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Maintaining Hope Amidst Critique: The Role of Social Change Frameworks in Sociotechnical Engineering Ethics Education

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Abstract

As sociotechnical ethical perspectives become more and more integrated into engineering education and popular writing, students are increasingly exposed to social and political contexts of engineering work – often through critique of existing projects. While this serves to combat the objective and neutral view of engineering, it introduces students to a new dilemma: How can engineers move forward in the face of overwhelming flaws in engineering culture and practice, and try to participate in more ideal projects, rather than abandoning engineering entirely? One aspect of this dilemma that we focus on in this work is students' capacities to remain hopeful that a better future can exist. As part of a sociotechnical data science ethics course, we presented students with materials related to both making incisive critiques of technology, and also maintaining hope and making change in the face of those critiques. Notably, materials related to change-making were not limited to more ethical engineering practices, but also included bottom-up social modes of change such as community organizing, student protest, and labor organization. Through qualitative analysis of reflection assignment responses throughout the semester, we find that students highlighted this material as critical in motivating them to view a better technological future as possible. Particularly, discussing change-making work being done by social justice organizations, as well as hosting a panel of local community leaders combatting oppressive technologies, inspired several students to adopt a more hopeful view. A few engineering students even acknowledged that other technology ethics courses they took through their department left them despondent, whereas this material gave them ideas for concrete action they can take that is aligned with their critical worldview. These results suggest that presenting students with frameworks for making social change, as well as real-world examples of that work, may be important for maintaining the hopeful attitudes crucial for acting ethically in the face of critical sociotechnical understandings.

Introduction

Critical sociotechnical education is becoming more widespread as STEM disciplines grapple with their responsibilities to society and social justice [14]. This crucial step rebuffs notions of science, technology, and engineering as objective disciplines divorced from the social world [7].

Students are being increasingly exposed to considerations of justice, fairness, sociopolitics, and ethical design.

Yet as more students are exposed to critical views of the technical world, and encouraged to act ethically in the face of injustice, a difficulty arises. Scholars of social movements, as well as a long lineage of change-makers, argue that action relies on, as prerequisites, a vision of a better future, and beliefs that change is possible and action towards the vision would be effective [17, 30]. In short, it relies on hope. Without adopting these prerequisites, students being encouraged towards ethics may instead face overwhelm, a lack of agency, and ultimately lose the motivation to act ethically [10].

The focus of this article is on an intervention aimed at bridging critique and action: teaching social change frameworks in a sociotechnical ethics course, and examining students' demonstration of hopeful attitudes and the motivation to act ethically. This course, offered through a computer science department at a medium-sized private university in Massachusetts, critiqued surveillance technologies and then offered examples of resistance, protest, community and labor organizing, reimagining, and just design as methods to change these technologies. The goal was to assist students in bypassing overwhelm and feeling knowledgeable and capable of taking ethical action once the course was over.

Using a framework of types of hope gathered by [28], we deductively coded student reflection responses and final projects to assess their expression of hopeful attitudes. We found that students expressed a wide array of hopeful attitudes and demonstrated hopeful behavior through their final projects. The most prevalent types of hope we found articulated were those expressing feelings of individual and collective agency, and the capacity to take concrete steps to achieve better futures. Students frequently wrote about and advocated for acts of resistance, protest, organizing, and building and expressing collective power. Notably, students showed less facility in articulating sharp visions of futures without surveillance, including the values that would engender such futures.

We conclude that this type of hopeful pedagogy must accompany critical sociotechnical learning, as we consider it essential to building student capacity to act ethically and change the unjust world. Several students commented in their assignments that this course stood out to them for its explicit focus on change work, whereas other ethics courses left them feeling despondent or uninspired. In future classrooms and studies, we hope that others adopt hopeful pedagogy alongside critique – including extra material focusing on envisioning better futures – and continue to study the effects of these materials on wider student populations.

Background

Sociotechnical, critical ethics in STEM education

There has been a growing interest in sociotechnical education from the standpoint of STEM education researchers. Engineering culture has traditionally been shaped around viewing it as a

neutral and objective practice, which has led to the devaluation of the social, political, and economic aspects of engineering [12, 17, 20, 24, 25]. Cech describes this devaluation as driving disengagement in engineering, where nontechnical aspects of engineering are deemed "lesser value or outside the scope of engineering" [7, 22].

Engineering ethics, which spans both technical and social aspects of engineering, has historically experienced the same treatment. Ethics that focuses on professional codes of ethics and dilemmas or case studies analyzed through moral philosophical frameworks (e.g., consequentialism, deontology, or virtue ethics) is perhaps the most common form of engineering ethics education [14, 15]. But recent trends in engineering ethics education have seen advocacy for a more expansive view of ethics: including contextualization drawing on Science and Technology Studies (STS) [8,18], and social impacts like sustainability and social justice [23].

Yet as critical sociotechnical treatments of engineering and ethics become more widespread, there is a risk that students feel existentially burdened, or hopeless in the face of large social and technological issues [10]. Students may fail to take ethical action in the face of these emotions, which should be the goal of ethical instruction.

