2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte

Paper ID #51946

Engineering Faculty at the Frontline of AI Workforce Readiness: Reimagining Roles in a Transforming Educational Landscape

Precious Njeck, Arizona State University

Precious Njeck is currently pursuing her Ph.D. in Engineering Education Systems and Design. Her research focuses on responsible and ethical integration of emerging technologies such as AI and VR in Education.

Dr. Brooke Charae Coley, Arizona State University, Polytechnic Campus

Dr. Brooke Coley, an Assistant Professor of Engineering at Arizona State University, is a pioneering force in disrupting the status quo of engineering to create a more equitable and inclusive field where all individuals can thrive. As the Founding Executive Director of the Center for Research Advancing Racial Equity, Justice, and Sociotechnical Innovation Centered in Engineering (RARE JUSTICE), Dr. Coley leads transformative efforts to challenge systemic barriers and promote equity in academia. Her research focuses on amplifying the lived experiences of racially minoritized scholars, dismantling anti-Blackness in STEM, graduate student education, and fostering awareness of, and ultimately, accountability for, the lived realities of individuals navigating STEM through immersive virtual reality experiences. Collaborating with mental health experts, she also is intentional to integrate a head-on focus on the implications for wellness and wholeness in academic environments. Dr. Coley's transparent and culturally responsive approaches, coupled with her dedication and fortitude, have positioned her as a recognized leader in the field. Since 2017, she has secured millions of dollars in grant funding from the National Science Foundation, employing critical qualitative and arts-based methodologies in her work. She received the Wickenden Award and Betty Vetter Award in 2024 and was named a Virtual Visiting Scholar by the ARC Network in 2023. Launching from the Ph.D. in Bioengineering from the University of Pittsburgh oriented to the challenges of navigating STEM as an underrepresented and minoritized scholar, she continues to lead change and advocate for institutional transformation and accountability through novel applications and approaches.

©American Society for Engineering Education, 2026

Engineering Faculty at the Frontline of AI Workforce Readiness: Reimagining Roles in a Transforming Educational Landscape

Introduction

Artificial intelligence has evolved rapidly over the last few years, transforming the way different businesses and industries operate, including the education sector. This shift has created an urgent demand for graduates equipped not only with technical proficiency in AI tools and methods, but also the ethical reasoning, adaptability, and systems-level thinking necessary to thrive in AI augmented workplaces. However, there have been mixed reactions to the adoption of AI in education. Some scholars argue that allowing students to use AI tools like ChatGPT, Claude, and Gemini could cause more cheating and plagiarism of academic work, leading to a decline in their writing and critical thinking skills [1]. Other studies have found that teachers are often reluctant to incorporate AI into their teaching content because of a lack of clear AI policies at the institutional level [2]. The lack of structured policies on AI use in many institutions has also led to inconsistent implementation by individual faculty [3]. On the other hand, there are researchers who argue that there is great value to allowing students to use AI tools, including, but not limited to intelligent personalized tutoring and intelligent support for collaborative learning [4]. Whether or not education researchers agree to allow students to use AI, the fact remains that the job market is evolving, and the skills needed are evolving with it. The US National Science Foundation (NSF) has responded to the rapid evolution of the job market by providing more funding opportunities to advance AI education for workforce development [5]. Researchers suggest that teachers should ensure that students acquire the technical AI skills that will be necessary for their future careers, while being cautious to maintain a balanced curriculum, ensuring that students do not lose relevant soft skills like communication, critical thinking, and creativity [6].

The purpose of this study is to investigate how a small group of engineering faculty at one research university make sense of AI in their teaching contexts and perceive their roles in supporting students' preparation for an increasingly AI-driven workforce. Using a qualitative approach, this study centers the voices and perspectives of faculty, whose role and practices meaningfully shape how students engage with AI during their training. This study seeks to contribute to a broader conversation about responsible AI integration in engineering programs by highlighting the nuanced perspectives of faculty who are navigating these questions in real time. The findings aim to inform curricular, pedagogical, and institutional strategies of AI adoption in ways that reflect the experiences of those at the frontline of engineering education. This study addresses the following research questions:

RQ1: What are engineering faculty's perceptions of AI use in education?

RQ2: What reservations do faculty have about integrating AI into their curriculum?

RQ3: How do engineering faculty perceive their role in positioning students for the AI-driven workforce?

Background Literature

How Engineering Students Traditionally Prepare for Industry

Traditionally, institutions follow the directives of accreditation bodies such as the Accreditation Board for Engineering and Technology (ABET) to train engineers. ABET's expectations for engineering students' learning outcomes include the ability to solve complex engineering problems by applying knowledge of mathematics, science, and engineering; apply engineering design to develop solutions for specific needs; communicate effectively; know their ethical and professional responsibility; function in teams; conduct appropriate experiments; and the ability to acquire and apply new knowledge [7]. ABET lays emphasis on the acquisition of technical skills, but encourages soft skills like teamwork, leadership, etc. Researchers have found soft skills/ transferrable skills listed in ABET's criteria, as well as others such as written communication, time management, loyalty and integrity, to be most sought after in industry [8]. These transferrable skills are taught to students using induction skills classes, where they are made to give presentations, work in teams, run effective meetings, and manage time using practical case studies [9]. Literature highlights a clear gap, where a lot of focus has been on the acquisition of fundamental technical and soft skills for engineering students. There is a need for more studies on the acquisition of emerging technical skills, specifically AI skills, and examining the role that faculty play in their students' acquisition of these skills.

