Teaching to Transgress in a Technology and Society Course

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Introduction

In her book *Teaching to Transgress*, bell hooks* shares insights into pedagogy informed by her own history as a student and a postsecondary instructor, as well as anticolonial, feminist, and critical approaches to teaching and learning [1]. She highlights the importance of passion, relationality, and criticality to liberatory pedagogy that empowers students to engage deeply and agentively in the classroom. hooks's ideas can be especially helpful as we consider how to effectively engage undergraduate engineering students in courses that ask them to demonstrate their understanding of engineering in a social context – an outcome that is often required for accreditation purposes. As instructors respond to the complex ethical, social, political, and environmental challenges of today, they may begin to eschew traditional case studies that portray engineering as objective and apolitical. In this way, they may begin to "transgress" against dominant views of engineering that can limit students' critical thinking and engagement with socio-political issues within engineering contexts. Liberatory pedagogy also disrupts the status quo of power dynamics and practices in the postsecondary classroom, opening up space for new classroom activities and assessments that create a more collaborative and equitable learning environment [1].

In this paper, I explore the redesign of an undergraduate engineering technology and society course in relation to the idea of liberatory pedagogy in bell hooks' *Teaching to Transgress.* I begin by summarizing some key ideas from the book and subsequent calls for more liberatory pedagogies in engineering education. Next, I provide some context for my specific course as well as my positionality. I discuss the course redesign along four themes: creating a community of learning, transgressing against objectivity and apoliticism in engineering, promoting legitimacy and intellectual authority, and centering critical reflection. Finally, I conclude by reflecting on my successes and challenges, and providing some lessons learned about "teaching to transgress" in an engineering technology and society course that I hope will be useful to instructors of similar courses.

Background

Teaching to Transgress

Teaching to Transgress [1] is a collection of essays published by bell hooks in 1994. She situates the book in her own experiences as a learner in schools and universities, and in her work teaching as a professor. She writes about how schooling is often about obedience, and that emotions of excitement and joy can be transgressive in institutions of higher education. In addition, postsecondary institutions uphold white supremacy, imperialism, sexism, and racism in

* bell hooks uses lowercase for her name.

ways that constrain different ways of being and knowing in the classroom [1]. Drawing upon anticolonial, critical, and feminist pedagogies, she writes essays for both teachers and students that "celebrate teaching that enables transgressions – a movement against and beyond boundaries… which makes education the practice of freedom" [1, p. 12]. Throughout the book, hooks highlights many different ideas and principles that come together to support liberatory pedagogy in the higher education classroom. While I cannot hope to explore all of her ideas in the depth they deserve here, next I will highlight some of the key points that changed the way I think about my own pedagogy and guided the course redesign that is the focus of this paper.

One of hooks's main ideas is that professors need to genuinely value everyone's presence in the classroom in order to create excitement and joy [1]. She notes that it is difficult to get students to engage deeply and agentively in the postsecondary classroom because, over the course of their educational experiences, they have often been told that they do not have authority or legitimacy in the classroom. That is, students have been conditioned to believe that they are there to learn from an expert, rather than share their own "uninformed" opinions or personal experiences. This educational mindset has been repeated so often throughout their schooling that any attempt to shift this dynamic can be met with indifference or resistance. hooks suggests incorporating a focus on experience in classroom activities and assignments, as it "allows students to claim a knowledge base from which they can speak" [1, p. 148]. At the same time, professors need to actually listen when students speak and seek to understand their perspectives. Importantly, this does not mean that the classroom is a free-for-all, as hooks notes that "[encouraging discussion of opinions] doesn't mean we listen uncritically or that classrooms can be open so that anything someone else says is taken as true, but it means really taking seriously what someone says" [1, p. 150]. These behaviours are critical to establishing a community of learning that empowers both students and professors in the classroom. While traditional power dynamics still exist (e.g., the professor still grades students' work), the professor it not solely responsible for those classroom dynamics when everyone can speak from positions of intellectual authority and feel that their contributions are encouraged and valued [1].

