Examining How Engineering Educators (Re)Produce or Challenge Technocracy in Their Pedagogical Reasoning

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Abstract: Sociologists and historians of science have documented the salience of meritocracy and technocracy in engineering (Cech, 2014; Slaton, 2015; Riley, 2008). Meritocracy is often paired with a technocratic ideology, which distinguishes technical and "soft" skills and assigns more worth to the technical. Scholars have shown how technocracy and meritocracy contribute to marginalization within engineering education (Slaton, 2015; Foor et al., 2007; Secules et al., 2018). Our team has been iteratively redesigning a pedagogy seminar for engineering peer educators to disrupt such forces of marginalization. We study peer educators because they can do harm if these ideologies aren't challenged, and they have the potential to disrupt these ideologies. Using tools from discourse analysis and the ideology-in-pieces framework (Philip, 2011), we analyze how technocratic stances are reproduced or challenged in engineering peer educators' talk. Such analyses can help others to recognize technocratic reasoning and see some of its negative consequences.

Introduction

Cech (2014) and Slaton (2015) document meritocracy and technocracy as ideological pillars in engineering education, ideologies that also appear in engineering "mindsets" articulated by Riley (2008). Meritocracy and technocracy are embedded in structures and narratives within engineering education that contribute to reducing engineering students' sense of social responsibility (Cech, 2014), which we see as harmful. In response, Leydens and Lucena (2017) call for engineering students to learn to identify these structural conditions. However, learning to "see" these structural conditions and cultural narratives is non-trivial for students, since students more readily attribute violence/harm to bad actors than to structural and cultural factors (Lachney & Banks, 2017; Papak et al., 2018). Additionally, those from privileged backgrounds are more likely to struggle in recognizing the "culture of power" within disciplinary spaces (Delpit, 1988). So, we anticipate that it will be challenging work for engineering students to learn to see the harm precipitated by these ideologies. Despite this challenge, little previous work has explored how and to what end these ideological narratives emerge in engineering students' reasoning (Lambrinidou & Canney, 2016; Lachney & Bank, 2017; Papak et al., 2018; Philip et al., 2018; Canney, 2018). Our paper contributes to this line of inquiry.

As scholars, we are committed to cultivating educational experiences that contribute to learners feeling more competent, not less competent. We acknowledge that this is not a reality in many college STEM classrooms which tend to convey to students that they "are not cut out" for science and engineering (Margolis & Fisher, 2003; Seymour & Hewitt, 1997; Secules et al., 2018). This "weed out" culture plays out in highly gendered, racialized, classed, and ableist ways in the US due to historical patterns of exclusion that still being reproduced in the present (Foor et al., 2007; Fries-Britt et al., 2013; Leyva, 2016; McGee, 2016; McGee & Bentley, 2017; Rosa & Mensah, 2016). As scholars and educators, we enter college classrooms with a sense of responsibility towards the design of anti-oppressive trajectories for our students within STEM fields, especially those from historically excluded identities who are in contested spaces.

This work is embedded within a broader design research study to iteratively improve on the design of a pedagogy seminar for undergraduate peer educators–Learning Assistants (LAs)–that enables LAs to contribute to the creation of more ideologically expansive learning experiences for their students (Quan et al., 2017). We study LAs taking a pedagogy seminar while serving as teaching assistants within an introductory, project-based engineering design course. Our data consist of coursework and video records of class discussions in the pedagogy seminar. Using tools of discourse analysis, we operationalize how we "see" technocracy (and, at times, meritocracy) in LAs' talk. In one segment of class discussion, we show how LAs at times take up stances that challenge technocracy but end up converging on stances that construct some teammates as inert and burdensome based on technocratic assessments of their contributions.

