Faculty Perspectives on Undergraduate Use of Generative Artificial Intelligence (GAI) Assistance: A Work-in-Progress

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Abstract

This work-in-progress paper explores faculty perspectives regarding student use of Generative Artificial Intelligence (GAI) assistance tools, such as ChatGPT, to complete engineering coursework. A common debate in engineering and computer science exists about how faculty should address GAI tools (i.e., prevent their usage in order to maintain academic integrity, teach students the new technologies, or establish regulatory guidelines in higher education). While GAI continues to disrupt traditional educational paradigms, its full impacts on teaching and learning are currently unknown. Such work is especially useful for fields such as engineering and computer science, whose work lies at the forefront of technological advancement and whose students more readily adopt new technologies into course tasks.

This paper discusses the preliminary findings of an intrinsic qualitative case study that answers the research question: How do engineering faculty perceive student use of GAI assistance in undergraduate course completion? Data were collected using semi-structured interviews with engineering and computer science faculty, including civil, mechanical, electrical, and biological engineering and computer science. As a result, this paper lays the groundwork for more extensive research in this domain and contributes to the broader discourse on the role of emerging technologies in shaping the future of engineering education.

Introduction

The advent of Generative Artificial Intelligence (GAI) has revolutionized various sectors, including shipping and manufacturing, management and hiring practices, economics and finance markets, art and creative endeavors, and education [1]-[4]. Generative AI's intrusion into academic practices, particularly homework completion, is a subject that has garnered recent attention [5] and controversy [6]. Artificial Intelligence has disrupted traditional pedagogical methods, offering students tools that make problem-solving and homework completion more efficient [7]. Other AI tools, such as automated grading, plagiarism detectors, and intelligent tutoring systems, have provided needed support for educators [7]-[10]. Concurrently, academic institutions are grappling with ethical implications, such as the lack of equitable access to AI, and academic integrity issues, such as tensions around cheating, that GAI technologies might bring [11]-[13].

This work-in-progress paper provides an initial exploration of engineering faculty perspectives on students' use of AI assistance in homework completion. The research draws upon role identity theory [14], [15] and activity theory [16] as guiding frameworks. By doing so, the full research will uncover the multi-dimensional views of faculty regarding student use of AI, investigating the similarities or differences across engineering disciplines and between proponents and opponents of AI assistance in academic settings. Overall, this study seeks to answer the research question: How do engineering faculty perceive student use of GAI assistance in undergraduate course completion?

Preface on Grey Literature

In the study of new areas such as GAI in engineering education, non-peer-reviewed sources—think tank reports, white papers, and conference papers— are crucial in expanding our understanding [17], especially when peer-reviewed articles are scarce [18], [19]. Peer-reviewed literature remains the gold standard in academia for its rigor and reliability [20], [21]. However, including carefully selected grey literature is essential for a more thorough and nuanced understanding of the latest developments and perspectives in rapidly evolving fields, such as GAIs [22]. This approach—which intentionally excludes biased sources—balances diverse insights and academic integrity and offers a comprehensive narrative that enhances understanding of the roles and implications of AI assistance in educational settings.

Gaps in the Literature

While existing literature has explored student perspectives and ethical concerns surrounding AI in education [23], very little research focuses on faculty perspectives [24], especially in engineering [13]. At the same time, extant studies in this area tend to treat engineering as a monolith without considering differences among engineering disciplines. The nuances between subjects like electrical engineering and computer science, which might seem similar but have distinct educational approaches and challenges, are often overlooked [13].

The current literature does not adequately address how GAI tools interact with and influence human behaviors and cultural practices in creating objects [7], [16]. Additionally, there's a lack of understanding of the nuances and impacts of GAI on the norms, values, community interactions, labor division, and regulations within specific engineering disciplines [25], [7]. This can be corrected by remembering that “a tool always implies more possible uses than the original operations that have given birth to it” [16, p. 149]. Considering the unforeseen implications of using GAI in education provides valuable insights for educators, policymakers, students, and researchers [26]. These insights can guide individuals or organizations in creating culturally sensitive teaching strategies, developing governance policies, and integrating the use of AI tools in daily practice to foster more effective and inclusive educational environments [27]. Therefore, a sociocultural understanding can facilitate and enrich the discourse on AI in higher education leading to more focused and ethical approaches to research and teaching applications.