One way that some professors may choose to disrupt notions of racism, sexism, imperialism, and colonialism in their courses is to include lecture content that discusses these systems and their impacts, or to assign texts and readings from critical scholars of colour. Certainly, these curricular efforts can help students understand their world (and their learning) in new ways. However, hooks cautions us that there can be a disconnect between these critical ideas and more conservative practices in how professors treat students in the classroom [1]. Even though the ideas presented by the professor may be critical or radical, and students may seem to accept that material, the pedagogical methods reinforce the status quo and may not actually change how the students think about and relate to that material in meaningful ways. Radical content is not the same as liberatory pedagogy [1]. Critical thinking is another important piece of liberatory pedagogy as "without the capacity to think critically about our selves and our lives, none of us would be able to move forward, to change, to grow" [1, p. 202]. Cultivating critical thinking in this community of learning can help students meaningfully engage with a wide variety of topics, and I believe this idea is even more important when considering the types of learning outcomes and content that are common in technology and society courses – those related to perspective-taking, engineering ethics, and understanding the relationships between engineering and society.

Liberatory pedagogies in engineering education

In her 2003 paper, Donna Riley puts forward a call for more use of liberatory pedagogies in engineering education [2]. Her arguments are guided by the ideas that hooks discusses in her book. Riley notes that liberatory pedagogies in engineering can address three critiques of engineering education: progressive critiques, such as those from Paulo Freire which find fault with lecture-only classrooms and obedience; mainstream critiques to strengthen mathematics and integrate the liberal arts; and feminist critiques of how engineering education is often rooted in colonialism and militarism in ways that exclude women and other minorities [2]. Pedagogies of liberation are needed to address systems of oppression that impact engineering education and professional practice [2]. In addition, these pedagogies can foster the professional skills (e.g., critical thinking, communication, and lifelong learning) that accreditation bodies such as the Accreditation Board on Engineering and Technology (ABET) and the Canadian Engineering Accreditation Board (CEAB) are looking for. Finally, Riley argues that liberatory pedagogy can change engineering education in ways that make it more welcoming for women and other underserved groups in engineering. In short:

> liberative pedagogies bring new principles and focal points that can push engineering further toward becoming a more diverse and accessible profession and empower future engineers to find or make places in the field that resonate with their senses of social justice [2, p. 138]

Riley [2] illustrates her arguments by discussing how she has included liberatory pedagogies in an engineering thermodynamics course. She redesigned the course such that students could connect course material to their own life experiences, have authority in the classroom (such as taking on teaching roles), critically discuss issues of ethics and policy, and understand engineering from perspectives other than the dominant Western notion of engineering. Employing liberatory pedagogies in engineering is not without trade-offs, and Riley is honest about the time it takes to run a class in this way, and how logistical limitations such as class time and a lack of support or education in these types of pedagogies may pose barriers [2]. She does not expect us to radically redesign an entire course; instead, we can make small, incremental changes over time. Finally, she recommends that faculty members taking steps along this path share their findings with others [2]. This paper aims to respond to that call.

Course context and overview

The Price Faculty of Engineering at the University of Manitoba has an undergraduate student population of approximately 1800 students. After completing a first-year program of core courses, students join one of four departments: electrical and computer engineering, mechanical engineering, civil engineering, or biosystems engineering. Most students finish the program after 4-5 years of study. In the Price Faculty of Engineering, 23% of students identify as female[†], 7% of students identify as Indigenous, and 33% of students are international students [3].

ENG 3020 – Technology, Society and the Future is a required course for students in the mechanical, civil, and biosystems engineering programs. The course calendar description is as follows:

[†] An additional 0.2% of students identify as a gender other than male or female or did not declare a gender.

> *Impact of technology and technological change on society-past, present, future; specific technologies, e.g. construction. machine power, computers, communications, medical, military: the process of technological change; invisible effects of technology; technology and resource use; sustainable development, limits to growth and the role of technology.*

In general, this course is expected to fulfill the CEAB requirements in the Impact of Engineering on Society, Ethics and Equity, and Professionalism graduate attributes.

