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Critical Consciousness, Equity, and Speculative Futures: Reframing AI as a Catalyst for Human Connection and Systemic Change in Engineering Education

Dr. Nadia N. Kellam, Arizona State University

Nadia Kellam (she/they) is an Associate Professor of Engineering and Associate Director of Research Excellence at The Polytechnic School (TPS) in ASU's Ira A. Fulton Schools of Engineering. A faculty member in the Engineering Education Systems and Design PhD program and TPS's undergraduate Engineering program, Kellam is an engineering education researcher and mechanical engineer. Their research examines engineering education culture and institutional change, focusing on marginalized students and educators. An AI enthusiast, Kellam explores the ethical and equity implications of generative AI in engineering education, leveraging AI to foster human connection, challenge inequities, and prepare students for an AI-driven future.

Critical Consciousness, Equity, and Speculative Futures: Reframing AI as a Catalyst for Human Connection and Systemic Change in Engineering Education

This practice paper explores the intersection of power, equity, and artificial intelligence (AI). Through a theoretical argument and three narratives about my experiences with AI, I propose a subversive reframing of AI as a tool for liberation rather than control. AI, when critically engaged, has the potential to cultivate critical consciousness, challenge systemic inequities, and foster human connection in engineering education. Through three narratives, I explore how AI might be reimagined to advance equity-centered goals in unexpected but potentially impactful ways.

The first narrative highlights the use of AI as a critical friend for PhD students in a qualitative research methods course, providing constructive, non-judgmental feedback to help them create research proposals and so that they can practice interviewing and coding through role-playing with AI. The second examines the potential of AI as a mentor for neurodivergent faculty, offering tailored guidance and support. The third narrative involves a speculative design exercise where faculty engaged in equity-centered institutional change used AI to create "dark futures" narratives and envisioned emancipatory interventions to prevent those futures from becoming reality. Together, these narratives illustrate how AI, far from being solely a technical tool, can be a relational and transformative force in engineering education.

In many current conversations about AI in engineering education, AI is framed as a purely technical tool, often divorced from its social and ethical implications [1], [2]. AI can perpetuate oppression, domination, and control when designed and deployed without critical reflection. Furthermore, there are significant and well-founded concerns regarding both privacy [3] and the environmental impact [4] of AI. The training and deployment of large AI models require vast computational resources, leading to high energy consumption and carbon emissions. These environmental costs are often overlooked, reinforcing existing global inequities, as access to AI development remains concentrated in regions with the necessary infrastructure and energy capacity. A more sustainable approach to AI must address not only its biases and social impacts but also its long-term environmental consequences.

Concerns over privacy, surveillance, and the consolidation of power among a few dominant players often overshadow AI's potential to foster human connection and disrupt inequities. Many widely used AI tools, such as ChatGPT, are trained on massive proprietary datasets controlled by private corporations, raising questions about data security, bias, and accessibility. These concerns are particularly pressing in education, where AI's role in student and faculty interactions must be

critically examined. Without transparent and equitable governance, AI risks reinforcing existing power imbalances rather than dismantling them.

By centering only on the technical aspects of AI, we risk unintended consequences that reinforce systemic inequities, creating outcomes that disproportionately harm marginalized groups. Some researchers are exploring ethics, bias, and social responsibility regarding AI [5]. In this practice paper, we propose extending this conversation on ethics, bias, and social responsibility to consider how AI can be a tool for oppression and liberation.

In this work, I have been influenced and shaped by Black feminist thought, scholarship, and art [6], [7], [8], [9], [10], [11], [12], [13]. I find myself drawn to Black feminist ways of thinking as I am interested in understanding and uncovering oppressions in technology while also contributing to a resistance to these technologies. Black women skillfully recognize and critique this marginalization and oppression while simultaneously resisting this oppression [9]. I am particularly inspired by speculative design [14], [15] and arts and crafts [15], [16], [17] as ways of resisting oppression.

The purpose of sharing narratives is to provide an honest account of my journey in engaging with AI as an engineering educator. By openly discussing the successes and the mistakes I encountered along the way, I aim to foster transparency in how educators might critically and creatively engage with AI in their work. Mistakes are an inevitable part of exploring new tools, and I hope that by sharing mine, I can contribute to a broader, collective understanding of how AI might be thoughtfully incorporated into equity-centered education.

