable demand from students in their daily lives.
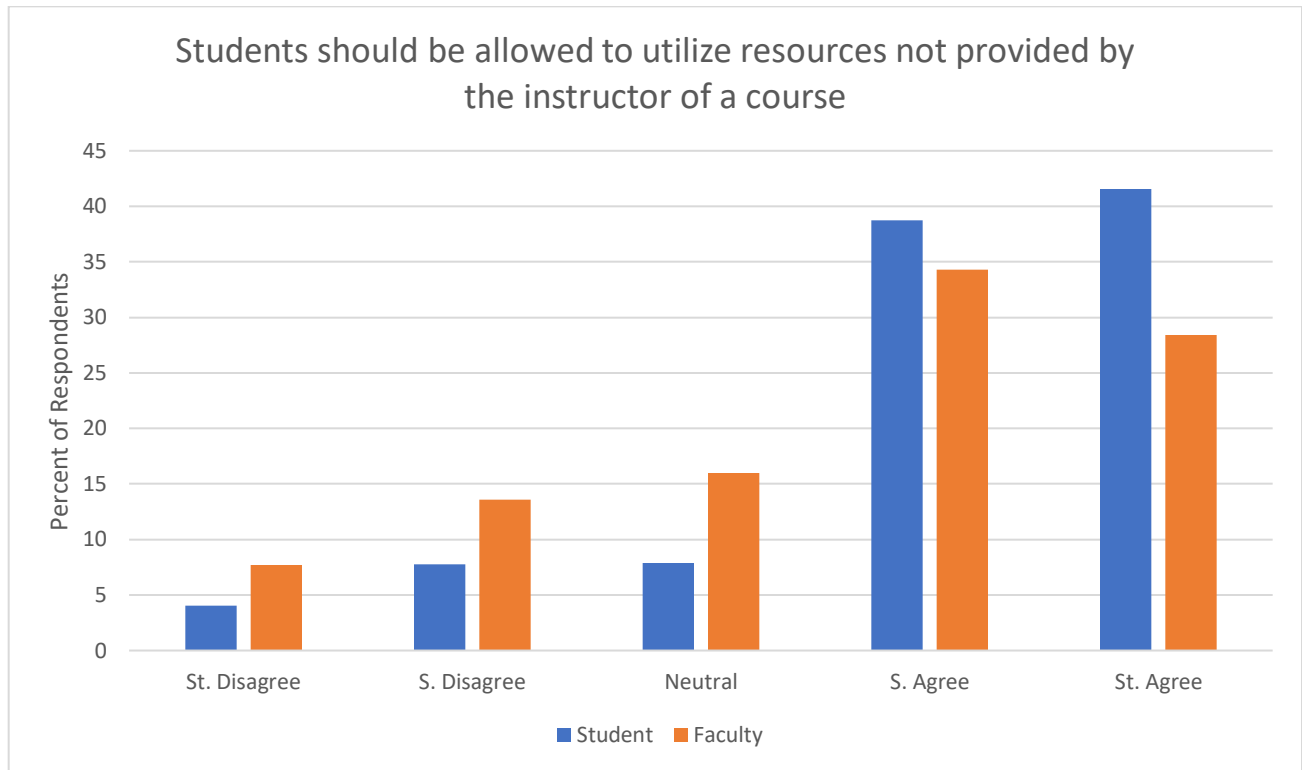
Figure 4: Faculty/Student perceptions of whether students should be allowed to use outside resources.

What is particularly interesting in the quantitative data so far will be the following two questions as they are juxtaposed to data in Figure 4. Faculty in that question mostly agree that students should be able to use outside resources, albeit not to the same extent of students. However, when faculty were asked how comfortable they would be with students using ChatGPT in their own course, the data indicates a bimodal distribution where 34.3% of faculty are either extremely or somewhat uncomfortable and 46.7% of the faculty are either extremely or somewhat comfortable. Both sides are weighted closer to a neutral position, but when juxtaposed to the Figure 4 data it leads us to wonder what about ChatGPT would make faculty feel differently about it compared to other versions of external resources. The visualization for this faculty data can be seen in Figure 5 where the bimodal behavior is evident. These perceptions of faculty will be further discussed in the qualitative portion of this work to better understand how faculty are conceptualizing the potential usage and desired usage of a technology, such as ChatGPT in their courses.