Hope as critical to the motivation to act ethically

In other politically-oriented disciplines, such as social movement theory and communication studies, it is a fundamental consideration that action (e.g., for political change, or in the face of a health crisis) can be stimied by what are called avoidance emotions – fear, hopelessness, or inefficacy (see [17] for a review from social movement theory; and [30] for a review from communication studies). In contrast, what [17] calls approach emotions – anger, feeling efficacious, hope – are said to lead to motivation to act. Recent social psychological studies have been evaluating models of hopeful attitudes leading to motivation to take political action, and concluding that utopian visioning – imagining a better society – has a positive effect on motivational attitudes [1, 4, 5].

One major attitude that factors into approach emotions, the subject of this study, is hope. Discussions of hope are common among leading figures in social change. Macy, in her work *Active Hope*, describes hope as both involving believing in an outcome and desiring a better future, but also as a practice and process [19]. West, in *Democracy Matters*, discusses what he calls "tragicomic hope" as preserving the belief in better futures while "staring into the face of hate and hypocrisy," countering nihilism [29]. Kaba shares her view of hope as a discipline, something to be practiced every day to counter a hopeless world [27]. In the field of education, Freire is noted for his writing on hope, arguing that "the hope of remaking the world is indispensable in the struggle of oppressed men and women" [16]. Some recent studies invoke Freire and his pedagogy as they examine students' ability to connect engineering to social crises of our time – climate change and social justice [26, 21].

Hope is a messy concept used in a multitude of ways between disciplines and different practitioners. In a sharp and insightful review, [28] dichotomizes hope into five major types based on a wide reading of literature from philosophy, theology, and psychology: *patient* hope,

critical hope, *sound* hope, *resolute* hope, and *transformative* hope. Patient hope captures the notion that things will work out, life tends towards a positive direction, and emphasizes moral literacy surrounding virtues of trust, patience, responsibility, and fortitude. Critical hope embodies seeing a lack in the world based on your experience, envisioning a better future, and deciding to push towards it. Sound hope describes the more calculated hopeful attitude, imagining highly probabilistic futures and concrete ways to move towards that new world. Resolute hope accepts that some futures may be low-probability, but rejects nihilism and pessimism, seeing the plasticity of society as a means to think hopefully despite the odds. Finally, transformative hope also hopes against the odds, but does so in a way that inspires hope in others through a vision rich with motivating values, ultimately mobilizing collective action.

We use [28]'s framework in this study because it precisely captures prerequisites to ethical action that we are concerned with: remaining steadfast, visioning better futures, rejecting pessimism, and imagining individual or collective steps to new worlds. By measuring these types of hope, we capture the attitudes necessary for feeling efficacious and motivated, ultimately driving ethical action based on critical views of a sociotechnical world.

Course Description

The course driving this research was taught as an elective, special topics course offered through the computer science department at a medium-sized, private university in Massachusetts. Its focus was on sociotechnical ethics through the lens of analyzing surveillance technologies. It was held as a seminar style course, meeting twice weekly, featuring weekly readings, videos, or podcasts to engage with outside of the classroom, while in-class time was devoted to discussion and reflection. Throughout the semester, students wrote reflections based on prompts for each week's material. Additionally, they completed a mid-semester project requiring them to analyze a surveillance technology of their choosing in groups and present findings to the class, and a final project where they did the same but with deeper analysis on a different technology, and presented findings to a public exhibition attended by community members from the university and beyond.

The course was broken into three major sections: (1) problem, (2) practice, and (3) application. The problem section included materials presenting various surveillance technologies (data collection, targeted ads, workplace surveillance, racialized surveillance) and critiqued them by leveraging frameworks of power, democracy, capitalism, labor, and privacy. The practice section highlighted the work of practitioners actively opposing surveillance technologies (critical technology theorists, exploring design justice, featuring local community organizers) and focused on how to take action. Finally, the application section blocked out several weeks for students to craft their final projects, with frequent check-ins and dialogues between project groups and instructors to refine their work. We include a condensed syllabus in Appendix A, and a more detailed description of the course can be found in [31].

Relevant to the purpose of this article, the material we featured related to social change was predominantly included in the practice section. The section began with readings from

Guendelsberger's *On the Clock* [13] discussing worker resistance to Taylorist surveillance, and from Browne's *Dark Matters* [6] as she described enslaved people's resistance against slaveholders in the United States. It continued by featuring a panel of local community organizers and city politicians who spoke about their work and engaged in dialogue with students. Additionally, this section included articles about Alphabet (Google) workers unionizing and protesting the use of Google technology in the Occupied Palestinian Territories, a student organizing toolkit to protest campus recruitment for companies supplying Immigration and Customs Enforcement (ICE) with critical technology, as well as readings and videos about power and resistance from D'Ignazio & Klein's *Data Feminism* [11], Costanza-Chock's *Design Justice* [9], and Benjamin's *Race After Technology* [2]. Further details on these materials can be found in the condensed course syllabus in Appendix A.

We additionally note that this course was not explicitly designed with the background social psychological and social movement literature in mind; viewing hope, visioning, and efficacy as critical precursors to the motivation to act ethically. We did, however, have an intuitive sense that much of the critical content had the potential to demotivate students and burden them with existential dread. Moreover, as the course progressed, as the instructors debriefed class sessions, we found that students were, indeed, feeling burdened by the material and we wanted to alleviate these feelings. The material that we included on social methods of change, and encouragement during final projects to reimagine surveillance technologies, was intended simply as means to counter these demotivating feelings without a sharp hypothesis of their role in ethical action.