Listening to LAs reasoning about engineering pedagogy and professional practice enables us to see how they sometimes reproduce and sometimes challenge meritocratic and technocratic narratives. Of course, our pedagogy seminar is not a "neutral" context; course readings and instructional activities aim to reveal how meritocracy and technocracy can be dehumanizing and to cultivate a sense of social responsibility for bringing

(particularly marginalized) students into meaningful engineering work. In the long term, we aim to examine how these instructional supports influence LAs' reasoning and instructional moves. Here, we explore how LAs (re)produce or challenge technocratic stances in making sense of the design work of student engineering teams. This gives us the opportunity to investigate not only LAs' reasoning but also the instructional conditions that may influence it. Understanding how these context-dependent reasoning dynamics play out in discourse can help us learn how to disrupt harmful ideologies and help LAs generate alternatives.

Of the many actors who co-construct the culture of the design course, LAs are closest to students in terms of age, shared experiences, and day-to-day contact. As such, LAs have a unique role in reproducing and/or disrupting classroom practices that reify meritocracy and technocracy. So, understanding how to cultivate critical stances towards technocracy and meritocracy within LAs is worthwhile. We recognize that LAs have less power than faculty to structure the classroom policies, and ideological differences between LAs and instructors could be risky for LAs. Struggling with these unresolved ethical tensions is part of our work.

Contribution: We bring the constructs of technocracy and meritocracy as developed by sociologists and historians of science into contact with the ideology-in-pieces framework (Philip, 2011; Philip et al., 2018) from the learning sciences (discussed below) to understand how ideological stances are co-constructed in the talk of engineering peer educators. Our analysis specifically intends to support others in (1) recognizing technocratic narratives in educators' reasoning and seeing its negative consequences, and (2) recognizing early "seeds" of ideological divergence from technocracy in educators' reasoning.

Background

In *Engineering and Social Justice* (2008), Donna Riley analyzes prevalent jokes about engineering to document cultural narratives, or "mindsets," that characterize part of the culture of engineering, manifested in how engineering work is organized. Riley also how the centrality of military and private profit-driven organizations tends to infuse engineering work with managerialism – "viewing human relationships within the organization through a lens of inputs and outputs and increasing organizational efficiencies by minimizing inputs and maximizing outputs (Pawley, 1998)" (Riley, 2008, p. 40). Aligned with Riley, Cech (2014), argues that the culture of engineering is characterized by "three ideological pillars: the ideology of depoliticization, which frames any 'non-technical' concerns such as public welfare as irrelevant to 'real' engineering work; the technical/social dualism, which devalues 'social' competencies such as those related to public welfare; and the meritocratic ideology, which frames existing social structures as fair and just." (Cech, 2014, p. 45).

Building on these insights, Riley, Cech, and others (Slaton, 2015; Leydens & Lucena, 2017) identify a cluster of ideas that pervade engineering, which we call ***technocracy***. A technocratic stance is characterized by distinguishing and valuing technical work (based on math and/or science content) over other kinds of engineering work, accruing social and/or intellectual capital to those engaged in technical work, understanding this technical work to be uncritically good (i.e., divorced from unintended adverse impacts), and viewing engineering work as devoid of "politics" and power relations. Critiques of this stance resonate with insights from science and technology studies (STS) documenting that engineering culture is dominated by *technological determinism* (Smith and Marx, 1994), a loose cluster of cultural narratives stating that technological development inevitably leads to progress, technical experts know best how to govern new technologies, technology homogenizes cultures, and society adapts to technology rather than shapes it.

Over the last few decades, engineering education scholars have begun to elaborate how technocracy does harm in engineering education, reducing students' sense of social responsibility (Cech, 2014; Bielefeldt & Canney, 2016), and pushing students out of engineering (Foor et al., 2007; Secules et al., 2018). For example, Foor, Walden, and Trytten (2007) document the story of a student, Inez, whose experiences of feeling marginalized and "othered" within engineering are structured through assumptions that privilege prior preparation, technical prowess over social skills, and individual over collaborative learning. These technocratic and meritocratic assumptions were also shaped by raced, gendered, and classed prejudices. Tonso (2006) documents how meritocratic considerations that pervade engineering, such as basing opportunities for jobs and internships on grade point averages, entangle with the socio-technical dualism (Faulkner, 2009) to produce status differences among members of student design teams. Slaton (2015) argues that the narrative of engineering education as based on technocratic, "meritocratic judgement of eligibility and skills" (p. 171), not only limits access for students from backgrounds traditionally underrepresented in engineering, but also obscures how structural features of society such as ideologies of gender, race, class, and ability contribute to the historic and ongoing asymmetries in who gets to participate in engineering. Further, technocracy and meritocracy entangle with dominant capitalist ideologies to perpetuate one another and to occlude possible inquiry into what purposes the technical work of engineering serve. These entangled ideologies support and are supported by an uncritical view of engineering's processes and products as contributing positively to social