Theoretical Frameworks

GAI is a disruptive technology that has affected many aspects of education [1]-[4] and requires sociocultural approaches that consider individual use within a broader social ecosystem [28]. In this case, an individual’s roles as engineering faculty - and all the responsibilities associated with that role - are considered. Activity theory then connects individual subjects and their roles to the tools, other individuals, artifacts, objects, communities, rules, and division of labor that drive activity, action, and operation [29], [30]. Combining activity theory and faculty perceptions of GAI draws on the specific benefit of collaborative tools and the apparent contradictions between perceptions [31].

Methodology

Research Design

This research adopts an intrinsic qualitative case study methodology [32], focusing on five engineering disciplines at Utah State University: civil engineering, mechanical engineering, electrical engineering, biological engineering, and computer science [33]. In this specific work-in-progress paper, our discussion presents the initial findings from interviews with faculty from two of these disciplines: civil engineering (CE) and computer science (CS). Utah State University presents fertile ground for understanding the dynamics and faculty perspectives of student use of GAI in coursework due to its institutional emphasis on engineering and related fields. While computer science is separate from the College of Engineering and housed in the College of Science at Utah State University, this research includes CS as an engineering discipline as it is often incorporated into engineering programs at other universities [33].

Participant Recruitment and Sampling

Faculty members in CE and CS were sent access to a digital recruitment questionnaire via email Questionnaire items included several 10-point Likert scale questions related to respondents' opinions and perspectives of GAIs (adapted from [34]), questions related to gathering minimal demographic information—such as department and role—and an open-ended opinion question. Two participants were then purposefully selected for interviews: one who was a proponent of using AI assistance in education and another who was either neutral or opposed based on their public opinions, articles, departmental roles [32], and their responses to the questionnaire sent amongst the faculty in these departments. Overall, nine participants responded to the digital recruitment questionnaire: five from civil engineering, three from computer science, and one from electrical engineering. Figure 1 illustrates the demographic information collected: gender, Ethnicity, Age, and Department.

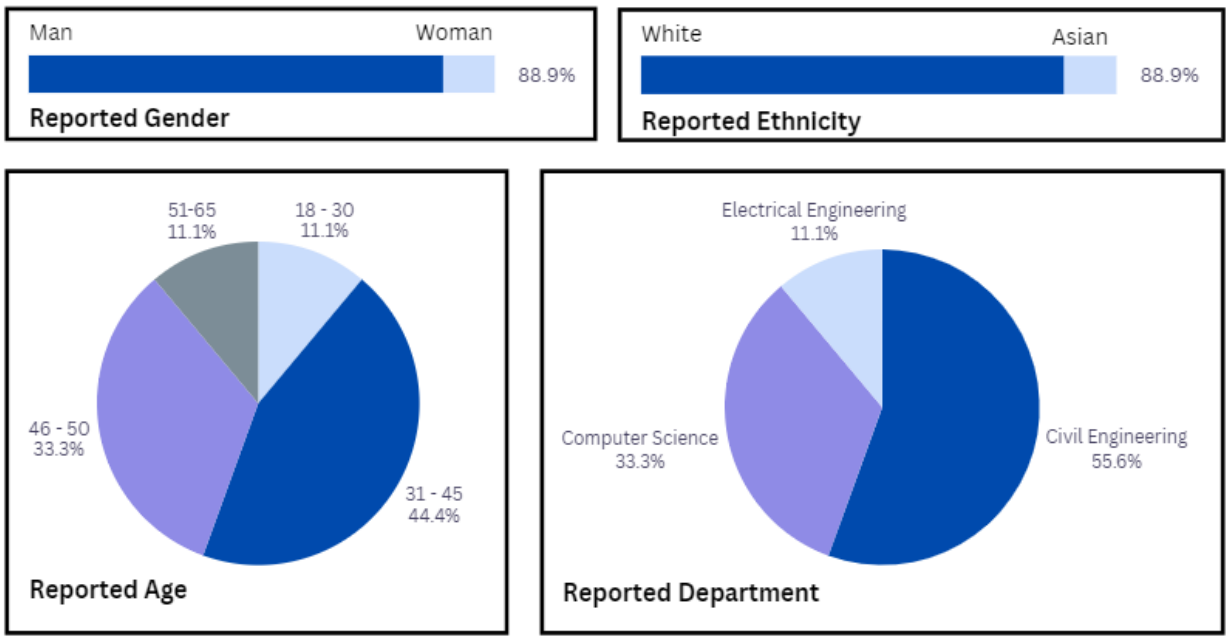

Figure 1. Reported demographics.