Pros of AI integration in Education

Artificial intelligence has added value to the education industry. A major problem that has existed in education is that students have different learning styles and paces, and some faculty tend to pull the rest of the class at the fastest student's pace. This causes some students to be left behind while others advance, and a continuation of this practice throughout the course could limit students' understanding or even cause them to fail [10]. This is one main area where AI has revolutionized the education sector, offering personalized educational content [11], as well as personalized assessments and real-time feedback [4], [12]. With this innovation, students can learn adaptively, with access to intelligent education systems that align with their individual learning needs. They can ask as many questions as they need for their understanding outside of class, quiz themselves, and get real-time feedback [13]. These intelligent systems also analyze students' learning history, interests, and learning styles for more tailored content. Additionally, AI is used in facial recognition software applied in classrooms to assess students' engagement and attention [11]. For faculty, AI serves as a tool for grading by helping to generate tests and evaluation criteria, allowing faculty more time to enhance their teaching material [14].

Challenges or Risks with Adopting AI in Education

Despite the many applications of AI in Education, its integration into the industry is not without its challenges and risks. A major challenge lies in the fact that educational programs mostly have already established and rigid curricula, making it difficult for faculty to integrate AI components into their teaching practices [15]. The rigidity of curricula is often linked to accreditation requirements and institutional policies. Similarly, some institutions, faculty, and students are resistant to adopting AI due to fear of the unknown and other concerns, including an awareness of AI's impact on the environment [16]. Another challenge with adopting AI in education is a lack of the extensive resources needed, including hardware and software infrastructure, and the large amount of training data [17]. The problem of limited resources could cause bias against underrepresented or financially disadvantaged institutions, impacting certain disadvantaged students' ability to learn and access AI [18].

Risk factors associated with the adoption of AI in education are extensive; there is a significant risk that people in the education sector, particularly students who are still on their learning journey, could lose critical thinking and writing skills as a result of overreliance on generative AI [19]. The risk of losing critical thinking skills does not lie in using AI for repetitive tasks like computation or syntax-based tasks, but with more creative aspects like writing. Researchers equally caution against the adoption of AI due to issues regarding compromised academic integrity and cheating among students [1].

Additionally, there are other ethical concerns associated with AI use in education, such as its environmental impact. The environmental impacts of AI include, but are not limited to, high energy consumption, high carbon footprint, and excess water consumption [20]. These are as a result of the vast amounts of data needed for AI processing and the extensive quantities of water needed for cooling AI data centers. Another concern is the lack of clear guidelines and boundaries on what can and cannot be uploaded onto AI platforms, leading to sensitive private information and sometimes even companies' intellectual property being uploaded to AI platforms without consideration of the consequences [21].

Engineering Industry and Demands for AI Skills

The emergence of the fourth industrial revolution (Industry 4.0) has led to the digital transformation of businesses and manufacturing processes [22]. Industry 4.0 is characterized by evolving technologies such as Artificial Intelligence, Internet of Things, and automation, among others [23]. The World Economic Forum for 2025 reported that recent advancements in AI are expected to fuel the demand for technology related skills, with AI and big data topping the list of fastest growing skills that employers expect employees to have [24]. Researchers have found that students need to be prepared for the demands of modern industries and sustainability challenges that arise with the trends of industry 4.0 [25]. These trends highlight a gap in traditional engineering curricula that may limit students' exposure to attaining new high-demand skills.

AI in education is a new but steady growing area of research, and although there have been some studies on faculty perceptions of AI and students' readiness for an AI-driven job market [26], [27], [28], a major gap remains in literature. Mainly, there has been little to no exploration of how this new development will be incorporated in students' training and the role faculty will play in the process. This study contributes to previous findings on faculty perceptions of AI while elucidating potential roles they play in educating students as they prepare for the job market.

Theoretical Framework

The diffusion of innovations theory refers to the processes that occur when people adopt new ideas, philosophies, practices, or technologies over time [29]. The theory served as a guided lens for two main purposes: First, it informed the design of interview questions, which were structured to highlight participants' openness to adopting AI, their level of awareness of existing AI tools, and their awareness of industry needs and trends. Second, it provided an interpretive frame for understanding variations in faculty perspectives during data analysis. Specifically, it helped distinguish participants who had already integrated AI into their teaching practices from those who were still navigating uncertainty around its use.