Literature Review

Systemic biases in AI arise from the deeply embedded inequities in the data, design, and deployment processes of these technologies. Joy Buolamwini's groundbreaking work in *Unmasking AI* reveals how these biases are often baked into AI systems, disproportionately harming marginalized communities [8]. For instance, facial recognition algorithms have been shown to perform poorly on individuals with darker skin tones, a failure directly tied to the lack of diversity in the datasets used to train these systems. Buolamwini highlights how these shortcomings are not merely technical errors but reflections of broader societal inequities.

AI, when developed without intentional consideration of equity, codifies historical patterns of discrimination into digital systems. These harms are further exacerbated by the privileged positionality of AI designers, who frequently prioritize technical capabilities over societal consequences. As a result, AI systems often serve the needs of the privileged while harming marginalized populations. To address these inequities, Buolamwini introduces the concept of algorithmic justice, a framework that emphasizes accountability, diversity among AI creators,

and fairness informed by historical and social contexts [18]. Her work serves as a call to action for systemic changes in how AI is conceived, developed, and governed, pushing beyond narrow, technocentric solutions toward justice-oriented innovation and community-driven solutions.

The Algorithmic Justice League's initiatives embody the liberatory spirit of Black feminist resistance. For instance, the "Drag vs. AI" workshop invites participants to explore facial recognition technology by learning from veteran drag performers how to use makeup and drag to trick these systems [19]. This interactive approach not only exposes the biases embedded in facial recognition but also empowers participants to subvert these systems in creative, liberative ways. Such efforts exemplify how resistance can take the form of playful disruption while fostering critical awareness of technology's harms.

The design and deployment of AI are deeply shaped by the positionality of those who create it. As Kara Swisher observes in *Burn Boo*k, many CEOs and tech leaders operate from a "cocoon of comfort and privilege" [20]. This privileged position often limits their understanding of the diverse contexts in which their technologies are used. As a result, these leaders prioritize features and applications that reflect their own experiences and needs while neglecting the lived realities of marginalized communities. Additionally, these leaders shape privacy and accessibility policies to serve corporate interests—protecting profits and consolidating power—at the expense of users. This is becoming exacerbated as these CEOs and tech leaders are gaining power in government and access to large data sets. Still, there are some ways that their power is being destabilized. A recent example (as of the writing of this paper) of this is DeepSeek, an open-source model that was developed in China and cost far less to create than other AI platforms, including OpenAI [21].

This disconnect between the people who use technology and those who create it has significant implications for the outcomes of AI systems. In *Race After Technology,* Ruha Benjamin argues that technologies, rather than being neutral or apolitical, frequently exacerbate existing social inequities [5]. She describes how AI often reinforces white supremacy and systemic inequities by prioritizing the perspectives of the powerful at the expense of the marginalized. For example, many AI systems focus on efficiency and profitability without addressing how these priorities may perpetuate harm, such as biased hiring algorithms or inequitable resource allocation.

The framing of technology as "neutral" or "objective" serves to obscure these power dynamics, making it easier for designers to sidestep accountability for the societal consequences of their creations [7], [8]. Without deliberate efforts to interrogate how privilege influences AI design, the systems we create may perpetuate systems that serve the few at the expense of many. This critique underscores the urgent need to integrate diverse voices and experiences into the development of AI to ensure that its applications reflect a broader range of human realities.

Theorizations of technology reveal its dual potential to either reinforce oppression or serve as a catalyst for liberation. Paulo Freire, in his seminal work on critical pedagogy, argues that

technology, like education, is never neutral—it can either perpetuate domination or contribute to emancipation, depending on how it is wielded [22]. Michel Foucault extends this critique by framing technology as a mechanism of surveillance and control, often employed to maintain existing power structures [23]. Together, these perspectives emphasize the sociopolitical dimensions of technology, challenging the notion that its effects are purely technical or inevitable.

When designed and deployed without critical reflection, AI systems frequently act as tools of oppression. For example, predictive policing algorithms disproportionately target communities of color, reinforcing systemic inequities under the guise of objectivity [7]. Similarly, workplace surveillance tools often exacerbate exploitative labor practices, privileging efficiency over the well-being of workers [7]. These examples illustrate how AI can consolidate power in the hands of the few, perpetuating harm to marginalized populations.