The sample gender and ethnicity were fairly homogenous, with all participants being white men except for one white woman and one Asian man. Thus, nearly 90% (88.9%) of survey responses were from white men. Ages varied more, with the majority being in the middle age groups: 11.1% age 18-30, 44.4% age 31-45, 33.3% age 46-50, and 11.1% age 51-65. Civil engineering had the highest departmental survey response rate at 55.6% of responses, computer science represented 33.3% of responses, and the remaining 11.1% was from electrical engineering.

Data Collection

Semi-structured interviews were conducted with each selected participant, focusing on their views on GAI and their personal roles in education. The work of [35] informed the key interview questions, listed below:

- What do you think or know of generative AI in coursework?
- Should students be allowed or banned from using AI in coursework?
    - Why or why not?
    - Do you think there should be a difference in requirements in entry-level courses compared to advanced courses?
- What do you see as your role as an instructor?
    - How does your role impact your willingness to allow or disallow students from using GAI in coursework?
- What effects do you see from GAI coursework assistance on society as a whole?
- Have you used GAI in your professional career? If so, how?

Interviews lasted between 30 and 60 minutes, and follow-up questions were used to gather any insights related to the subjects, tools, individuals, artifacts, objects, communities, rules, and division of labor that influenced their rationale for their views (i.e., proponent, neutral, or opponent) on students' use of AI in the classroom [29], [32].

Data Analysis and Results

While the questionnaire was primarily used for recruitment and exploratory descriptive frequencies, the open-ended question, "Briefly describe your feelings about students using GAI (such as ChatGPT) in your undergraduate courses," yielded some interesting themes. Even participants deemed opponents of student GAI use commented that this technology could be useful. For example, one opposing participant considered allowing GAI assistance in one of his classes but not others because the technological difficulty in the course did not provide results from GAI that warranted fears of cheating. Both opponents and proponents of student GAI use generally agreed that GAIs could be used incorrectly; however, proponents determined that students should be taught how to use these disruptive technologies properly. One proponent compared GAI to calculators, and another stated, "[N]ot that long ago, nearly everyone could be expected to know how to saddle a horse. Advances in technology have made that no longer the case. The advancement of GAI should be treated similarly."

Interviews provided deeper insights into these observations. Data is in the beginning stages of thematic analysis and inductive coding [36, 37], guided by role identity and activity theory frameworks. The goal of this analysis is to identify common themes related to two sub-questions: (1) How do faculty perceptions of their roles affect their incorporation of GAIs into their undergraduate courses? and (2) How do faculty views of student GAI use differ among

engineering sub-disciplines?—and examine these within the broader sociocultural elements like rules, individuals, communities, and division of labor [16].

One of the recurrent themes that emerged through initial interview review and analysis was an echo of the statement in the questionnaire: “The advancement of GAI should be treated similarly [to other disruptive technologies].” Both opponents and proponents shared this perspective; however, the differences in opinion often manifested in how to address the disruption immediately. Proponents seemed more likely to support the notion that students should learn how to use the technology properly; opponents were more likely to recommend delaying student GAI use or banning them in their classrooms until more was known about the educational and ethical implications. One participant, deemed an opponent, described a hesitancy to implement or allow GAIs without knowing what other faculty members were doing locally, nationally, and internationally. They commented, “Am I behind, or are we ahead of the game in terms of considering these tools?” This participant was also concerned that, “You can only get the best AI assistance or outcome with paid resources… [is] our university gonna start subscribing to these services so all students can have it...and is it going to be integrated into Canvas in the future?” While this was the only participant who explicitly mentioned monetary access to GAI, ethics and access to GAI were common concerns for both proponents and opponents.

Limitations

The study is currently in the work-in-progress stage and limited to faculty views at a single institution, which might not represent the entire academic and educational ecosystem, inviting questions of transferability for any conclusions recommended from this work. Future research should include an understanding of individual institutional approaches to GAI implementation. Research also might benefit from an understanding of the greater academic ecosystem.

Next Steps

Based on the findings presented in this work-in-progress paper, the full research project aims to delve into the complexities surrounding the integration of generative AI in academic settings by using role identity theory and activity theory more heavily as guiding frameworks for continued analysis. The completed study will go beyond surface-level opinions to understand how broader philosophies and sociocultural factors shape faculty perspectives. At the time of writing, interviews have been conducted with faculty in the remaining engineering disciplines at Utah State University. To date, several consistent themes and concerns among faculty perspectives of student GAI use in coursework have been identified, including but not limited to ethical and access concerns, the understanding that GAIs are another disruptive technology, and recognized benefits for students who use GAIs—though those benefits were weighted against potentially detrimental effects. Each represents a potential recommendation and topic to address as this research continues.

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