Methodology

This study adopted a qualitative research approach, which allowed for the understanding of the meaning faculty make through their interaction with AI in educational spaces [30]. The choice was informed by the constructivist paradigm, which recognizes that people's beliefs are shaped by their assumptions, environments, cultural contexts, or lived experiences [31]. This approach was appropriate for the study because it allowed faculty to recount their experiences with, and their perceptions of, AI in educational contexts, as well as their perspectives of what skills will be relevant for the current AI-driven job market.

Participants and Sampling

The research site was a public pro-AI (AI use encouraged and integrated throughout the institution) R1 university (very high research activity) located in the Southwest of the United States. The site was selected through convenience sampling, as the researchers had existing connections at the institution. Snowball sampling was used, where participants were encouraged to tell another faculty about the study. This approach was particularly helpful in identifying faculty members to participate in the study. It was found that an introductory email from another faculty member made it more likely for faculty to respond and participate. Inclusion criteria included engineering faculty at any level in the university. The study was limited to only engineering faculty as the experts training engineers for the job market at the university level. Their perspectives on what AI-related skills students would need for an evolving job market would be highly relevant to the training students receive. A total of 10 faculty were contacted to participate in this study, of which 7 responded and 5 completed the study (see Table 1). Table 1 includes a description of the 5 participants involved in this study, including their educational qualification, rank, years of teaching experience, and their engineering specialty.

Table 1: Participant Demographics

Participant Code	Educational Qualification	Rank	Years of Teaching Experience	Specialty
1	PhD	Professor	18	Manufacturing Engineering
2	PhD	Associate Professor	10	Mechanical engineering
3	PhD	Professor	20	Engineering Education
4	PhD	Associate Professor	19	Biomedical Engineering
5	PhD	Assistant Professor	2	Engineering Education

Data Collection

Interviews served as the primary source of data in this study. Interviews are an effective data collection technique when the intention is to understand the experience of individual people and their meaning making of these experiences [32]. The interviews were semi-structured in nature, following an initial guide but making the process more flexible, allowing new questions to be asked based on a response provided by the participant [33]. Interviews were conducted both in-person and on Zoom, depending on the participant's preference. In-person interviews were conducted in the participant's office, and all interviews were audio-recorded via Zoom. Interviews ranged from 60-75 minutes in duration. Sample questions that were asked included: "How do you perceive students' use of AI in their coursework or learning?"; "What hesitations, if any, do you have about integrating AI into your teaching or curriculum?" ; "What do you see as your role in helping students develop the AI-related skills that will equip them to be prepared for the workforce?"

Data Analysis

The data was analyzed using thematic analysis, which involved identification of patterns and themes in the data [34]. Before analysis began, the interview transcripts, which had been prepared by Zoom, were cleaned by removing all identifiable information, replacing the participants' names with pseudonyms, correcting errors, and removing filler words. Cleaned transcripts were loaded into a software analysis tool called Qualcoder, which helped with managing, visualizing, and organizing emerging codes. Each coder read through the transcripts twice before coding. The coding technique used for this study was inductive coding, and the two coding strategies used were in vivo and process coding. After the first round of coding, about 70 codes were initially identified, which were later merged based on similarities to form 30 codes. Sample codes included "automating tasks," "sending emails," and "overwhelming resources." After coding was completed, patterns identified helped in developing 6 themes in the data.

Research Quality and Validity

Three elements of the "Big-Tent" model were adopted to ensure the quality of this study [35] including worthy topic, rich rigor, and ethics. The study met the worthy topic criteria as it investigates students' preparedness for an AI driven job market, a timely and relevant topic. To ensure the rigor of this study, the diffusion of innovations theory was used to guide the research and interview questions, and in making meaning of the findings. Ethics was incorporated by getting Institutional Review Board (IRB) approval at the research site in alignment with procedural ethics requirements and by addressing any other ethically important moments that came up during the research process, such as in interviews, appropriately.

Member checking was another technique used to enhance the studies credibility, and it was done by returning interview transcripts to participants to verify accuracy. Incorporating these measures ensured that the study maintained a high quality and produced trustworthy results.

Positionality

This work was conducted through a social constructivist paradigm. The first author is an engineering student currently pursuing her PhD degree. Her educational background includes an undergraduate degree in Computer Science and a master's degree in information technology. Her technical background has had a significant influence on her research, which focuses on responsible and ethical integration of emerging technologies such as Artificial Intelligence and Virtual Reality in Education. The second author is an Associate Professor in engineering experiencing firsthand the power and pressures of AI in real-time in the classroom. Being at an institution that is pro-AI has had a significant impact. However, the open-ended nature of how that could be enforced pedagogically leaves real considerations for what that looks like and the role faculty see as their responsibility. In a moment where the uptake of AI is rapid and pervasive, the authors wish to galvanize deep reflection on what may be blind spots in the process. Understanding the challenges that may hinder alignment between academic preparation and industry's needs in the era of AI is paramount. This work focuses on faculty as a major agent in the shaping and execution of the academic preparation that engineers receive to prepare them for the future workforce. Thus, this investigation to get a pulse on what faculty perceive as the value of AI as a workforce ready skill and their role in positioning students' development of these skills is of great significance.