However, technology also holds the potential to disrupt oppressive systems when intentionally designed to center equity and inclusion. By empowering users to challenge dominant narratives and dismantle inequitable structures, technology can become a tool for liberation. This potential aligns with Freire's vision of using tools to amplify the voices of the oppressed and foster critical consciousness [22]. Realizing this potential in AI design requires moving beyond surface-level fixes to interrogate the values, assumptions, and power dynamics embedded in these systems.

This dual nature of technology underscores the importance of intentionality in AI development. Whether AI reinforces oppression or fosters liberation depends not on the technology but on the sociopolitical frameworks guiding its design, creation, and use. By centering critical pedagogy and equity-oriented frameworks, AI can be reclaimed as a transformative force for justice. As engineering educators, we can help engineering students learn to critique these systems and recognize oppression while learning how to engage in liberation and resistance.

Black feminist approaches also emphasize the importance of community and collective action in addressing technological inequities [6], [7], [8], [9], [10], [24]. They call for shared oversight of AI systems and advocate for participatory design processes that center the voices and needs of those most impacted by technology. Rather than focusing on individual technocratic fixes, these perspectives call for systemic, justice-oriented solutions aimed at cultivating critical consciousness and advancing emancipatory education. This framing provides a crucial foundation for engineering educators and researchers seeking to engage students and communities in equity-centered technological practices.

While AI has often reflected and reinforced existing power structures, it also holds transformative potential when intentionally designed to center equity. Nemer's concept of "mundane technology" demonstrates how everyday tools—like smartphones and social media—can be repurposed by marginalized communities as vehicles for resistance and

empowerment [25]. These technologies gain their liberatory power not inherently but through the creative ways users reshape them to meet their needs and challenge systemic barriers.

AI, though not yet fully mundane, is rapidly becoming ubiquitous as it becomes embedded in daily life through smartphones, virtual assistants, applications, and social media algorithms. This trajectory presents both a significant risk and an opportunity. Left unchecked, AI systems continue replicating the inequities seen in other technologies, reinforcing systemic barriers rather than dismantling them. However, if reclaimed and redesigned with critical consciousness at the forefront, AI could serve as a tool to amplify voices, disrupt oppressive systems, and create new pathways for justice and inclusion.

In engineering education, we aim to inspire students, faculty, and staff to think critically about the intersection of technology and justice. This work should involve centering marginalized voices in the design of AI systems and Generative Pre-Trained Transformers (GPTs), challenging and critiquing embedded assumptions, and fostering equity-focused pedagogy that engages the social and ethical implications of AI while cultivating the imagination of alternative futures. By framing AI as a relational, equity-driven tool, educators can model how technology can be leveraged to address systemic inequities and foster critical consciousness and emancipatory educational ideals. This vision aligns with the principles of critical pedagogy, emphasizing the transformative power of education to challenge oppression and promote liberation.

Methods

This practice paper presents a theoretical exploration of AI alongside a reflective account of my attempts to use AI as a tool for fostering human connection, promoting equity, and driving systemic change. My work is grounded in the belief that AI, when intentionally designed and thoughtfully applied, could potentially serve as a liberatory force in education rather than perpetuating existing systems of oppression. Motivated by this potential, I began experimenting with AI to understand how it might be leveraged in ways that align with equity-centered goals.

The narratives presented in this paper are autoethnographic reflections on my experiences as an engineering educator engaging with AI. They recount how I explored AI's applications, the challenges I encountered, and the lessons I learned along the way. These reflections are not intended to present polished solutions but to share an authentic account of my journey, including mistakes and missteps, as I sought to reimagine AI's role in education. Rather than sharing lengthy narratives about my experiences with AI in engineering education, I have selected key incidents that illustrate how I engaged with AI, the opportunities AI presents, and AI's limitations.