The student portion of data related to what extent using ChatGPT is either ethical or appropriate for coursework is in stark contrast to the sentiment seen in Figure 5 by faculty. This data shows a clear favorability from students that it is either ethical or appropriate to use ChatGPT for their coursework with 57.2% of students choosing either somewhat appropriate or extremely appropriate. Although the bulk of responses for that positive side were more reserved, choosing somewhat appropriate with 42.4% of responses as visualized in Figure 6. This suggests that while students do favor ChatGPT they may have some conflict internally about what situations would allow for acceptable use in their coursework. This observation will be further discussed in the qualitative portion of this work.
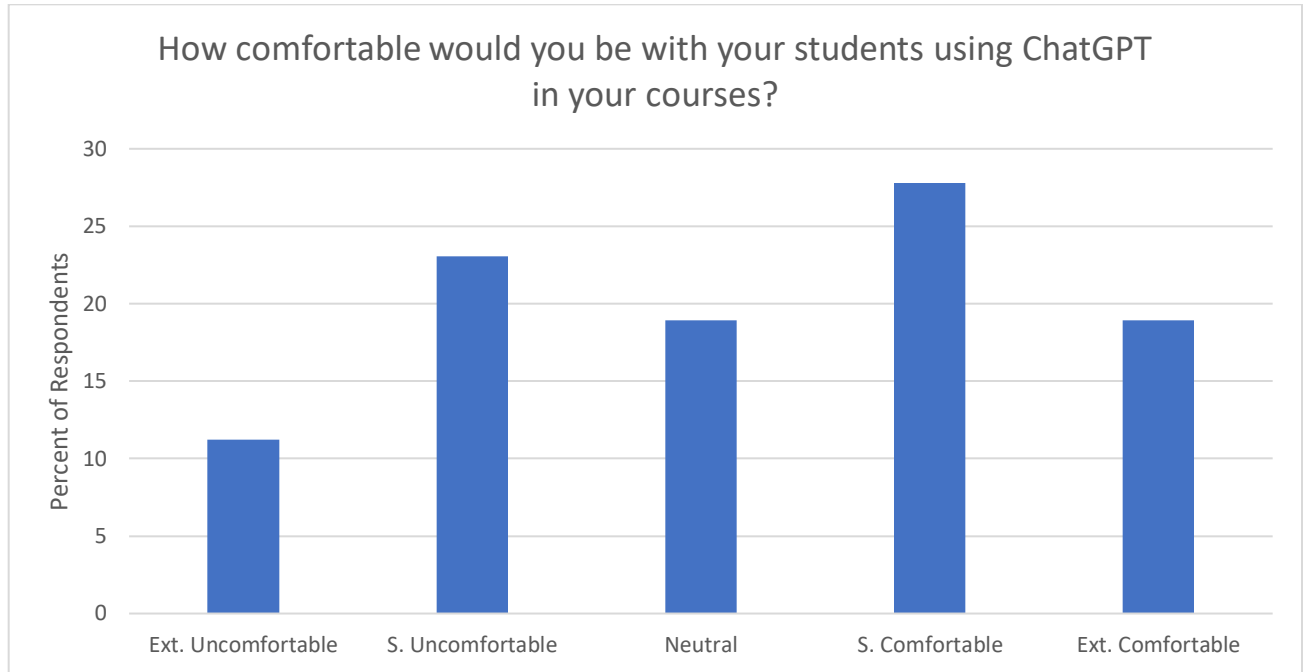
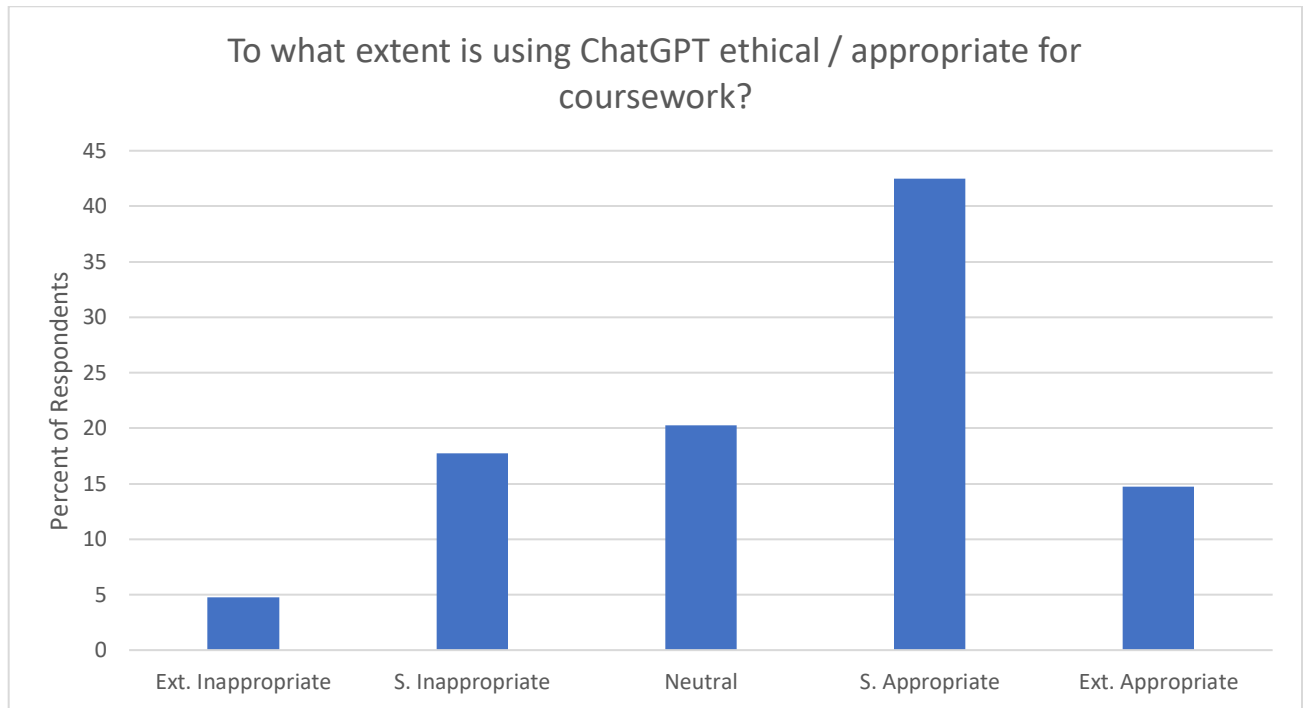*Figure 5: Faculty comfort levels with ChatGPT use in their courses.*