Methods and Research Setting

To gauge students' hopeful attitudes as they grappled with course material, we analyzed reflection assignment responses as well as students' final projects. In particular, two reflection assignments contained the most relevant information for assessing hopeful attitudes: a reflection on the role of citizens in a democracy, and the final reflection at the end of the semester. Prompts for both reflections and the final project are included in Appendices B and C. Responses were only analyzed for those students who consented to us using them for research through the Tufts University IRB.

We utilized a qualitative deductive coding method [3] to find discussions of hope in student materials. Our coding scheme was derived from [28]'s dichotomy of hopeful attitudes, including five distinct types of hope: patient hope, critical hope, sound hope, resolute hope, and transformative hope. This type of coding, leaning on theoretical literature to structure data, allows us to capture rich elements of participant thinking while also commenting on the prevalence of such attitudes across the class population. Brief summaries of these types of hope, including Webb's description of their objective, cognitive/affective, and pedagogical components, are listed in Table 1.

To code student work, one author assigned codes to student's written responses or project materials, and the results were reviewed to ensure quality. We note that this methodology could be performed more rigorously, as well as with multiple coders and judged for inter-rater reliability. Due to time constraints, that was not performed for this study. Additionally, we noted instances of students referring to specific material presented during the course.

	Objective	Cognitive/Affective	Pedagogy
Patient Hope	Trust in ourselves, others, the goodness of the world	Secure trust in the behavior of an other	Education as moral literacy; instilling virtues of trust, patience, responsibility, perseverance
Critical Hope	Directed towards a world without degradation, suffering, anxiety	"Something is missing"; a tension between promise and reality, future-oriented longing	Rejects the present but does not impose a vision; creates spaces of possibility for students to reflect on experience and uncover longing
Sound Hope	Directed towards a concrete, specific future goal	Envisioning an objective that appears possible; hoping because of reality rather than in spite of it	Critical analysis of current policies; calculating probability of success through research; envisioning pragmatic steps
Resolute Hope	Hoping against the evidence; setting aside overwhelm	Anti-deterministic; assuming individuals are free, have agency; assuming the world is molded by agency	High-hope classrooms; setting hopeful goals, including "hope activities" to learn patterns of thinking related to hoping
Transformative Hope	Hoping because of the inspirational qualities of the goal itself; expanding horizons of possibility	Utopian vision; sense of possibility grounded in confidence in the powers of human collective agency	Explicitly political; drawing on thwarted desires of students to mobilize action around a vision; inspiring mobilization for transformation

Table 1: Brief descriptions of the five types of hope from [28]'s review of hope theory and literature. Aspects included are the objectives, cognitive/affective components, and pedagogy associated with each type.

Our data is drawn from student responses from a computer science special topics course offered at Tufts University, a medium-sized private predominantly white university in Massachusetts. The course was offered to students of all majors and had no prerequisites, which resulted in the course being taken by students of many majors – including computer science, biology, economics, women's and gender studies, political science, international relations, and performance arts – and many different academic years. The course was additionally co-designed and co-taught by the two authors, who have STEM degrees in computer science and engineering. This iteration of the course was taught in Fall 2022, and had an enrollment of 38 students. In

Table 2, we share a brief summary of student demographics for the group who consented through IRB.

	Total Students	Women	Nonbinary	Men	Students of Color	White Students
STEM Majors	13	7	1	5	8	5
Liberal Arts Majors	7	7	0	0	3	4
Total	20	14	1	5	11	9

Table 2: Participant demographics.

We note that, despite the course being offered at a predominantly white university, our course was attended by a majority of students of color (22 of 38 students, or 58%) and these demographics are reflected in the consenting group of students (11 of 20, or 55%, students of color). This should be taken into consideration while interpreting our data and results, as well as for the applicability of results to other student groups or populations.

Results

We break down our findings by (1) those from student reflection assignments, where they were discussing their intentions and motivations related to hope and action, and (2) those from student final projects, where they demonstrated their hopeful attitudes related to reimagining and changing the surveillance system they chose to analyze. Then, we examine which class materials students most often referred to in their discussions of hopeful attitudes.

Expressing hopeful attitudes in student reflections

In students' reflection responses, over half the consenting participants articulated hopeful attitudes across the five types of hope from [28]. The results of our deductive coding of reflection assignments are listed in Table 3.

	Total Students	Patient Hope	Critical Hope	Sound Hope	Resolute Hope	Transformative Hope

STEM Majors	13	7 (54%)	5 (38%)	11 (84%)	8 (62%)	8 (62%)
Liberal Arts Majors	7	4 (57%)	4 (57%)	5 (71%)	4 (57%)	2 (29%)
All Majors	20	11 (55%)	9 (45%)	16 (80%)	12 (60%)	10 (50%)

Table 3: Deductive coding of [28]'s types of hope for student reflection assignment responses, disaggregated by student major group (STEM or Liberal Arts).

In order of most to least prominent hopeful attitudes, students most commonly reflected sound hope – which centers around a future-oriented, calculated type of hoping based on identifying steps to a possible new reality – and resolute hope – which counters pessimism towards change in an individualistic manner, seeing the world as able to be molded by action, and sparks individual agency. Students frequently cited types of individual action as steps to move towards a vague vision of democracy or a world without predatory surveillance. The breadth of actions cited was expansive, from researching tech companies' privacy scandals, to educating and spreading awareness, organizing petitions or marches, using technical skills for good, and simply raising one's voice. Notably, a few students mentioned how their work in class increased their sense of agency. One student, double majoring in international relations and computer science wrote, "I truly felt I was able to make an impact when I spoke to people at the [final project exhibition]. I saw the looks of shock in their eyes… That reaction was enough to convince me about the importance of educating the public." Another computer science student noted that being more conscious of her digital footprint made her "slightly fearful of the increasing levels of surveillance," but followed by expressing that "instead of being a bystander, I am determined to use my voice to speak up about the injustices in the field of computer science and technology."