Four sections of ENG 3020 are offered per year. Though capped at 70 students, enrolment fluctuates, with most sections having 40-60 students. In previous years, this course had no prerequisites, with a prerequisite of an Engineering Communication course only being added in the 2023-2024 academic year. Due to this, and the fact that the course is not a prerequisite for any other courses, students in this course come from any year of their program, with a slight majority coming from 3rd year and higher. This paper discusses the course as it was run in the Winter (Jan-Apr) 2023 semester, which had an enrolment of 48 students. While specific demographic information for the course section I am reporting on this paper is not available, it can be expected to follow the trends for the wider Faculty due to its mandatory status in three of four of the engineering programs offered by the Price Faculty of Engineering.

Previous offerings of the course by other instructors used the book *Technology & Society: Social Networks, Power, and Inequality* by Anabel Quan-Haase [4] as the basis for course content. Groups of students presented on each chapter of the book, while other students facilitated a discussion by posing questions to the class. Students also took part in formal debates, wrote short weekly reflections on how the course content was relevant to them, and completed a group project to analyze a historical engineering failure. The class also had a closed-book final exam worth 45% of the overall grade which included questions from the book chapters, a short case study, and questions from guest lecture content.

Positionality

I am currently in my 2nd year as a tenure-track assistant professor at the University of Manitoba. My research mandate is in engineering education. I teach undergraduate courses that are mostly focused on professional skills such as technical communication and technology and society. I also teach graduate seminars on engineering design and basic research and communication skills for new graduate students in engineering. The course section I discuss in this paper was the first time I was teaching ENG 3020, which took place during the first year of my position.

I have an interdisciplinary educational background, beginning with a B.Sc in Electrical Engineering. I then completed a M.Sc in Electrical Engineering with a focus on engineering education, specifically studying how computer coding can be taught in K-6 classrooms. My PhD is in Educational Research with a specialization in Learning Sciences. My dissertation research highlighted critical approaches to computing education in informal education spaces such as museums, with a particular focus on pedagogy and facilitation for underrepresented learners in these spaces. It was in my PhD that I was first introduced to critical and liberatory pedagogy, which necessitated critical reflection on my own positionality as a white settler cisgender woman from a middle-class background with an engineering parent. With the exception of my gender, my other identities align with dominant identities in engineering, which led to a sense of mostly

belonging during my undergraduate engineering education. Finally, during my postdoctoral position in Information Sciences, my departmental colleagues highlighted and discussed critical perspectives on the design and use of technologies such as social media, AI, and facial recognition. Overall, my doctoral and postdoctoral experiences had significant impacts on my teaching philosophy, and led to critical reflection on how ideas about technology and equity can be meaningfully explored in learning environments.

Course redesign for liberatory pedagogy

As I prepared for my first offering of the course, I drew upon my experiences in engineering, educational research, and information sciences to shape not only the content of the course but also course structure, assignments, and expectations. I engaged in this redesign work in close collaboration with my colleague Dr. Kari Zacharias who was also teaching this specific course for the first time that semester. Dr. Zacharias provided critical insight from her background in Science and Technology Studies as well as her past experience teaching a similar course at a different institution. We found that our different interdisciplinary backgrounds and commitments to critical pedagogy made space for new possibilities beyond traditional engineering approaches.

Our redesigned course had a new structure. After an introductory week, Mondays were reserved for lectures, Wednesdays for small group discussions, and Fridays for activities. Assignments included three reflections (15%), two discussion preparation assignments (10%), three debates (15%), a team project (20%), and a final examination (40%). I elaborate further on the course structure and assignments in the following sections of this paper. Overall, the course redesign aligned with four ideas from *Teaching to Transgress*: creating a community of learning, transgressing against objectivity and apoliticism in engineering, promoting legitimacy and intellectual authority, and centering critical reflection.