Results

Data analysis resulted in six themes which were relevant to answering the proposed research questions. For RQ1, two themes were identified: AI is an efficiency tool, and AI is a learning and thinking partner. Similarly, RQ2 had 2 themes: Overuse & overreliance and ethical concerns. Lastly, RQ3 had 2 themes: facilitators of adaptive learning and translators between academia and industry.

Faculty Perceptions of AI

AI is an Efficiency tool

Faculty identify AI as a tool for efficiency and offloading repetitive tasks. Sharing her experience during an internship where a senior engineer spent most of their time on redundant report generation, one participant shared:

> She didn't have to be doing all this repetitive stuff every day. She could contribute in more meaningful ways with her background. So that example really stuck with me, and I still think about it as I'm talking to you about AI, because I feel like that's the exact kind of thing, that if Sally was graduating today, and that was her job, then she should be able to go in and say oh, I see what you want me to do, and I think I can have AI help do that much faster, and then I can take on more responsibilities.

Similarly, other faculty members shared that AI can serve as a tool to perform redundant tasks. As one participant recounted: "Where I think its place is in education, and probably in the workplace is in that way. Offloading, repetitive maybe computation-based or syntax-based kind…I mean just the same way we use a calculator". While some faculty also see the benefit in using AI to respond to emails and save time, others feared that it would replace human interactions. One faculty shared:

> And I've also experienced students using AI to write emails to me that are obviously AI-generated. And I understand that, too. There's some I guess we could call it reputation management between students and faculty…And this might be a personal preference, because I'm a very relationally oriented person, but I would prefer an email with a typo or a grammar error that's written by the actual person than something outsourced to ChatGPT, or Claude, or any of the others.

This participant quote suggests that while faculty understand why students feel pressured to send perfectly written emails to faculty, they would still prefer that human touch in student emails. These quotes from faculty highlight the value of AI as a tool to enhance efficiency, thereby increasing productivity, but also acknowledges its ability to impact human interactions

A Partner in Learning and Thinking

All the faculty interviewed had a positive perspective on AI usage in the classroom and allowed students to use it as long as they were being honest about how it was used. One faculty shared about her classroom AI policy: “I'm not opposed to using AI. But then, like, if you did use it, like, how did you use it, and what ideas did it generate, and how that shows up in the final deliverables.” The positive AI policies were a reflection of faculty’s own belief of AI as a learning tool. A participant shared: “I think the way I tend to use it is like a critical, as a critical friend, someone to help me, like, think deeper about things.” Others also thought of it as an idea generation and brainstorming tool, which they thought was beneficial to both students and faculty. Overall, faculty mostly saw the value of AI in enhancing their learning capabilities, as well as those of their students, as long as they were honest about using it.

Faculty Reservations for Integrating AI

Overuse and Over-reliance

Despite an overwhelming positive attitude towards AI, faculty voiced some concerns they had about integrating AI into their teaching curriculum. Once major concern they had was the issue of overuse and overreliance, which could lead to the loss of foundational engineering skills. Particularly, faculty noted a disturbing trend across their first year and senior students. Senior students were more discerning in their use of AI as noted by this faculty:

> My seniors today presumably entered college without AI so they had at least an opportunity in the first couple years to engage in critical thinking a little bit, engaging in their own writing, and so I think that they might be more discerning in how they're using AI than my first years.
>
> On the other hand, faculty noted that first year students seemed to be over-reliant on AI: “incoming students, they can't do anything without it [AI].”

As faculty expressed these concerns, they shared that there is a need for balance: “We don't want students that can't do anything, and that need AI to think or do anything. But then also, we also don't want to graduate students that are just totally blinded to it and have no idea how to use it.”

Ethical Concerns

Another major concern that was shared across all faculty in this study was the ethical concerns of using AI, including environmental, privacy, and academic integrity concerns. One faculty member shared about AI and the environment:

> I try not to rely on it all the time, because I know that there's an environmental aspect to it. I know that there's concerns about the water usage and the negative impacts of data centers, so I try to be balanced.

The quote from this faculty demonstrates a need for balance and discernment in what tasks we actually need AI for. In relation to privacy concerns, faculty shared their reluctance to upload others’ interview data, as well as students’ and company’s intellectual property onto generative AI platforms without permission. He shared:

> You know, and here it's the same thing, like, other people's information that we may come into contact with, are we just uploading it? And in business, in engineering, it might be

> information about a company. I'm uploading supplier information into ChatGPT to help me within an hour. Is that okay? So, just the boundaries of where we need permission.

Another faculty equally shared their concerns about academic integrity:

> Another thing I think students need to know that I would like to, at least in my class, is I want them to think through the ethics of this, and so it's unethical to just accept an AI answer without checking it.

This quote was shared by a participant in relation to students just accepting AI generated answers as the ground truth, without checking their veracity.