One hopeful attitude that was present in many student reflections was that of patient hope, which is a type of hope expressing calm in the face of unrest; that things will work out, and one can focus on acting morally, responsibly, and having a sense of fortitude [28]. This attitude was widespread in reflections on the role of citizens in a community and democratic society. Many students focused on the responsibility aspect of patient hope, expressing that people have duties towards their communities: speaking up about injustices, being active, engaging in discussions. One computer science student shared that "whether there is a law we feel is detrimental we should do what we can in our power to change it." Another computer science and STS double major wrote that the role of a citizen is "to know and understand injustices… and want to do something to solve it." Two other students noted other aspects of democratic life as the responsibility of its citizens: voting, following laws, being informed. One performance arts student even noted that, in her experience, "change is slower than a turtle," articulating a call to patience and resilience even if "you may never see the change you dream of in your small lifetime."

Many students also discussed hope in the collective, which is best described by transformative hope. Webb [28] describes this type of hope as also countering pessimistic thinking, but in contrast to resolute hope, focused more on collective agency than individual agency, articulating values and visions that mobilize a collective. Students predominantly focused on the part of transformative hope concerned with collective action, and less on expressing values and visions. Several mentioned that although individual action may seem inconsequential, it can expand to a larger scale, reach others, and find efficacy through mass mobilization. One computer science student wrote that "[change] may be small and can start in our communities or even reach the nation." Another computer science student sharply articulated that "it may feel that one person does not have enough power to change the over-surveillance of marginalized communities; however, a single person does have the power to build collective power with others."

Perhaps most notable were student responses that explicitly mentioned feelings of pessimism and how they countered them with hopeful attitudes. One performance arts student wrote that "as someone who leans towards nihilism, I find considering how one can work towards the larger project of abolishing a specific system through smaller mini-abolition projects to be a sign of hope." A computer science student wrote, "One of the best and most unique parts of the class was the focus on organizing, something I haven't seen in any other course at Tufts... Often when courses focus on a topic that might be discouraging… students leave the class feeling pessimistic – but with this class, I felt like I understood what I could do to combat surveillance in my life and community."

Yet not all student reflections were hopeful. One computer science student expressed explicit pessimism, sharing that "issues are often daunting and feel impossible to tackle. It was great to hear how smaller groups… did something about them, but it still feels like outliers." Another computer science student, who is a black female, shared that when thinking of change work, she contextualizes this with her identity: "There's always this discussion of black women not being able to relax and always having to do the heavy lifting of social organizing… sometimes you just don't want to be the person organizing the effort… It sounds selfish, but you also can't lead everything." This latter example reflects the complexities around labor, particularly in volunteer, community-driven roles, and marginalization. Both it and the former example importantly remind us that there is no cure-all pedagogy, and that these discussions of ethical action must incorporate the nuances of social identity and position.

Demonstrating hopeful attitudes in student projects

While reflections are spaces where students can easily state hopeful intentions, projects allow us to examine if they can materialize those intentions and act on them. In total, 10 groups contained at least one student who consented to study through IRB. Students created projects analyzing a wide array of surveillance systems, including New York City Police Department (NYPD) surveillance, Amazon Alexa, COINTELPRO, ShotSpotter (a gunshot detection software used by police), COVID-19 surveillance systems in China, a smart city being constructed by Saudi

Arabia called NEOM, and more. Our deductive coding results for group projects, as well as a breakdown of groups by major composition, can be found in Table 4.

	Total Groups	Patient Hope	Critical Hope	Sound Hope	Resolute Hope	Transformative Hope
STEM Groups	4	0 (0%)	1 (25%)	2 (50%)	2 (50%)	1 (25%)
Liberal Arts Groups	2	0 (0%)	2 (100%)	1 (50%)	2 (100%)	1 (50%)
Mixed Groups	4	0 (0%)	1 (25%)	2 (50%)	3 (75%)	2 (50%)
All Groups	10	0 (0%)	4 (40%)	5 (50%)	7 (70%)	4 (40%)

Table 4: Deductive coding of [28]'s types of hope for student final projects, disaggregated by student major group (STEM or Liberal Arts).

The most prevalent type of hope we found articulated through student projects was resolute hope, which focuses on individual agency as countering pessimistic thinking. Somewhat overlapping, we also coded several of the same projects as embodying sound hope, as the individual actions advocated by students demonstrate some next steps towards an achievable vision. Most of the projects advocated for a variety of individual actions as counters to these surveillance measures. The group project examining NYPD surveillance created a zine which included a long list of ways to protect oneself against police surveillance – shielding your face, knowing local political representatives, recording police brutality – and also linked to other resources with similar lists. One group created an entire card game centered around digital surveillance and how to resist it, featuring cards players could use as protection like "block cookies," "opt out of data collection," "do a sit in," and many more. Through encouraging their audiences to resist surveillance, as well as giving them tangible steps to take, students demonstrated a strong capacity to inspire individual agency and push back against pessimism.