Creating a community of learning

One of the main ideas that hooks puts forward in *Teaching to Transgress* is the importance of creating a community of learning in the classroom. A community of learning for transformative pedagogy involves “making the classroom a democratic setting where everyone feels a responsibility to contribute” [1, p. 39]. My efforts to build a community of learning in ENG 3020 began on the first day of class. After going through the course syllabus, I devoted time to classroom conduct and norms. First, I highlighted main ideas from Arao and Clemens’s chapter “From Safe Spaces to Brave Spaces” [5], as they have noted that “safe spaces” may hinder student engagement with provocative topics such as those discussed in this course. They offer guidelines including controversy with civility, own your intentions and impact, challenge by choice, respect ourselves and others, and reflect on the differences between a personal attack and a challenge to ideas [5].

hooks also argues that classrooms are rarely safe spaces for students of colour, and goes on to reflect that “rather than focusing on issues of safety, [hooks thinks] that a feeling of community creates a sense that there is a shared commitment and a common good that binds us” [5, p. 40]. To strengthen this shared commitment, I opened up space for students to brainstorm additional classroom norms during class. These were shared anonymously using an online sticky note tool,

discussed, and then posted to the course website. I reiterated these norms periodically throughout the course, especially when introducing a new topic or activity that had what I viewed to be a higher chance of disrespectful behaviour, such as small-group discussions about gender and technology or before our first classroom debate.

I also tried to promote a community of learning in the classroom by disrupting traditional classroom power dynamics. On Mondays, I had a more traditional lecture-style class in which I presented definitions, concepts, and examples related to the weekly course topic. However, I also built in opportunities for students to interact with each other during lectures such as think-pair-share activities. On Wednesdays, I split the class into three different classrooms for small group discussions of ~15 students. Students were given a discussion question related to the weekly course topic, such as "Is technology making us healthier or unhealthier overall? Why?" Three or four students per room were assigned as discussion leaders for the week. They completed a short assignment ahead of time in which they prepared different facts, sources, questions, and arguments in relation to the weekly discussion question. The idea is that they would use their work to spark the discussion and bring up different perspectives.

The instructor or teaching assistant in the room would step in to facilitate discussion as needed, such as summarizing ideas, pointing out potential conflicting perspectives, and ensuring that everyone had a chance to speak. After 40 minutes of discussion, all groups reconvened in the main classroom and I led a short debrief exercise, which often involved either asking someone from each room to summarize their main discussion points verbally, or for students to share their thoughts using an online sticky note tool. These small group discussions allowed students to get to know their classmates better and to collectively reason about and discuss questions that did not have one "correct" answer. While I and the teaching assistants provided some additional considerations that we felt were missing from the discussion, we avoided framing these comments as a definitive "answer" to the question which could reify the traditional classroom power dynamics and cause convergence upon our own responses.

Finally, hooks notes that in a community of learning, all students must be valued as part of the classroom community [1]. I wanted to make it clear that I valued my students *as humans* rather than just as people producing academic work. To that end, I ensured that the course policies under my control reflected that ethos, while also preparing students for their work as future professionals. I allowed students to have five "late passes" for individual work and three for teamwork throughout the semester. Each late pass could be used for a 24-hour extension of the due date. These passes could be used for any reason and students did not need to tell me why they wanted to use them. I did not want students to feel the need to share their personal situations unnecessarily or fabricate "legitimate" reasons just to hand in something a couple of days late. On the first day of class, I also mentioned that these late passes were for small disruptions to their lives, and that if anything more serious was happening, they should let me know so that I could work out longer extensions and/or connect them to the appropriate campus resources. These late passes were also used in addition to any other official accommodations.

I believe that this policy acknowledged that students, like all of us, deserve some flexibility – especially as they work on the time management skills required of university students. In terms of preparing them for a professional workplace, while there are some hard deadlines in

engineering work (e.g., a request for proposals), there are many other situations where an extra day or two could be acceptable. Students told me that they appreciated being able to take an extra day or two to balance multiple course deadlines, studying for a midterm, or to work on their mental health. If we want students to connect to each other, and to us as instructors, we need to make it clear that we value their whole selves and whole lives in the classroom.