Faculty and Their Perceived Role

Facilitators of Adaptive Learning

Faculty mainly identified their role in positioning students for an AI-driven workforce as facilitators of learning. One faculty member shared:

> I see my role the same as it always has been, which is to help facilitate learning for students in a classroom setting…I think everybody's responsible for their own learning, and I think the faculty member's responsibility is being able to be thoughtful about what it is that they should be learning, and how to facilitate that learning.

This participant noted that although the AI-driven workforce is fairly new, their role as a facilitator of learning remained the same, while emphasizing that the student bears the primary responsibility for their own learning. Another participant shared similar sentiments:

> I've helped guide them [students] to understand the landscape of what they need to do, because they're responsible for their own learning and their own acquisition of skills. Our classes should support that and should move them forward in that path.

While some faculty identified students as being responsible for their own learning, others saw it as a shared responsibility between students, faculty, and the institution. In addition to identifying hers and her students' responsibility in preparing for an AI-driven workforce, a participant added what she considers as the institution's responsibility:

> I'd like to think, like, on a more institutional level, how do we change our programs, to really integrate AI so that they [the students] have the skills, and so they're more competitive, you know, for jobs when they get out, and are just also more critical thinkers and stuff?

In this quote, the faculty member raises questions about how institutions could strategically design their programs to provide adequate AI training to their students.

Translators Between Academia and Industry

Another key role faculty play is serving as a resource guide to their students, to keep up with current trends in the industry. One participant noted her role as "raising students' awareness that these tools exist, that industry cares about them. Paying attention to them. And trying to curate experiences where they're getting practice with the tools." Similarly, noting that the amount of AI resources available out there are abundant, this faculty member spoke of their role as a guide:

> I think I see my role almost as a guide. There are so many resources out there. It's… overwhelming. It's overwhelming for me, it's overwhelming for my colleagues, but because I'm using AI on a daily basis, and teaching AI on a daily basis, I see my role to be able to help kind of guide them on their own path.

In addition to figuring out what AI tools and resources are currently relevant in industry, faculty also saw their role as identifying industry needs, as one shared:

> I'm interested in figuring out, like, what's happening in industry, like, what do they think their needs sort of are? And then also, like, what might we be able to do? Or, what are the opportunities in this space? How we can sort of almost change engineering work, or change the curriculum.

In this quote, the participant identifies that industry needs are changing and that faculty need to constantly be updated on what those new trends are to better position their students for the AI-driven job market.

Discussion

The purpose of this study was to explore faculty perceptions of AI in educational contexts and to uncover their perceived roles in positioning students for an AI-driven job market. The findings revealed nuanced perspectives that embraced AI's growing role and relevance, while also raising concerns about overreliance and ethical issues. These findings contribute to the ongoing conversations in academia about how engineering programs can respond to the changing industry demands.

RQ1: Engineering faculty's perceptions of AI use in education

Faculty described AI as an efficiency and learning tool that can reduce redundant and computational tasks. They found it useful for tasks like software coding, responding to emails, generating reports, etc. This finding is consistent with existing literature that suggests AI is a productivity and personalized learning tool [4], [12]. Although all faculty who participated in this study were open to AI use, some were more accepting than others. Specifically, faculty who personally used AI for critical thinking and idea generation were more open to AI use in the classroom than those who did not. Their patterns of adoption of AI align with the diffusion of innovation theory [29]. Faculty who were already integrating AI into their own research and teaching, and openly experimenting with new AI tools reflect the behaviors of early adopters, that is, they are comfortable operating without any proven playbook. On the other hand, faculty who waited for AI tools to demonstrate consistent reliable value before incorporating them into their courses more closely resemble the late majority due to their cautiousness and skepticism

RQ2: Faculty Reservations about integrating AI into curriculum

Despite their support of AI, faculty voiced concern about overreliance on AI, especially among first-year students. Although previous studies have found that students overuse AI [1], this study uncovered an emerging observation: three faculty in this study perceived incoming students as more reliant on AI than senior students. These observations are worth exploring further, as they reflect faculty perceptions rather than direct measurements of student behavior. A possible explanation offered by one faculty member is that senior students had the opportunity to develop their cognitive skills and build domain knowledge before generative AI became widely popular. Though this explanation seems plausible, there may be alternative explanations, highlighting the need for research that directly examines students' AI usage patterns across different year groups.

Also, ethical concerns, including privacy, academic integrity, and environmental issues emerged. Faculty expressed their discomfort in uploading sensitive interview and student information onto generative AI platforms and also expressed their concerns for students uploading sensitive company intellectual property onto these platforms. All of these findings are consistent with prior literature [18], and highlights the need for boundaries and consent when uploading information onto AI platforms.

RQ3: Faculty Perceptions of their role

Faculty perceive their role in positioning students for an AI-driven workforce the same way they always have, as facilitators of learning who guide their students in navigating a new complex landscape rather than being solely responsible for their learning. They highlight the importance of engaging critically with AI, adaptability, and developing discernment, rather than training students to use specific tools that may become obsolete. This echoes prior findings that durable skills are essential for industry 4.0, not just technical skills [6]. Additionally, faculty described their role as resource guides and liaisons between academia and industry, helping students make sense of the overwhelming number of AI tools that exist. They equally help to identify meaningful applications that are relevant to industry while filtering out overhyped and irrelevant information.