Some projects also advocated for collective action, or cited existing social movements as points of resistance and change, which we coded as articulating transformative hope. Moreover, several projects articulated visions for possible futures driven by values such as privacy, equity, and community care. These projects also had some overlap with what we saw as critical hope, as students articulated visions and reimagined their chosen surveillance measures. One noteworthy expression of these visions was the zine about NYPD surveillance. This group reimagined a future of police abolition, where community safety was achieved through affordable housing, healthcare for all, and food access. They connected their work with movements for police abolition, like #8toAbolition, and encouraged readers to mobilize with these groups. The group

examining Chinese government COVID-19 surveillance connected their work to the A4Revolution movement and reimagined government policies to focus on transparency, democratic consent, and fairness in surveillance. A project examining the ecological footprint of cloud infrastructure advocated for degrowth and explicitly called out individual environmental action as "akin to people who don't use plastic straws, which ultimately does not affect Google's bottom line."

Interestingly, no projects articulated attitudes related to patient hope, concerned with staying steadfast in the face of challenge, or cultivating moral attitudes such as responsibility or fortitude. Whereas the reflection assignment focusing on our role in our communities prompted students to express people's responsibility to fight injustice, there were no such advocacies in the projects. Rather, students laid out steps that one could take, but took no explicit moral or faithful stances.

References to class material as inspiration

In final reflection responses, several students noted specific parts of the class that stuck with them as inspiring hopeful attitudes or a motivation to act. These parts included almost all of the specific change-making content we included, as well as the act of creating a project exhibition. A breakdown of material referenced by students is depicted in Table 5.

	Total Students	Local Change-Maker Panel	Google Workers Union	Simone Browne Resistance Acts	Final Projects
STEM Majors	13	8 (62%)	1 (8%)	0 (0%)	2 (15%)
Liberal Arts Majors	7	1 (14%)	0 (0%)	1 (14%)	0 (0%)
All Majors	20	9 (45%)	1 (5%)	1 (5%)	2 (10%)

Table 5: Mentions of other course material in student final reflection responses, disaggregated by student major group (STEM or Liberal Arts).

Overwhelmingly, the most frequently mentioned course material was the panel of local change-makers who were brought in to one class session to discuss their work. Students strongly resonated with this experience, citing it as one of the parts they remember most. One computer science student wrote that "the panel of community organizers was great, and very informative to have community members from such different spaces all talk to us about their experiences." A computer science and STS double major shared that "the panel of organizers and specifically [panel participant]'s work with the ACLU stuck with me because it made connections from the larger themes of the course down to a local level."

A few other students mentioned other change-making content from the course, including discussion of workers forming the Alphabet (Google) union and protesting Project Nimbus, resistance acts described by Simone Browne in her book *Dark Matters* [6], and the final projects themselves. The computer science graduate student writing about Google workers reflected on the role of someone in a democracy by saying "if Ariel Koren from Google did not speak up and told the whole truth about project Nimbus, not one would have known this." He also continued to write, "this is why I tried my own best to show my resistance to the Chinese surveillance system by letting others know what is happening right now in China," referring to his final project exhibition. An American studies student said "I feel that my understanding of resistance measures grew substantially during this class… I thought Simone Browne's concept of 'sous-veillance' introduced some interesting nuance… Generally I believe that 'the master's tools will never dismantle the master's house,' however, I came to question whether technology is intrinsically a tool of oppression."

Discussion

The necessity of hopeful pedagogy amidst critical pedagogy

As more educators are pushing for technical engineering education to embrace the sociotechnical, including political dimensions of technology and critiques of the status quo [7, 24], it is likely that more students will be exposed to worldviews that make them feel hopeless [10]. We found in our students' responses that there were several references to feelings of hopelessness, pessimism, or nihilism. While the majority of them mentioned these feelings only to then state how the course made them feel hopeful, it is notable that one student remained feeling pessimistic.

In [28]'s framework, countering low-odds thinking or pessimism is a central part of resolute and transformative hope. We can conclude from our findings that the material we featured surrounding social change and hopeful acts inspired a rejection of pessimism in several students. Students who mentioned the inclusion of community organizing content, resistance acts, and the panel of local organizers, indicated that they felt empowered by this content. Moreover, as 45% of students mentioned the panel of local change-makers in their reflection materials, we see evidence that offering local, tangible, relational experiences related to change-making is an effective form of hopeful pedagogy.

Additionally, one attitude that was prevalent in student reflections and projects was that of transformative hope – particularly with a focus on collective action. Several students, as they were discussing the role of citizens in democratic practice, or reflecting on their experience in class, noted that while it may be easy to feel disempowered as an individual facing society, it is easier to feel effective when acknowledging the power of the collective. Social movement study recognizes that collective efficacy and identifying with a social movement can be powerful attitudes that drive motivation to act [17, 1, 4]. Presenting examples of collective power, as well

as a diverse array of movements working towards ethical goals, may be a useful pedagogical tool for inspiring feelings of efficacy in students.

We can also learn from students' projects that examples of individual action and resistance measures are strong pedagogical methods for inspiring student action. It was notable that nearly all student project groups displayed examples of resolute hope, mostly focusing on individual action and resistance against their chosen surveillance system. This demonstrates to us that students are motivated to be ethical actors, as they used their projects to inspire ethical action in others. The active format of the final project exhibition, designed to have students spread their findings to the wider community, appears to be another useful method for cultivating hopeful attitudes. In the vein of transformative hope, students became teachers, and sought to motivate others to action.