Transgressing against objectivity and apoliticism in engineering

hooks is careful to note that radical content in itself does not automatically result in liberatory pedagogy in the classroom. When radical content is introduced alongside liberatory pedagogy, then students may not only accept this new content, but also change the way they think about it [1]. Dominant views of engineering still rest on assumptions of the field as objective and apolitical [6]. These assumptions can be perpetuated in technology and society courses through traditional engineering case studies which portray engineering failures such as the Tacoma Narrows Bridge or the Challenger disaster as resulting from rushed design, improper testing, or a bad decision made by a person or group, rather than systemic issues. While students can certainly learn something about "good" engineering design from these case studies, they may struggle to see how systems of oppression such as racism, sexism, and colonialism can be perpetuated through engineering.

To address this gap, I designed course lectures and shared resources that could speak to how power dynamics and systems of oppression impact engineering design. A critical consideration for me was the belief that discussions around topics such as race, gender, class, etc. should not be relegated to one week focused on "equity." I was worried that relegating all equity- and justice-related content to one week would devalue it in the minds of students and perpetuate the idea that all the other content in the course was neutral or apolitical. My course had two full weeks dedicated especially to gender and colonialism in the course. In addition, most of the other weeks included concepts, ideas, and examples that challenged engineering as neutral. For example, in the lecture discussing theories of technology (including critical theories of technology), I highlighted the works of Ruha Benjamin [7], Safiya Umoja Noble [8], and Virginia Eubanks [9] who examine the complex relationships between technology and race, sex/gender, and socioeconomic status. In our week on technology and health, I discussed topics such as race correction in clinical algorithms and how the overturning of Roe v. Wade in the United States has changed the way people think about health data privacy and security for apps that track menstruation. I also drew from Sasha Costanza-Chock's *Design Justice* [10] to question the ethics of designing technologies without consulting or working with people with disabilities. Finally, in a week devoted to ideas of labour and technology, I discussed racialized labour in the technology industry in terms of visas [11], manufacturing and assembly, and sourcing raw materials.

These can be difficult and heavy topics. Creating the community of learning, as mentioned previously, is a necessary step for these types of topics to be discussed in scholarly and respectful ways. I reminded students periodically of our classroom norms, especially before activities and discussions related to these topics. I encouraged students to engage with the ideas and examples presented in ways that were meaningful and sustainable for them. Missteps were possible, and as I will note in the challenges section of this paper, did occur. However, our classroom community

allowed us to meet such missteps with grace and move forward together. Success in discussing these topics was also supported through the other two ideas guiding my course design, which I will discuss next: promoting legitimacy and intellectual authority, and encouraging critical reflection.

Promoting legitimacy and intellectual authority

Another consideration in my course redesign was considering ways to promote students' legitimacy and intellectual authority in the classroom. That is, I wanted them to feel that their opinions and experiences were valued as ways to contribute to our collective learning. I reminded students throughout the course that I did not require or expect for their views on course content to align with mine, and that I encouraged dissenting opinions so long as they were presented in a way that followed our classroom norms (i.e. controversy with civility). I also included four-corner debates in the classroom, which differ from more traditional and formal debate activities as students could choose their own stance (strongly agree, agree, disagree, or strongly disagree) on a statement and then discuss this opinion with their classmates. These statements were based on complex sociotechnical issues that do not have one correct answer. For example, one statement was "Engineers should never be considered responsible for failures due to misuse of their design – intentional or otherwise." After students had time to share their reasoning with their classmates, there were often a small number of students whose stance changed, but all four positions were usually still represented at the end.

Following hooks's idea that experience should be viewed as a starting point for classroom engagement [1], I designed assignments to rely on a mix of research as well as personal experiences. In terms of research, I encouraged the use of both traditional scholarly sources (e.g., books, journal articles) as well as other sources such as news articles, podcasts, and blogs. Rather than simply positioning those other sources as biased and therefore not appropriate for their work in the course, I discussed how more informal sources such as blogs and podcasts may provide additional viewpoints beyond those in academic discourse. Student experiences were explicitly included in assignment descriptions as an attempt to legitimize their use in the course. Reflection assignments, which I will discuss in more detail later, asked students to critically consider their own course experiences and how they might impact their future work. For the debates, students had to do some written preparation by determining their initial stance and supporting it using a mix of information sources and their own experiences. The use of personal experiences was included as a way of acknowledging that students' experiences would likely inform their opinions and were both valid and valued contributions to the debate.