Figure 6: Student perceptions of ChatGPT being ethical or appropriate for use on coursework.

Qualitative Narrative

The following is a fictional narrative inspired by the above quantitative and qualitative analysis to illustrate how the perspectives of faculty and students frame their understanding of GAI and how they envision their participation in utilizing this technology in their lives. The conceptual framework seen in Figure 1 has informed this narrative along with the quantitative look at the survey data in the past section.

Dr. Paige is a tenured associate professor at a moderately sized high research activity university in the United States. They are interested in modifying their own course and pedagogical approach given the new integration of AI tools into their own institution through Microsoft's copilot service, which uses the same engine as Open AI's ChatGPT, GPT 4.0. They have been a part of faculty conversations about the current state of engineering education and the academic dishonesty concerns that predominately senior faculty are having, so they are aware of the skepticism of their own leadership at the institution. Through this process of modifying their course and pedagogical approach, they decide to discuss the change with a student they have had not only in their own class but as a peer teacher during the last year or so. This student is Taylor Watson, a rising senior who has been mentioning to Dr. Paige regularly how they have been using GAI to their great benefit in the development of a research project they are using for an undergraduate thesis.

Taylor is open and honest with Dr. Paige and explains that they tend to use the technology to streamline some processes that tend to be tedious, such as summarizing emails and literature during early phases of a research paper, but they also use it as a chat bot to understand new information that arises when it is necessary in their research. Of course, they have not learned everything they would need to be successful in their courses alone, so ChatGPT has been very convenient for them. Dr. Paige asks why Taylor chooses to use GAI like that instead of reaching out to an expert at the university. Taylor explains that when they have reached out to some faculty, they seem to only be interested in helping them when they have extra time or find it beneficial for themselves, and that is seldom the case for an undergraduate student. In fact, when Taylor approached a graduate student about some help, that graduate student introduced Taylor to the technology, recommending it to be a more dynamic solution to learning than something like a traditional search engine.

Dr. Paige inquires as to what makes it such a dynamic experience. Taylor explains how they use it to have a conversation, present a problem or question, and then proceed to dive deeper into the topic as it pertains to their unique application or situation. Dr. Paige asks if there is a specific example to which Taylor explains how they had a heat transfer issue they needed to explore with nontypical materials and a complex geometry. Taylor had proposed the question to ChatGPT, and it suggested a few options for analysis depending on the level of depth necessary ranging from a lump capacitance model to a full suite of simulation options that could be used to determine the heat transfer phenomena computationally. Taylor explained how that led them to become more interested in the prospect of computational methods as a topic they would be interested in pursuing in graduate school. Dr. Paige felt inspired; not only was Taylor explaining this experience that was so positive for them, but it was acting as a resource beyond that of attempting to haphazardly solve the problem like Dr. Paige had originally anticipated.

Dr. Paige asked Taylor what some of the issues have arisen while using ChatGPT, and Taylor quickly answered explaining that it is less than reliable when considering analysis of data, often misunderstanding what the best methods for analysis are, but when prompted appropriately it has been useful in cleaning and pre-processing data in a few minutes that would previously take a few hours or even days to do manually. Taylor explains that in their experience it's most useful when the question or problem is well defined and the expectations of what it can do are managed well, rather than approaching it as an all-knowing answer machine. This all aligned with what Dr. Paige had hoped to hear from a student, responsible usage, understanding of limitations, and ethical and appropriate usage of the technology overall.

Dr. Paige presented the plan to develop a new curricular design to their course, centering it around the power of GAI and how it can be used to allow students to better utilize their time in their studies to explore the questions and grand problems they are interested in and developing solutions more rapidly and better informed than previous students could without this technology. Taylor seemed to be excited learning that this new technology would be implemented so quickly into the program, and expressed how they look forward to being a better and more informed engineer now having familiarized themself with the technology, and how every engineer should be ready to embrace this technology as time moves forward.

Dr. Paige and Taylor both see the benefits these new AI technologies will present for educators and engineers soon, but the question of academic integrity issues seems to still linger in the back of Dr. Paige's mind while Taylor envisions these tools to soon be as standard for students as watching YouTube videos to better understand lecture materials. This dissonance between the two viewpoints is what gives Dr. Paige the most concern. Will students use AI how they are instructed and do it ethically and responsibly on their own? Or if not, how will Dr. Paige integrate those lessons into their course and pedagogy to embrace the technology but also encouraging and educating new students about how and when they should be using these tools along with the level of healthy skepticism they should hold for any technology as it is being proven over time. This is far from a simple task and may require a complete rework of their courses and potentially a significant portion of the overall engineering curriculum, but given the potential this technology has, there is a hope that much of the time dedicated in an engineering curricula could better be used probing the minds of students to address new and more grand challenges at earlier stages in their development as engineers.