A strong focus on action without equally strong vision

One major consideration for future work is that, while students excelled at both writing about and demonstrating motivation through individual actions, they appear to have more difficulty articulating clear visions of a better future. Part of the reason this may have been the case is that, for one, our reflection prompts were not asking students to articulate their visions of a better future. However, even though we did not ask about, for example, hopeful attitudes versus pessimistic attitudes in the final reflection prompt, many students did write about this without encouragement.

Student reflections and projects were full of strong examples of individual and collective action as remedy to the surveillance systems they examined in class. A large number of students described taking action in their communities to counter injustice, including protest, voting, education, and community organizing. In final projects, groups instructed others in how to evade police surveillance, how to protect your data online, and also advocated for the use of Freedom of Information Act (FOIA) requests, protesting police gunshot detection systems at city council meetings, and for general awareness and education.

Some student final projects did contain aspects of visioning, but in vague terms. The best examples were those few which advocated for community safety as opposed to surveillance measures, as well as reimagined government policies around transparency and privacy, but those were exceptional cases. For the most part, student projects did not put forward a vision to complement their critique of the surveillance system they analyzed.

From the social movement and social psychological disciplines, envisioning a better society frequently appears as a critical factor towards motivation to act [17, 1, 5, 4]. Similarly, prominent social theorists and activists, such as Macy, West, and Kaba, all align on describing hope as something that cultivates a belief in a better future [19, 29, 27]. From this standpoint, the conclusion that our course did not inspire much observable utopian visioning means that one critical aspect of motivating students to act ethically was lost.

However, as Kaba and Macy make clear, hope is often something of a practice, something to be cultivated [27, 29]. Webb [28], in his description of resolute hope, also reflects

on pedagogy through “hope activities”: classroom activities that cultivate a pattern of thinking hopefully. It is likely that students did not demonstrate strong skills of visioning because it was not as central to our pedagogy as practicing critique and learning how to resist through examples of individual and collective action. At the same time, one other aspect of this result may be that, as opposed to critical skills, which are prominently features in other courses and widespread in media, visioning skills are not as prominent in the dominant culture. It is thus even more important that critical sociotechnical courses become spaces to practice visioning and hopeful attitudes.

Conclusion and Future Work

In this article, we analyzed student learning during a university course on sociotechnical ethics, specifically focused on learning surrounding hopeful attitudes as a precursor to students taking ethical action in the face of critical sociotechnical worldviews. Using a framework conceptualizing five types of hopeful attitudes, we qualitatively, deductively coded student reflection assignment responses and final projects to gauge learning through expression of these attitudes. We found a wide variety of hopeful attitudes demonstrated in both reflection assignments and projects, noting that types of hope focused on critique and action were more prevalent than types envisioning better futures. Additionally, we found that one course activity in particular, featuring a panel of local change-makers during one class session, inspired many students to the degree that they shared back their lasting memory of the event in their assignments. We conclude that, as hopeful attitudes – countering pessimistic thinking, envisioning better futures, and planning action as concrete steps to achieve new worlds – are key factors to motivate ethical social and political action, the type of content offered in this course is critical for a sociotechnical education that includes ethical instruction.

There are several directions that can be taken for future study of the role of hopeful pedagogy in bridging the gap between critical sociotechnical education and ethical action. One is that the same type of instruction and study should be done with diverse student populations. Our sample, in a private predominantly white institution, is biased towards certain types of students trained for certain skills. Other institutions may find different results from the same material. Additionally, crafting similar courses, but with more explicit focus on pedagogy supporting envisioning better futures, would yield important results. Our study found that students prioritized critique and action over articulating strong, value-driven visions for a world without oppressive surveillance, but that is likely due to an imbalance of focus during the course.

One major takeaway, however, is that students appear to be grateful for this type of content, which counters the depressing nature of other ethics courses or discourse in media. Educators looking to adopt sociotechnical instruction in their curricula would benefit from including material centered around social change, with an emphasis on activities that promote hopeful attitudes and skills. Without such content, students are at risk of becoming overwhelmed

by pessimism and not acting ethically. Hopeful pedagogy bridges this gap, and stands to motivate students towards ethical action beyond the classroom.

References

[1] V. Badaan, et al. "Envisioning change: An empirical test of the social psychological model of utopian thinking and collective action," *Journal of Social Psychology Research,* vol. 1.1 pp. 77-96, 2022.

[2] R. Benjamin. *Race After Technology: Abolitionist Tools for the New Jim Code*. Polity, 2019.

[3] A.J. Bingham & P. Witkowsky. "Deductive and inductive approaches to qualitative data analysis," *Analyzing and interpreting qualitative data: After the interview* pp. 133-146, 2022.

[4] J. Bleh, et al. "From imagination to activism: Cognitive alternatives motivate commitment to activism through identification with social movements and collective efficacy," *British Journal of Social Psychology,* vol 64, 2024.

[5] Bosone, Lucia, et al. "Visioning sustainable futures: Exposure to positive visions increases individual and collective intention to act for a decarbonated world." *Global Environmental Psychology* 2 (2024): 1-28.

[6] S. Browne. *Dark matters: On the surveillance of blackness*. Durham, NC: Duke University Press, 2015.