It is important to note that faculty view the responsibility as not solely individual instructors' responsibility, but rather as a shared responsibility, with students and institutions playing their own roles. They identified students as being primarily responsible for their learning, while also identifying important roles institutions could play, including curricular redesign to support equitable AI skill development across different programs, which aligns with prior literature [3]. Viewed through the lens of the diffusion of innovations theory, the findings suggest that faculty roles in AI workforce preparation depend on their adoption category. Faculty who actively engage in AI and industry trends are more likely to assume leadership roles, serving as guides and curriculum innovators, while those who are more cautious are more likely to focus on foundational skills and limiting students' exposure to AI. Together, these faculty roles contribute to a gradual yet steady preparation for an AI-driven workforce in engineering education.

Implications

The findings reinforce the value of integrating ethics into engineering programs, especially as AI becomes more and more embedded into students' lives. There is a need to establish boundaries and consent when it comes to AI use, both with uploading sensitive information on AI platforms and using AI in classrooms. Faculty and institutions need to be cautious about respecting individual students' choices and providing alternate assignment options for students who would rather not use AI. Additionally, faculty can begin requiring critical evaluation of assignments and asking students to include reflections to justify their responses. More specifically, faculty can include AI-use disclosure statements in their assignment guidelines, requiring students to not only document whether they used AI, but how they used it, which prompts they entered, and how they evaluated or modified the output. Requiring the submission of prompt logs containing a record of interactions with AI could also serve as a transparency mechanism that encourages student reflection. Faculty can also introduce model critique exercises where students are asked to identify errors, biases, or limitations of AI-generated responses. These strategies could help reinforce critical evaluation skills rather than passive acceptance of AI responses.

The findings also suggest a shift in faculty roles from being transmitters of technical knowledge to facilitators of adaptive learning. This would mean that rather than training students to use every single AI tool – which, by the way, is not feasible – students should be taught how to learn AI and to critically evaluate its responses. The findings equally highlight the need for stronger industry connections and the importance of faculty staying up to date with industry trends to better support student learning. Finally, the shared responsibility for teaching students AI skills means that each party (students, faculty, and institutions) must join forces together for students to succeed.

At institutional levels, there is a need for a coordinated policy development approach that reflects the shared responsibility in AI training as identified by faculty in this study. Engineering departments could establish AI polices at the program level that reflect discipline-specific ethical considerations, such as uploading proprietary information unto generative AI platforms. Educational institutions could also create faculty learning communities, where faculty can share pedagogical strategies and stay current on industry trends. This approach would reduce the burden currently placed on individual faculty to navigate AI integration alone.

Limitations and Future work

The goal of this study was not to produce generalizable results, but to develop a conceptual understanding of how a small group of engineering faculty navigate AI integration.

A major limitation of this study is that all participants were sourced from a single R1 institution with a culture that leans favorably towards AI adoption as described by the participants. Faculty perspectives at institutions with more restrictive AI policies or with fewer resources may produce different outcomes. Additionally, the study included faculty from only a subset of engineering disciplines, including manufacturing engineering, mechanical engineering, biomedical engineering, and engineering education, and perspectives from other fields such as civil engineering or computer engineering may introduce new insights, particularly around professional ethical practices.

These findings serve as a foundation for several directions of future research. In future studies, the themes identified could be used in developing survey instruments that would allow for broader examinations of faculty's perception of AI and their role across engineering discipline and institution types. Additionally, further research will include perspectives from students, institutions, and industry partners on the role they play in preparing students for an AI-driven workforce.

Conclusion

This study investigated faculty perceptions of AI use in educational settings and sought to uncover their perceived roles in positioning students for an AI-driven job market. The findings revealed that faculty identified the value of AI as an efficiency tool and a learning partner. At the same time, they expressed significant concerns regarding student overreliance on AI, particularly among first-year students, as well as ethical issues related to academic integrity, privacy, and environmental sustainability. Their concerns highlight the importance of preserving foundational engineering skills and ensuring that students are still able to learn the domain knowledge related to their field. Faculty equally identified their role as facilitators of adaptive learning and translators between academia and industry, highlighting the importance of keeping up with industry trends and helping students navigate an overwhelming AI ecosystem.

As AI continues to disrupt both industry and academia, engineering faculty must begin to reimagine their roles as facilitators of students’ learning, to ensure that they can adaptively learn new AI skills and tools as they emerge. Engineering programs must also proactively adapt curricula and develop policies to ensure that graduates are equipped with the skills and ethical judgement necessary to thrive in the job market.

References

[1] C. K. Y. Chan, "A comprehensive AI policy education framework for university teaching and learning," *Int. J. Educ. Technol. High. Educ.*, vol. 20, no. 1, p. 38, Jul. 2023, doi: 10.1186/s41239-023-00408-3.