Limitations

It is important to consider that the study sample was drawn exclusively from Texas A&M University, which complicates the generalizability of the results to the engineering education community at large. To address this, it would be important to replicate this type of study at a variety of institutions in order to gain a broader perspective. Despite the substantial sample size, it remains complex to determine whether the perspectives gathered accurately represent the diversity of opinions within the field. In addition, the institutional context of Texas A&M University may have

unique characteristics that influence attitudes toward ChatGPT or GAI, further complicating the generalizability of the results.

Temporal limitations further constrain the study's findings. Conducted shortly after ChatGPT's free access version was released, the study captures attitudes at a particular moment in time. With the rapid evolution of AI technologies, these perceptions are likely to change, highlighting the need for ongoing research to track these shifts.

The limitations highlighted in this study underscore the importance of cautious interpretation and application of its findings within the broader context of engineering education and AI technology integration. The constraints, ranging from the specificity of the sample population to the study's methodological and thematic focus, indicate a need for further, more diverse research to fully understand the implications and potential of AI tools like ChatGPT in educational settings. Future studies should aim to address these limitations by expanding sample sizes to include a broader demographic, conducting longitudinal research to capture evolving perceptions, incorporating a wider range of factors influencing attitudes toward AI, and exploring the ethical dimensions of AI integration more thoroughly. By acknowledging these limitations, researchers can better design studies that provide insights that are both comprehensive and applicable across various contexts, ultimately contributing to the effective and ethical integration of AI technologies in education.

Conclusion

Generative AI will continue to prevail in permeating our lives in a variety of ways, becoming a standard technology every industry will harness to increase their efficiency, potency, and reach. It is up to the faculty educating engineers to act as a first line of influence to ensure our future generations of engineers understand how to implement that integration ethically and responsibly. We are currently only at the epicenter of the AI tech wave and without planning and accepting the reality that this technology will be what future generations accept as natural tool we will ultimately be doing a disservice to our students. The analysis in this work is overall positive about ChatGPT and generative AI tools in general. However, there are some reservations regarding academic dishonesty for faculty, but the prospect of students utilizing ChatGPT as a tool to better their lives and improve their work is exciting. A best-case scenario would be a world in which engineering education can change and evolve to include more GAI tools into the curricula that are relevant to the continually evolving needs of industry and the world. The authors are aware that resistance from faculty who are skeptical of the benefits of GAI and the intentions of students will always be there as pessimism prevails in all facets of our lives, but those pessimistic perceptions should inform educators and students as to how and what challenges might be faced as our world continues to trend towards an AI saturated world.

Future Work

The findings from the current study at TAMU provide an introductory understanding of the perceptions of faculty and students towards ChatGPT in the context of engineering education. The rapid evolution of GAI and its implications in educational settings suggest that this is an ongoing area of research.

To capture the evolving nature of perceptions and attitudes toward GAI, especially ChatGPT, the survey will be repeated during the coming semester, with one year having passed between the two surveys. This will allow us to track changes in perceptions over time, as technology evolves and its integration into educational contexts becomes more widespread and sophisticated. To gain a broader understanding of the impact of ChatGPT on engineering education, we hope to collaborate with other institutions to gain a more complete picture of the academic community's attitudes toward GAI in various educational settings.

The proposed conceptual framework for integrating AI into engineering education, as described in this study, needs to be applied and tested in real educational settings. Application of the conceptual framework in course design and pedagogy, and subsequent evaluation of its effectiveness, can provide valuable information on how best to integrate AI into engineering curricula.
Given the rapid integration of GAI in education, research is needed to inform policy development at institutional and educational system levels. This includes creating ethical guidelines and best practices for the use of GAI in academic settings. Future research should aim to deepen our understanding of the long-term implications of GAI in education, expand the scope of investigation to include a variety of educational contexts and disciplines, and contribute to the development of effective and ethical practices for integrating GAI into teaching and learning.

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