[7] E. A. Cech "Culture of disengagement in engineering education?" *Science, Technology, & Human Values* vol 39, pp. 42-72, 2013.

[8] S. Chance, et al., "Above and beyond: Ethics and responsibility in civil engineering," *Australasian Journal of Engineering Education,* vol 26, pp. 93-116, 2021.

[9] S. Costanza-Chock. *Design Justice: Community-Led Practices to Build the Worlds We Need.* Cambridge, MA: MIT Press, 2020.

[10] A. Danowitz, and K. Beddoes. "Characterizing Mental Health and Wellness in Students Across Engineering Disciplines." In 2018 *The Collaborative Network for Engineering and Computing Diversity Conference Proceedings*, 2018.

[11] C. D'Ignazio, and L. Klein. *Data Feminism*. Cambridge, MA: MIT Press, 2020.

[12] E. Godfrey. "Understanding Disciplinary Cultures," In *Cambridge Handbook of Engineering Education Research*, Cambridge: Cambridge University Press, pp. 437–456, 2014.

[13] E. Guendelsberger. *On the Clock: What Low-Wage Work Did to Me and How It Drives America Insane*. Little, Brown, and Co., 2019.

[14] J. R. Herkert, "Engineering Ethics Education in the USA: Content, Pedagogy and Curriculum." *European Journal of Engineering Education* vol. 25, pp. 303-313, 2000.

[15] D. J. Hess, and L. A. Satcher."Conditions for successful environmental justice mobilizations: an analysis of 50 cases." *Environmental Politics*, vol. 28, pp. 663–684, 2019.
[16] P. Freire. *Pedagogy of Hope: Reliving Pedagogy of the Oppressed.* Continuum, 2004.
[17] B. Klandermans. "Motivations to action," in *The Oxford handbook of social movements,* 2015.
[18] M. S. Kleine, K. Zacharias, and D. Ozkan. "Contextualization in Engineering Education: A Scoping Literature Review." *Journal of Engineering Education* pp. 1-25, 2023.
[19] J. Macy, and C. Johnstone. *Active Hope: How to Face the Mess We're in without Going Crazy.* New World Library, 2012.
[20] C. Mitcham, "A Historico-Ethical Perspective on Engineering Education: From Use and Convenience to Policy Engagement." *Engineering Studies* vol. 1, pp. 35-53, 2009.
[21] D. Morales-Doyle, "Putting science education in its place: the science question in social justice education." *Cultural Studies of Science Education* vol. 18, pp. 81–94, 2023.
[22] S. Niles, S. Roudbari, and S. Contreras. "Integrating Social Justice and Political Engagement into Engineering." *International Journal of Engineering, Social Justice, and Peace,* vol. 7, pp. 52-64, 2020.
[23] M. Polmear, A. R. Bielefeldt, D. Knight, N. Canney, and C. Swan. "Analysis of Macroethics Teaching practices and perceptions in engineering: a cultural comparison." *European Journal of Engineering Education* vol. 44, pp. 866-881, 2019.
[24] D. Riley, "Engineering and Social Justice." *Synthesis Lectures on Engineers, Technology, and Society* vol. 3, pp. 1-152, 2008.
[25] S. Roeser. "Emotional Engineers: Toward Morally Responsible Design." *Science and Engineering Ethics,* vol. 18, pp. 103-115, 2012.
[26] I. Salinas, M.B. Fernández, D. Johnson, et al., "Freire's hope in radically changing times: a dialogue for curriculum integration from science education to face the climate crisis," *Cultural Studies of Science Education* vol. 18, pp. 21–39, 2023.
[27] B. Sonenstein, and K. Wilson. "Hope Is A Discipline feat. Mariame Kaba." *Beyond Prisons Podcast*. Jan, 2018. Available: https://www.beyond-prisons.com/home/hope-is-a-discipline-feat-mariame-kaba. [Accessed Jan. 13, 2025].
[28] D. Webb, "Pedagogies of Hope," *Studies in Philosophy and Education,* vol. 32, pp. 397–414, 2013.
[29] C. West. *Democracy Matters: Winning the Fight Against Imperialism.* Penguin Books, 2005.
[30] K. Witte, and M. Allen. "A meta-analysis of fear appeals: Implications for effective public health campaigns." *Health education & behavior,* vol. 27, pp. 591-615, 2000.
[31] D. S. Özkan and N. Rabb. "Critical, Motivated, Hopeful: Empowering Students Through Sociotechnical Data Science Ethics Education." *Teaching Ethics* vol. 24, pp. 97-127, 2024.

Appendix

A. Condensed Course Syllabus

	Week	**Topic**	**Read/Do for the Start of Class**
Week 0	Pre-Class	Introductions on Canvas	
Part 1 - Problem			
Week 1	Wednesday 9/7	What is a problem Surveillance - Intro	*Shoshana Zuboff on surveillance capitalism | VPRO Documentary*
Week 2	Monday 9/12	Surveillance Capitalism - Past & present surveillance	***Zuboff - Chapter 1 - Home or Exile in the Digital Future p. 3-26***
	Wednesday 9/14	Surveillance Capitalism	***Zuboff - Chapter 2 - August 9, 2011: Setting the Stage for Surveillance Capitalism p. 27-62***
Week 3	Monday 9/19	Histories of surveillance	***Browne – p. 12-24 (Intro – Surveillance studies)*** *Philosophize This! – Foucault part 1 & 3*
	Wednesday 9/21	Racialization in Power/Knowledge Introduce Paired Research Project	***Browne – p. 76-83 (Crisis & Lantern Laws)***
Week 4	Monday 9/26	Work day for Paired Research Project	Submit initial drafts to questions for the research project
	Wednesday 9/28	Presentations of Paired Research Projects	3-5 minute presentation on your research project Submit a 1 pager memo on the crisis you chose for your project
Week 5	Monday 10/3		
	Wednesday 10/5	Nonacademic ways to	*Guendelsberger chapters on*