Positionality

I am a white, queer woman who has been an engineering faculty member for almost 20 years. As I began to engage in institutional change projects, I became interested in power and privilege and how these social forces influence our work as educators, researchers, and change agents. In recent years, I have learned more about speculative design and Black feminist perspectives, and these ideas have begun to influence my work and my thinking. I am particularly drawn to the work of Black women scholars who emphasize the need to critique and understand marginalization and oppression, especially from an intersectional and structural perspective, while also providing space for reimagining the future. I love reading and have also been influenced by Africanfuturist work such as Nnedi Okorafor's Binti tetralogy [12]. My engagement with AI is grounded in a commitment to critical pedagogy and emancipatory education. I view engineering education as a site where cultivating critical consciousness is essential for empowering students to challenge systemic inequities and reimagine more just technological futures.

Through an autoethnographic lens, I center my own experiences, using personal reflection as a tool to critically examine the complexities of working with AI. This approach not only allows me to document the process authentically but also underscores the importance of embracing imperfection as part of meaningful learning and growth. While the reflections are grounded in my perspective, I have ensured that the identities and perspectives of others involved remain confidential.

Reflective Narratives

Narrative 1: Creating Personas in a Qualitative Research Methods Class

Motivation: To make the coding assignment in my qualitative research methods course more relevant to students, I wanted them to work with mock data aligned with their specific research interests. Instead of relying on data from my research as I have done in prior semesters, I envisioned students using a GPT to create three diverse participant personas and conduct mock interviews with GPT playing the participant's role. The resulting interview transcripts would then serve as the data for their coding assignment. This approach deepened student engagement by tailoring the exercise to their research interests.

Implementation: To test this idea, I designed a GPT and introduced it in class. Prior to the start of the semester, I applied for funding for the ChatGPT Enterprise edition for me and my students at my university. Within this edition of ChatGPT, I created a GPT through a back-and-forth dialogue where I explained my learning objectives and how I would like the GPT to interact with the student (e.g., asking questions instead of rushing to answers), and tested the GPT. The GPT then created a summary of the GPT, which is included in Figure 1 for reference.

565 Interview Transcript Generator
Description:
This GPT helps create interview personas and generates realistic interview transcripts for coding assignments.
Instructions:
This GPT assists students by generating mock interview transcripts for coding assignments. It begins by guiding students in creating three personas of potential interviewees. For each persona, it asks questions about traits, background, and name, encouraging students to develop unique and realistic personas. Once the personas are finalized, the GPT checks with the student to confirm satisfaction before asking for their research question and possibly a copy of their research protocol. Then, it takes on the role of one of the personas, allowing the student to conduct an interview as if the GPT were the persona. The GPT responds realistically to the student's questions, simulating a live interview. After the interview, it provides a downloadable transcript in a Word or text file for the student to review and use.

Figure 1. Summary of the GPT created for class

During class, students experimented with the GPT, generating three participant personas based on their research topics. However, we quickly encountered a problem: the personas created by the GPT reflected biases and relied on narrow, outdated definitions of diversity. These personas reproduced stereotypes, undermining the exercise's intended depth and nuance.

In response, I pivoted the exercise. Instead of relying solely on GPT, students created the participant personas, which they entered into GPT for the role-playing interviews. This adjustment allowed students to retain creative control over the persona design while using the GPT for mock interviews. The process worked better when students asked probing questions during the interviews, but those with weaker protocols or less critical engagement ended up with generic, repetitive transcripts. This, in turn, limited the insights they could draw from their coding assignment.

Key Insights and Outcomes: This exercise highlighted GPT's limitations in creating diverse participant personas, as it tended to reproduce systemic biases and stereotypes. Students, in contrast, often brought more thoughtful and relevant perspectives to persona creation. The activity also revealed differences in how students interacted with AI: some engaged in iterative, back-and-forth dialogues to refine their outputs. In contrast, others accepted GPT’s initial responses without much critical questioning.

A particularly valuable outcome was the discomfort students expressed when they encountered bias in GPT’s responses. This sparked a productive classroom discussion about bias in AI, rooted in their direct experiences. The exercise not only deepened their understanding of coding and

qualitative research but also provided an opportunity to examine the ethics and limitations of AI in research critically. This discomfort was a catalyst for developing critical consciousness, helping students not only recognize systemic biases embedded in AI systems but also begin to imagine more equitable technological futures.