welfare (Vakil, 2018). Technocracy, in conjunction with meritocracy and neoliberal ideologies, thus hinders the democratization of engineering and engineering education.

Study setting

All LAs in our study work within the same introductory engineering design course that serves all first-year students considering a major in engineering at Univ. of Maryland. Thus, our study involves two coupled contexts–the Introduction to Engineering Design course and a required pedagogy seminar course for the LAs. In the engineering design course, students work in teams of eight to construct an oversand vehicle that can autonomously navigate a terrain with obstacles and complete various missions (Calabro et al., 2015).

Our data come from the second iteration of the LA pedagogy seminar (Quan et al., 2017; Tanu et al., 2017; Turpen et al., 2018). We conceptualize the course as having three primary conceptual themes: (1) Theories and strategies for teaching and learning, (2) Design thinking in engineering, and (3) Equity (Turpen et al., 2019). Since the LAs were concurrently teaching in the design course, they were able to bring concrete "problems of practice" (Horn & Little, 2010) into the pedagogy seminar discussions. During pedagogy seminar discussions, LAs often referred to their prior experiences as learners in that design course. The second iteration of the pedagogy seminar foregrounded adopting an inquiry stance toward making sense of your students' learning and your own instructional approach, and sustained attention to issues of equity.

Theoretical and methodological approach

Theoretical Orientation: We bring the ideological constructs of technocracy and meritocracy (Cech, 2014; Slaton, 2015; Riley, 2008) into contact with the ideology-in-pieces framework from the learning sciences (Philip, 2011; Philip et al., 2018). Sociologists often conceptualize ideologies in broad strokes or "pillars" (Cech, 2014) which can serve to illuminate the enduring and coherent qualities of these ideologies within certain disciplinary spaces, but such conceptualizations can also serve to obscure the microgenetic processes through which they are reproduced (or contested/transformed) in discourse. By bringing Philip's ideology-in-pieces framework (Philip, 2011; Philip et al., 2018) to looking for technocracy in our data, we can conceptualize technocracy as a cluster of more piecewise ideas (or taken-for-granted assumptions) that may tend to come up together.

We operationalize a technocratic stance in an utterance as one that reflects any of the ideas in this cluster: the distinguishing of technical work based on math and/or science content from other kinds of engineering work, the valuing of technical work over non-technical work, the accruing of social and/or intellectual capital to those engaged in technical work, understanding this technical work to be uncritically good (i.e., divorced from unintended adverse impacts), and engineering work as devoid of power relations.

Data collection: Members of the project team video and audio recorded each pedagogy seminar. One camera was placed at the front of the room, facing the LAs. Multiple streams of audio were recorded, in order to capture each discussion group. LAs' written assignments (e.g., reading reflections) and classroom artifacts (e.g., whiteboard drawings) were also collected. In addition, a member of the research team collected field notes of large and small group discussions.

Data selection: In this paper, we present an illustrative example of LAs (1) reproducing and (2) contesting aspects of technocracy. This example comes from a full-class discussion in the pedagogy seminar, five weeks into the course, when LAs were discussing their students' first assignment. Both the field-noter and one of the seminar instructors noted this moment because LAs used dehumanizing language to talk about their former peers from when they were enrolled in the engineering design course. Having a general sense of where to look, we located this moment in the video records, then we proceeded to clip and transcribe it. Returning to this episode, we found that the dehumanizing language was coupled with technocratic narratives.