		make change - *organizing*	*Taylorism* *Revisit - Browne - Resistance Themes from intro & ch1 (pg 48, 54,55,72)*
Monday 10/10 NO CLASS			
Week 6	Wednesday 10/12	***Panel of Local Organizers & Changemakers:***	*Read about guests and their work* *You can use these to prepare some questions that you can ask to the panel. Think about the arc that we've traveled as we've deconstructed surveillance thus far in class: recognizing the problem, seeing it from many angles, and then asking some questions about "how do we change this?" Our panelists are especially suited to talk about the last aspect -- how to change certain systems and policies. Keep all that in mind as you craft your questions!*
Part 2 - Practice			
Week 7	Monday 10/17	Nonacademic ways of making change – examples from tech	***No tech for apartheid/Union Organizing*** ***Mijente – 'Who's Behind ICE' report (executive summary); #NoTechForICE student toolkit***
	Wednesday 10/19	Building a framework: Defining and understanding problems	***D'Ignazio & Klein - Chapter 1, Power Chapter 2, Collect, Analyze, Imagine, Tech***
Week 8	Monday 10/24	Stakeholders through a lens of power	***Costanza-Chock - Design Justice - Chapter 3 - Who's not at the table***
	Wednesday 10/26	Reimagining the Default Settings of Technology & Society by Dr. Ruha	*https://iclr.cc/virtual_2020/speaker_3.html*

		Benjamin	
Week 9	Monday 10/31	Starting Final Projects	***Final Project Planning***
	Wednesday 11/2	Forming groups and picking projects	Final Project Planning
Part 3 - Application			
Week 10	Monday 11/7	What is YOUR problem? Defining and understanding YOUR problem	Documenting research process Submit on canvas: What are you reading this week for your project?
	Wednesday 11/9	Initial Group Meeting and Brainstorm	Your own project research. Nothing to submit.
Week 11	Monday 11/14	Historicizing your problem	Submit on canvas: >2 article titles & links per group to discuss with another group.
	Wednesday 11/16	Workshop & Feedback for Final Projects	Prepare introduction to your final project with specific aspects you want feedback on.
THANKSGIVING BREAK WEEK OF 11/21			
Week 12	Monday 11/28	Who are the stakeholders of your problem?	Submit on canvas: Discussion posts based on student-driven research
	Wednesday 11/30		Your own project research. Nothing to submit.
Week 13	Monday 12/5	Student Presentations (3-5 minutes) to get ready for Poster Gala	Submit on canvas: Discussion posts based on student-driven research
	Wednesday 12/7	Incorporate feedback from Monday - Final Work Day	Your own project research. Nothing to submit.
Week 14	Monday 12/12	Final - Poster Gala for Tufts Community with food	Submit on canvas: Discussion posts based on student-driven research

B. Reflection Prompts

Week 6: Doing the work to resist
Reflection prompt: 200-300 words

In light of the stories shared by local organizers who worked on many campaigns, including helping to put into effect facial recognition bans in Somerville and Boston, we can think about the role of organizations and government in the fight against increased surveillance. Addressing problems at a local level presents an opportunity to learn and act in our place-based communities, embodying virtues of civic democracy.

What do you think the role of a citizen is in their respective communities? Their neighborhood? Their workplace? When thinking of what "democracy" means, what actions do you think help bring about democracy? How might this relate to projects of surveillance that we have learned about?

End of semester – Individual reflection

This reflection is more involved than the typical reflection post, so make sure to give this some time and more words than usual. Instead of the typical 200-300 words, this reflection should be somewhere between **600-800** words.

To help you with your task, we created a scaffold of questions that you can answer to help you think through the assignment.

- How did this class compare to your typical courses thus far at Tufts?
- How did you feel that your conception of technology, computer science or data science was critiqued or challenged (if at all)?
- How did you feel that your conception of surveillance, power, or social systems was critiqued or challenged (if at all)?
- How did you feel that your domain-specific knowledge was utilized or not utilized during the class?
- What might you take away with you from the class?

C. Final Project Prompt

Surveillance measures can be defined broadly. If you are unsure, please chat with [instructors]. For this final project, you can work individually or in a group.

There are several guiding questions that will help you structure your project and make sure you analyze multiple aspects of the measure you chose:

- What is the **surveillance measure** and what **organization(s)/company(ies)** created and implemented it?
    - Could be helpful to map those creating & implementing it (in power), those impacted by it (less power), who's resisting?
- What is the '**problem**' this surveillance measure set out to solve?
    - Who is this surveillance measure for?
    - Who does this surveillance measure hurt?
- What are the **historical & present contexts** in which this surveillance measure came to be?
- What are the **benefits and harms** of this surveillance measure?
    - For who?
    - By who?
- What does **resistance** look like for this surveillance measure? (Examples)
- What would this surveillance measure (or context) look like **reimagined**?