Students were also encouraged to pull from their own personal experiences in the small group discussions. Like the debate statements, these questions did not have one "correct" answer and students were not expected to come to a consensus in their discussions. Students assigned to lead the weekly discussion could open with a scenario they had experienced in relation to the weekly discussion question. Other students could also share their own examples or experiences that are meaningful to them. At the end of the course, several students told me that they appreciated the small group discussions as a way to follow their personal interests and share opinions without fear of being "correct" or being judged by others.

Finally, it was important to me that this work to promote intellectual authority and legitimacy was carried through in the final exam. I chose four of the discussion questions from throughout the course and told the students that of these four questions, two would show up on the final exam. Students were reminded that the questions do not have a single "correct" answer and that they should draw upon a mix of course materials and personal experiences to answer the questions. Students were allowed to bring one double-sided page of notes into the exam as a way of gathering their thoughts and preparing their responses. In this way, I created space for students to come to their own conclusions about course topics and to demonstrate those conclusions as a considerable portion of the final exam (40% of the exam grade).

Centering critical reflection

hooks writes that liberatory pedagogy should encourage students to "think critically about [themselves] and [their] lives… to move forward, to change, to grow" [1, p. 202]. I included three written reflection assignments in ENG 3020, each worth 5% of a student's final grade. At the beginning of the course, I asked students to make a collage of images representing an engineer's role in society, accompanied by a short written explanation. The intent of this assignment was twofold. Firstly, I wanted to get students thinking about the professional roles and responsibilities they would take on in co-op work terms or after graduation. Secondly, I wanted to gain an understanding of how students conceptualized professional engineering at the beginning of the course, so that I could better tailor my course content to encourage growth in terms of their thinking about topics such as professional ethics and equity.

Halfway through the course, students completed their second reflection assignment. In roughly 700 words, I asked them to reflect on their experiences in the course so far, focusing on what has been surprising and why, what has been impactful and why, and what they still want to learn or questions they still have about technology and society. Students were expected to draw upon a mix of personal experiences and materials within and beyond the course to support their reflection. At the end of the course, students completed a final reflection centered around their future as an engineer. In roughly 700 words, students responded to the following question: What lessons learned, values, or considerations do you want to take with you as an engineer who is also a used and designer of technology in the future? This prompt asked students to critically consider what they have learned in the course and how it might be applicable to their future professional work within (and possibly beyond) engineering. As in the previous reflection, students were expected to draw on their personal experiences, course materials, and external sources. In terms of assessment, I used a rubric which indicated expectations for different levels of achievement along five dimensions: the connection to reflection questions, the depth of their reflection, writing quality, citations and bibliography, and the diversity of sources used. This rubric was provided to students at the beginning of the course to serve as another tool for critical reflection; students could self-assess their own work against the rubric before submitting.

I carried this idea of critical reflection into the final examination for this course. The final assessment had to align with the critical mindsets and approaches we practiced throughout the semester. It was important to me that the questions on the exam required students to think critically about the values, perspectives, issues, and questions discussed in the course, rather than regurgitating memorized definitions or examples, or answering multiple choice questions about

the “correct” response to a simplistic ethical dilemma. The case study section of the exam (worth 40% of the exam grade) is the section that I believe encouraged the most critical thinking from students. In the scenario, students were told they have just been hired onto the engineering team for a new smartphone application. Details were given about the purpose of the app and its various features and specifications. It is important to note here that the app described was not inherently unethical; rather, its design presented possible issues in terms of data privacy and security, use/classification of demographic information (e.g., gender), access to technology and social services, etc.