Reflections and Future Directions: While AI offers unique possibilities, it might be more effective for students to role-play interviews with one another and use transcription tools to generate simulated data for their coding assignments. This approach would center student interactions, eliminate reliance on AI, and preserve the exercise's personal relevance while avoiding the biases inherent in AI-generated content.

Another approach might be to challenge students to experiment with available tools to generate interview transcripts, allowing them to decide for themselves whether and to what degree they want to incorporate AI. This process fosters student agency, pushing them to critically assess the benefits and drawbacks of AI rather than using it passively.

However, there is also value in having students directly engage with AI's limitations and biases. Many students in the class were surprised and even unsettled by the biases they encountered in AI-generated personas. Their discomfort sparked meaningful discussions about the sources of these biases and the broader ethical implications of AI in research and education. Educators can build on these moments by designing activities that intentionally expose AI's flaws, much like Joy Buolamwini's facial recognition workshop using drag to trick biased facial recognition software [19]. By guiding students to uncover and critique AI's blind spots firsthand, we can cultivate critical consciousness--helping them not only recognize systemic inequities but also develop the skills to navigate, challenge, and disrupt biased technological systems from within.

Moving forward, I encourage us, as educators, to consider balancing the use of AI as both a tool and an object of critique. Rather than positioning AI as either entirely useful or problematic, we might frame it as a system that students can learn to interrogate. This requires intentional pedagogy that not only fosters critical consciousness by helping students understand AI's capabilities, recognize its limitations, and actively push for more equitable, transparent, and accountable technological futures.

Narrative 2: Creating an AI Mentor for Neurodivergent Engineering Faculty and Graduate Students

Motivation: This fall, I led the development of an NSF Broadening Participation in Engineering (BPE) proposal focused on establishing a mentoring hub for neurodivergent (ND) engineering faculty and graduate students. As part of this effort, I considered the potential of developing an AI-based mentor, leveraging GPT technology, to provide support to community members during challenging times, particularly late at night or in moments when reaching out to a human mentor

was not feasible. The goal was to offer tailored, on-demand guidance to ND academics navigating unique professional and personal challenges.

Considerations and Challenges: While the concept of an AI mentor appealed to me for its accessibility and scalability, several critical concerns emerged among our broader team. The AI would require continuous training to provide accurate, empathetic, and contextually appropriate advice. This presented significant technical challenges, as even minor biases or inaccuracies in the AI's responses could erode trust or lead to harmful advice.

Another challenge that our team faced in considering an AI mentor was the issue of data privacy. Many AI platforms, including those we initially considered, operate within closed corporate ecosystems, collecting and storing vast amounts of user data. Given the sensitive nature of mentoring conversations, particularly for ND faculty and students navigating professional and personal challenges, this raised ethical concerns. Who ultimately controls this data? What safeguards exist against misuse? Would users feel comfortable engaging honestly with an AI system if their responses could be stored or analyzed by a for-profit entity? These questions made it clear that any AI-driven mentoring tool would need to be designed with privacy at the forefront, potentially requiring the development of open-source, decentralized AI models that do not depend on billionaire-owned data infrastructures.

We also recognized the potential for unintended consequences. For example, reliance on an AI mentor may isolate ND faculty and graduate students further, reducing their opportunities for meaningful human connections. A mentoring hub, by contrast, could foster authentic relationships and build community—an essential goal of the broader project.

Key Insights and Outcomes: These considerations ultimately led to the decision not to include the AI mentor in the proposed project. Instead, we prioritized creating spaces where ND academics could connect with peers and mentors in supportive, inclusive environments. This decision highlighted the importance of balancing technological solutions with human-centered design principles, particularly in efforts to foster equity and inclusion. This exploration provided valuable insights into the potential and limitations of AI in addressing systemic barriers. For instance, the AI mentor idea underscored the importance of ensuring that any technology developed for ND communities prioritizes inclusivity, reduces isolation, and complements rather than replaces human interactions.

Reflections and Future Directions: While we chose not to pursue the AI mentor in this project, the idea remains intriguing. In the future, it may be possible to develop a carefully curated AI tool as a supplementary resource within a broader mentoring ecosystem. Such a tool could be designed to answer basic questions, provide quick encouragement, or offer general guidance while connecting users to human mentors with particular expertise or community resources for

deeper support. This approach could ensure the technology serves as an enhancement to, rather than a replacement for, human connection.