[2] H. Wang, A. Dang, Z. Wu, and S. Mac, "Generative AI in higher education: Seeing ChatGPT through universities' policies, resources, and guidelines," *Comput. Educ. Artif. Intell.*, vol. 7, p. 100326, Dec. 2024, doi: 10.1016/j.caeai.2024.100326.

[3] O. V. Spivakovsky, S. A. Omelchuk, V. V. Kobets, N. V. Valko, and D. S. Malchykova, "INSTITUTIONAL POLICIES ON ARTIFICIAL INTELLIGENCE IN UNIVERSITY LEARNING, TEACHING AND RESEARCH," *Inf. Technol. Learn. Tools*, vol. 97, no. 5, Art. no. 5, Oct. 2023, doi: 10.33407/itlt.v97i5.5395.

[4] R. Luckin and W. Holmes, "Intelligence Unleashed: An argument for AI in Education," UCL Knowledge Lab, London, UK, Report, Feb. 2016. Accessed: Sep. 11, 2025. [Online]. Available: https://www.pearson.com/content/dam/corporate/global/pearson-dot-com/files/innovation/Intelligence-Unleashed-Publication.pdf

[5] National Science Foundation, "NSF announces new funding opportunities to advance AI education and build the STEM workforce of the future | NSF - National Science Foundation." Accessed: Sep. 15, 2025. [Online]. Available: https://www.nsf.gov/news/nsf-announces-new-funding-opportunities-advance-ai-education

[6] J. Hutson and J. Ceballos, "Rethinking Education in the Age of AI: The Importance of Developing Durable Skills in the Industry 4.0," *J. Inf. Econ.*, vol. 1, no. 2, Jul. 2023, doi: 10.58567/jie01020002.

[7] ABET, "Criteria for Accrediting Engineering Programs, 2025 - 2026," ABET. Accessed: Sep. 15, 2025. [Online]. Available: https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2025-2026/

[8] C. D. Grant and B. R. Dickson, "Personal Skills in Chemical Engineering Graduates: The Development of Skills Within Degree Programmes to Meet the Needs of Employers," *Educ. Chem. Eng.*, vol. 1, no. 1, pp. 23–29, Jan. 2006, doi: 10.1205/ece.05004.

[9] A. J. Fletcher, A. W. A. Sharif, and M. D. Haw, "Using the perceptions of chemical engineering students and graduates to develop employability skills," *Educ. Chem. Eng.*, vol. 18, pp. 11–25, Jan. 2017, doi: 10.1016/j.ece.2016.07.001.

[10] K. R. Koedinger, P. F. Carvalho, R. Liu, and E. A. McLaughlin, "An astonishing regularity in student learning rate," *Proc. Natl. Acad. Sci.*, vol. 120, no. 13, p. e2221311120, Mar. 2023, doi: 10.1073/pnas.2221311120.

[11] M. Pan, J. Wang, and J. Wang, "Application of Artificial Intelligence in Education: Opportunities, Challenges, and Suggestions," in *2023 13th International Conference on Information Technology in Medicine and Education (ITME)*, Nov. 2023, pp. 623–627. doi: 10.1109/ITME60234.2023.00130.

[12] X. Chen, H. Xie, D. Zou, and G.-J. Hwang, "Application and theory gaps during the rise of Artificial Intelligence in Education," *Comput. Educ. Artif. Intell.*, vol. 1, p. 100002, Jan. 2020, doi: 10.1016/j.caeai.2020.100002.

[13] C. G. Demartini, L. Sciascia, A. Bosso, and F. Manuri, "Artificial Intelligence Bringing Improvements to Adaptive Learning in Education: A Case Study," *Sustainability*, vol. 16, no. 3, p. 1347, Jan. 2024, doi: 10.3390/su16031347.

[14] T. Kabudi, I. Pappas, and D. H. Olsen, “AI-enabled adaptive learning systems: A systematic mapping of the literature,” *Comput. Educ. Artif. Intell.*, vol. 2, p. 100017, Jan. 2021, doi: 10.1016/j.caeai.2021.100017.

[15] A. C. Dixit, P. K. N, H. B, A. A, and A. Taranum, “Barriers to Integrating AI in Curriculum for Enhanced Engineering Education: A Fuzzy ISM Approach,” *J. Eng. Educ. Transform.*, pp. 137–147, May 2025, doi: 10.16920/jeet/2025/v38is2/25017.

[16] G. Pitts, V. Marcus, and S. Motamedi, “Student Perspectives on the Benefits and Risks of AI in Education,” Jun. 03, 2025, *arXiv*: arXiv:2505.02198. doi: 10.48550/arXiv.2505.02198.

[17] I. Mosly, “Artificial Intelligence’s Opportunities and Challenges in Engineering Curricular Design: A Combined Review and Focus Group Study,” *Societies*, vol. 14, no. 6, p. 89, Jun. 2024, doi: 10.3390/soc14060089.

[18] K. Yelamarthi, R. Dandu, M. Rao, V. P. Yanambaka, and S. Mahajan, “Exploring the Potential of Generative AI in Shaping Engineering Education: Opportunities and Challenges,” *J. Eng. Educ. Transform.*, pp. 439–445, 2024.