Students were told to identify three questions related to the social, cultural, or ethical aspects of the project that they would want to ask before starting their work. The goal here was to draw on the mindset developed in class about the importance of asking questions and thinking about potential impact *before* designing new technologies. It encouraged critical reflection on what students already knew (from the case description), and what else they might need to know to design the technology ethically. Students also had to provide a one-paragraph explanation to explain why they felt each question was important. While I had intended this “why” to draw on both personal reasons and concepts provided in class, most answers spoke about issues as being important to engineers in general without any personal connections. I believe that this critical reflection would be stronger with that personal connection, and I am considering rewording the exam question to elicit more personal responses next year.

Successes and challenges

I experienced successes in the redesigned version of this course. My class was often boisterous and noisy, and though attendance was not perfect, the students in the room engaged wholly with the activities. Many students also remarked that they had never thought about some of the course topics before, such as gender and colonialism, especially in relation to technology and engineering. The guest lecture by Indigenous Elder Norman Meade was particularly well-attended and well-received by students, which to me highlighted the fact that students know these topics are important to them, both personally and professionally. Including this type of critical content was important to me, and with the exception of one small incident (which I will discuss below), I felt that students were able to engage with these topics in respectful and meaningful ways. I also believe that my reworking of the final exam to allow for students to authentically demonstrate intellectual authority.

In terms of my own interactions and relationships with students, my course design and policies allowed me to get to know students, hear their opinions and understand their experiences, and to value their whole selves in the classroom. While I could not completely avoid professor-student power dynamics, I believe that my course design allowed me to get to know students in a deeper way than would be possible in a traditional, lecture-only style class. My policies also had direct positive impacts on my administrative workload. For example, the use of late passes cut down my emails about extension requests to nearly 0. My overall impression of the course was that it went fairly well for its first iteration, and that I met many of my own goals in terms of pedagogy and student classroom experiences.

Alongside these successes, there were some challenges the arose. I used the textbook that had been used in past offerings of the course. At first glance through the table of contents, it seemed like it would be a good fit for my vision of the course due to its inclusion of some critical perspectives on technology. However, as the course progressed, it became clear to me that the book was more focused on *using* technology rather than *designing* it. The dominant focus on digital technologies and social media were familiar to students who use those technologies, but students in the class (who all came from mechanical, civil, or biosystems engineering) felt constrained by the limited scope of the book, and struggled to relate it to types of projects typical in their industries.

Secondly, I made some assumptions about what students already knew, and what they might be comfortable with. For example, while I thought my lecture on gender and technology worked well, I did not spend enough time setting up terminology and being clear about what topics were appropriate for discussion (e.g., how we can change the design process to better consider gender) vs. which were not appropriate (e.g., the opinion that some people are "too sensitive" about gender these days). While I recognized that my students and TAs would likely be less comfortable with the topic than I was, I failed to understand just how much scaffolding I would have to do. As a result, the small group discussions were challenging and a few students made comments that could have caused harm, and the TA was not prepared to recognize and respond to those comments. Afterwards, I got good feedback from a student about how I could scaffold the discussion and include various resources (e.g,. a "cheat sheet" of gender terminology) to avoid a similar situation next time.

Disrupting traditional engineering norms also came with some difficulty. In the very first class where I asked students to collaboratively brainstorm class norms, one student proposed something along the lines of "use logic rather than emotions in discussions". I had to decide whether I wanted to speak up, or to let the class decide on their own norms together. After a few moments, I decided to positively acknowledge the intent behind the idea (i.e., that we shouldn't get angry and disruptive with each other) while also pointing out that we are all humans with emotions, and that emotions can be a good starting place for deeper reflections on our own experiences and values. There were also a few students at the end of the course who thought I was "pushing an agenda" and failing to stay neutral – which, I will admit, is the case when it comes to pointing out how technological design can reify systemic issues in society.

A final set of challenges were more related to the class activities and assignments. While I assumed that most engineering students would have very little experience with small group discussions (as they are not common in technical lecture-based courses), I did not expect the initial level of resistance and confusion around the discussions to be as high as it was. I naïvely assumed that since students had taken part in casual conversations as well as team meetings in previous projects that they would understand how to build on each other's ideas and share airtime, which unfortunately was not the case for some students. This lack of experience, combined with some discussion prompts that were a bit too vague or complicated for students to think about on the spot, led to some stilted or inequitable discussions. Students also voiced some frustration that they did not have enough guidance to complete assignments and did not understand what I was asking for, despite the detailed assignment documents and rubrics.