Narrative 3: Storycrafting with GATHER to Reimagine the Future

Motivation: GATHER is an NSF-funded project in which we are bringing together institutional change agents in a Community of Transformation and are using storycrafting and arts-based approaches to help support these change agents as they engage in change efforts on their campus. As part of our efforts to inspire equity-focused institutional change, we sought to engage participants in radical reimaginings of the future through speculative design. This included the creation of dark futures narratives and prequels with the participants in the role of change agents that would keep us from realizing the imagined dark future.

Implementation: During a GATHERing with our Community of Transformation, we experimented with using ChatGPT and Dall-E to develop cohesive narratives and generate images from brainstormed ideas rapidly. The session began with attendees contributing fragments of "dark futures" scenarios, imagining worst-case outcomes for their equity work. With time running short, a collaborator (Vanessa Svihla) and I entered our collective notes into ChatGPT and Dall-E, which generated a cohesive, provocative story arc and illustrations.

The following session built on this dark narrative. Participants responded to prompts about their institutional contexts, roles, and equity projects, exploring ways their work could avert the dark future and create a prequel grounded in hope. Using ChatGPT again, we quickly transformed these responses into a prequel, weaving individual stories into a collective vision of change. To make this activity accessible beyond our group, I created a GATHER Storycrafter GPT for others to engage in this reflective storytelling process. Unfortunately, we encountered significant hurdles: international participants could not access the GPT due to restrictions, and my switch to ChatGPT Enterprise later limited the tool's broader shareability beyond my institution.

Key Insights and Outcomes: This experience revealed both the promise and the pitfalls of using AI in collaborative storytelling. On one hand, AI helped participants quickly move from scattered ideas to a cohesive narrative, allowing us to focus on meaning-making rather than the mechanics of storytelling. It enabled participants to see their equity work as interconnected and impactful, fostering a sense of community and shared purpose. However, accessibility issues highlighted the need for more inclusive technological solutions. Another issue in the GATHER Storycrafter GPT was that the generated stories were not very “dark.” The idea with dark narratives is that they present ridiculous, out-there stories of a dark future, and the prequels are used to help us see how we have agency in avoiding such a dark future. The GPT seemed to avoid going very dark and tended to tell a less dark story--limiting the potential impact of the

workshop activity. Despite these challenges, the tool was a powerful conversation starter, bridging brainstorming and actionable visioning.

Reflections and Future Directions: This experience in the GATHERings and in the conference session underscored the value of combining speculative design with technology to envision equitable futures. Moving forward, we plan to refine our approach by integrating more human-centered facilitation alongside AI tools, ensuring accessibility and addressing hesitancies.

This experience taught us that technology should complement rather than replace human creativity and connection. By centering equity and inclusivity in tool design and implementation, we can expand the reach and impact of activities like this. Above all, the GATHER Storycrafter reminded us that even in the face of systemic barriers, collaborative storytelling can inspire radical hope and catalyze meaningful change.

Limitations

While this paper highlights the potential of AI to foster equity, empathy, and human connection in engineering education, several limitations emerged. ChatGPT often defaulted to providing polished answers rather than guiding reflective, iterative learning, occasionally undermining deeper pedagogical goals. Accessibility challenges also surfaced, as some participants faced technical or institutional barriers, limiting the accessible and equitable use of AI tools. Privacy concerns also arose, particularly with free or non-enterprise versions of ChatGPT, leading to discomfort about sharing sensitive information.

A critical limitation of AI adoption, particularly in educational and research contexts, is the economic disparity in access to these tools. Many AI platforms, especially those with advanced capabilities, operate on subscription-based models or require significant computational resources, which can be prohibitively expensive for individuals, institutions, or communities with limited funding. This financial barrier creates inequities in who can effectively engage with AI, reinforcing existing digital divides. However, DeepSeek has recently challenged this disparity by offering open-source AI software, prompting companies to reconsider access models and the role of paywalls in AI availability [21].

Beyond financial constraints, the infrastructure needed to run AI tools—such as high-performance computing systems, stable internet access, and technical support—may not be readily available in underfunded institutions or lower-income regions. These disparities limit opportunities for marginalized groups to critically engage with AI, whether in education, research, or entrepreneurial ventures. Without addressing these systemic inequities, AI risks becoming another technology that disproportionately benefits those with financial privilege while further excluding those without.