[19] Queen’s University, “ChatGPT can hinder students’ critical thinking skills,” The Queen’s Journal. Accessed: Dec. 12, 2025. [Online]. Available: https://www.queensjournal.ca/chatgpt-can-hinder-students-critical-thinking-skills/

[20] E. Delort, L. Riou, and A. Srivastava, “Environmental Impact of Artificial Intelligence,” PhD Thesis, INRIA; CEA Leti, 2023. Accessed: Dec. 12, 2025. [Online]. Available: https://inria.hal.science/hal-04283245/document

[21] H. Abgaryan, S. Asatryan, and A. Matevosyan, “REVOLUTIONARY CHANGES IN HIGHER EDUCATION WITH ARTIFICIAL INTELLIGENCE,” *Main Issues Pedagogy Psychol.*, vol. 10, no. 1, pp. 76–86, 2023, doi: 10.24234/miopap.v10i1.454.

[22] IBM, “What is Industry 4.0 and how does it work? | IBM.” Accessed: Sep. 11, 2025. [Online]. Available: https://www.ibm.com/think/topics/industry-4-0

[23] Z. Jan *et al.*, “Artificial intelligence for industry 4.0: Systematic review of applications, challenges, and opportunities,” *Expert Syst. Appl.*, vol. 216, p. 119456, Apr. 2023, doi: 10.1016/j.eswa.2022.119456.

[24] World Economic Forum, “The Future of Jobs Report 2025,” World Economic Forum. Accessed: Sep. 15, 2025. [Online]. Available: https://www.weforum.org/publications/the-future-of-jobs-report-2025/digest/

[25] A. Abulibdeh, E. Zaidan, and R. Abulibdeh, “Navigating the confluence of artificial intelligence and education for sustainable development in the era of industry 4.0: Challenges, opportunities, and ethical dimensions,” *J. Clean. Prod.*, vol. 437, p. 140527, Jan. 2024, doi: 10.1016/j.jclepro.2023.140527.

[26] K. Ofosu-Ampong, “Beyond the hype: exploring faculty perceptions and acceptability of AI in teaching practices,” *Discov. Educ.*, vol. 3, no. 1, p. 38, Apr. 2024, doi: 10.1007/s44217-024-00128-4.

[27] A. Shata and K. Hartley, “Artificial intelligence and communication technologies in academia: faculty perceptions and the adoption of generative AI,” *Int. J. Educ. Technol. High. Educ.*, vol. 22, no. 1, p. 14, Mar. 2025, doi: 10.1186/s41239-025-00511-7.

[28] B. Pandya, L. Patterson, and U. Ruhi, “The readiness of workforce for the world of work in 2030: perceptions of university students,” *Int. J. Bus. Perform. Manag.*, vol. 23, no. 1–2, pp. 54–75, Jan. 2022, doi: 10.1504/IJBPM.2022.119555.

[29] E. M. Rogers, *Diffusion of Innovations*. Simon and Schuster, 2003. Accessed: Jan. 18, 2026. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=9U1K5LjUOwEC&oi=fnd&pg=PP1&ots=R7oIj_nLsJ&sig=sslfC1p4d8tc7ZwKj3I3aFca8TQ
[30] E. J. Tisdell, S. B. Merriam, and H. L. Stuckey-Peyrot, *Qualitative research: A guide to design and implementation*. John Wiley & Sons, 2025. Accessed: Sep. 22, 2025. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=tRpCEQAAQBAJ&oi=fnd&pg=PR7&dq=qualitative+research+a+guide+to+design+and+implementation&ots=0Cy7Q_KXHt&sig=EFDhd_XDvJyo_3f1xMR6XvkdsFk
[31] J. Maxwell, "Qualitative Research Design : An Interactive Approach / J.A. Maxwell.," Jan. 2012.
[32] I. Seidman, *Interviewing As Qualitative Research: A Guide for Researchers in Education and the Social Sciences*. New York, NY, UNITED STATES: Teachers College Press, 2019. Accessed: Sep. 21, 2025. [Online]. Available: http://ebookcentral.proquest.com/lib/asulib-ebooks/detail.action?docID=5790771
[33] R. Ruslin, S. Mashuri, M. S. A. Rasak, F. Alhabsyi, and H. Syam, "Semi-structured Interview: A methodological reflection on the development of a qualitative research instrument in educational studies," *IOSR J. Res. Method Educ. IOSR-JRME*, vol. 12, no. 1, pp. 22–29, 2022.
[34] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qual. Res. Psychol.*, vol. 3, no. 2, Art. no. 2, 2006, doi: 10.1191/1478088706qp063oa.
[35] S. J. Tracy, "Qualitative Quality: Eight 'Big-Tent' Criteria for Excellent Qualitative Research," *Qual. Inq.*, vol. 16, no. 10, pp. 837–851, Dec. 2010, doi: 10.1177/1077800410383121.