While some of these challenges were uncomfortable or frustrating for myself and my students, I am heartened by a quote from hooks on mistakes:

> "In all cultural revolutions there are periods of chaos and confusion, times when grave mistakes are made. If we fear mistakes, doing things wrongly, constantly evaluating ourselves, we will never make the academy a culturally diverse place where scholars and the curricula address every dimension of that difference." [1, p. 33]

I view my challenges and mistakes as necessary steps on the path towards liberatory pedagogy. I believe that liberatory pedagogy is critical in helping engineering students to understand the relationship between technology and society, and to instill a broad sense of ethics and justice that will allow them to address the sociotechnical problems of the future.

Lessons learned

I offer some "lessons learned" from my first implementation of this course in the hopes that it may guide others who are considering reworking parts of their own technology and society (or similar) course.

- **Be more explicit about why the course has been designed the way it is.** hooks notes that in a transformed classroom, you may need to explain more about the philosophy, strategy, and intent behind pedagogical decisions in order for students to understand and accept them [1]. While I spent some time on this in the first class, I could've been more explicit about my teaching philosophy and goals – that is, that I believe learning about ethics, equity, and impact in engineering requires us to be explicit about our own opinions and experiences, and that we learn most when we discuss those opinions with others. I will reiterate this idea frequently throughout my winter 2024 course offering.

- **Provide more examples or guidance for "unusual" assignments.** Despite the existence of critical reflection assignments in the recently added prerequisite for my course, I could provide more guidance about what critical reflection actually looks like. In winter 2024, I am planning on sharing two example paragraphs, one which is more descriptive and the other which is critically reflective, and asking the students to identify the differences between them to support their own critical reflection. I also created a template for the debate reports to help students understand the expectations in terms of content, level of detail, citations, etc. for each section of the assignment. Overall, I had to recognize that not all students can understand my rubrics (if they choose to read them at all!) and therefore I need to provide more guidance in class for the types of assignments with which they had very little experience.

- **Provide more structure and guidance for small group discussions.** In my winter 2024 offering, I spent an entire class period on how to have good small group discussions, in which I went over guidelines for good small group discussions including showing respect, being prepared, building on others' ideas (including providing sentence starters), and sharing airtime. I also included a 10-minute small group discussion in that class period to help students practice those skills. Structure can also be added by thinking

about what assignment (if any) should be paired with the discussion. Last year, when select students had to prepare a response to the provided question, discussion was stilted as it was hard for students to build on each other's ideas. This year, I have revised the assignment so that students need to come up with their own open-ended discussion questions that can be used to spark those discussions.

- **Carefully scaffold discussions on more "controversial" topics such as race, gender, etc.** It may be the first time that engineering students are discussing these topics in an academic setting, so be sure to pick accessible and appropriate readings, provide terminology sheets as needed. I also think that allowing students to come up with their own questions, rather than trying to answer an instructor-defined question, allows for them to engage with the topic at different levels – though this does introduce some risk that questions posed may not be appropriate. I will provide additional guidance on what types of questions are encouraged, and if there are types of questions that are not appropriate for discussion (e.g., questions about the validity of different gender identities).

- **Acknowledge that students may not recognize or appreciate the value of liberatory pedagogy right away.** For me, this is a shift in mindset that has really helped me to stop overthinking every in-class activity, and to avoid taking critical comments personally. Students told me that while they didn't like the small group discussions at the beginning of the course (evident in their reluctance to speak up), they did eventually grow to enjoy the small group discussion days because they could share their thoughts, ask questions, and follow their interests. hooks discusses how some students may not value these types of learning experiences until months or years after the end of the course. I know that I will not make very single student in my class perfectly happy. However, I hope that a few of the students who complained about the "unusual assignments" on my course evaluations eventually recognize that they supported their learning about technology and society in productive ways.

References

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