Addressing these economic barriers requires advocating for more accessible AI resources, such as open-source alternatives, institutional support for AI literacy, and policies that promote equitable distribution of technological infrastructure. Future research might explore how AI can be designed and deployed in ways that minimize financial barriers and maximize inclusive participation.

Additionally, AI systems frequently perpetuate biases and stereotypes, as seen in the creation of participant personas, where ChatGPT often relied on narrow, outdated definitions of diversity. In my experience, ChatGPT sometimes provides generic or middle-of-the-road responses or stories that are not as impactful and occasionally reinforce biases. While these outputs were often well-structured and polished, they were not always insightful or meaningful. Over-reliance on AI also risks prioritizing efficiency over human connection, potentially devaluing the relational aspects of trust and learning.

Another critical limitation of AI adoption is its environmental impact [4]. The training of large-scale AI models requires extensive computational power, contributing to high carbon emissions and energy consumption. Research suggests that training a single deep-learning model can generate as much carbon as five cars over their entire lifetimes [26]. These environmental costs are particularly troubling when AI is framed as a universal solution without consideration of its sustainability. Additionally, the increasing demand for AI exacerbates resource consumption, favoring well-funded institutions and corporations that can afford energy-intensive computing infrastructure. As AI becomes more embedded in education and research, addressing its ecological footprint should be part of a broader conversation on equitable and responsible AI development.

These limitations underscore the importance of using AI as a complementary tool rather than a replacement for human engagement. To ensure AI serves as a catalyst for equity rather than perpetuating harm, its design and implementation must be approached with intentionality, critical reflection, and transparency.

Discussion and Conclusion

Reclaiming AI for equity requires intentional design practices that prioritize connection, inclusion, and empowerment over efficiency and profitability. Buolamwini promotes four guiding principles to mitigate the harms and biases of AI in her work with the Algorithmic Justice League, and these principles might be helpful for engineering educators to consider as we engage with AI [18]: affirmative consent, meaningful transparency, continuous oversight and accountability, and actionable critique.

The findings from this work demonstrate both the potential and the challenges of using AI to foster equity, empathy, and human connection in engineering education. Across the narratives,

AI tools like ChatGPT served as catalysts for critical engagement and reflective learning, but they also revealed systemic limitations that must be addressed to fully realize their promise.

Building on these insights, future work should explore additional strategies for integrating AI into equity-centered educational practices. This includes developing new tools and pedagogical approaches that explicitly address the limitations identified in this study. For instance, creating training modules to help faculty and students critically engage with AI or designing collaborative activities that combine human interaction with AI support could further enhance the learning experience. Moreover, the broader implications of AI for systemic change in engineering education merit further exploration. How can AI help disrupt inequitable institutional practices? What role can AI play in amplifying the voices of marginalized communities within academia? Addressing these questions will require interdisciplinary collaboration and a sustained commitment to equity and justice.

Future AI development should address bias, privacy, and accessibility and consider sustainability. AI's energy consumption and environmental costs raise pressing concerns about its long-term impact, especially in marginalized communities disproportionately affected by climate change. As educators and researchers, we must critically engage with AI's ecological footprint and advocate for sustainable AI practices that align with equity-driven innovation.

As AI becomes increasingly integrated into education and daily life, the question of who owns and controls these tools cannot be ignored. Many AI systems rely on billion-dollar datasets controlled by private entities, raising concerns about data privacy, access, and equity. This paper argues that educators should not only introduce students to AI's potential applications but also help them critically analyze and resist systems that prioritize profit over public good. Developing alternative AI models—open-source, community-driven, and ethically designed—should be a key consideration for the future of AI in education.

This discussion has highlighted the transformative potential of AI in fostering equity and empathy within engineering education while also acknowledging the systemic challenges that must be addressed. By approaching AI as a relational and equity-driven tool, educators and researchers can cultivate critical consciousness, foster emancipatory learning, and open new possibilities for systemic change and social justice. Ultimately, the success of these efforts depends on intentionality, collaboration, and a commitment to ensuring that AI serves as a catalyst for systemic change.

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