Analytical approach: As a group we watched the video with the transcript, stopping after every 3-5 utterances, to build collective understandings of the discourse. We built preliminary interpretations of how LAs were constructing or challenging technocracy (Engle et al., 2007), subsequently teasing apart fine shades of meaning (Siegler & Crowley, 1991) when utterances shared some term or idea. To understand the interactional dynamics of this conversation, we attended to paraverbal features of the utterances (for example, volume, pitch, register) as well as turn-taking, gestures, posture, facial expressions, and the use of hedge words. This multimodal analysis (Stivers & Sidnell, 2005), while informing the discourse analysis, is not included below in our findings.

Working in this way, we looked for evidence of technocratic stances being reproduced or challenged in utterances. Then looking across a short set of utterances, we worked to understand how successive utterances get layered to build a convergence towards or away from a technocratic stance. This allowed us to conceptualize the reproduction or contestation of technocratic stances as a co-construction among the conversation

participants. This approach to modeling the processes of cultural construction (McDermott, 1993; McDermott & Varenne, 2006) within the pedagogy seminar space acknowledges the agency of actors within this setting along with the cultural-historical "roots" and disciplinary qualities that are drawn into our local conversations and practices/routines. In what follows, we show an example of LAs converging on a technocratic stance, despite some challenges to it. Due to space constraints, we do not provide a full transcript and, at times, we share a narrative account without direct quotations, for context.

Data analysis

This episode occurred during the fifth week of the term. An instructor and nine LAs are arranged in a circle where all participants can see one another. The previous week, the design teams in the engineering design course had made 10-minute presentations on how they will organize themselves over the course of the semester. The LAs are debriefing about how this assignment went for their students. About 30 minutes into the debrief, some LAs launch into a discussion about the benefits and drawbacks of different team structures for the 8-person design teams—co-led teams, decentralized leadership, specialization, etc.

At the start of this episode, Quinn shares a story about his experience as a student in the engineering design course. He describes coming to open lab hours intending to work on one subsystem of his team's vehicle only to find that multiple subsystems needed work. While troubleshooting, he found that he might get a subsystem or component to start functioning in a desired manner without understanding why what he did solved the problem. Quinn reflects on how this pattern made him more knowledgeable about multiple subsystems, but also constrained his ability to explain to his peers when asked *why* his changes worked, which prevented them from entering into the design work. Theo suggests that this dynamic may have given Quinn's peers an excuse not to learn how the subsystems work, but Quinn contests Theo's interpretation, saying that his peers tried to help, but the pressure of deadlines made it difficult to catch them up. In Quinn's narrative, his peers' inability to work on the vehicle fabrication and design is explained through the convergence of different circumstances that led to their gradual distancing from the artifact being designed, making it difficult for them to test and troubleshoot the vehicle without relying on Quinn. Thus, Quinn contests meritocratic explanations for the asymmetry of contributions within his team. In expressing the tension between finding time to help his teammates develop a deeper facility with the technical aspects of the design and making timely progress in testing and troubleshooting, we can see the seeds of a non-technocratic stance; Quinn's account captures how his team's emergent work routines constrained his peers' learning opportunities in problematic ways. This account importantly intertwines the social organization of the setting with the technical "progress" and the learning of members of the design team in ways that contest technocracy.

In the next turn of talk, Tony says:

> It was just like more efficient to like, do all the wiring and coding by yourself. Cause… anyone can build the OSV (*oversand vehicle*), so… all I did was like, it's more efficient for me to do all the wiring and coding and like tell you what to build, than me to go back and explain two weeks' worth of coding and the mess of wires that I had at that time. It's just way more efficient for me to do everything.

Here we see Tony cuing up narratives of efficiency and beginning to define various forms of labor within design teams. He describes some forms of labor that "anyone can do" (e.g., building the transportation system) and other forms of labor as requiring more specialized expertise, such as wiring and coding. He describes delegating the building work to others, and not finding it worth his time to catch others up on his wiring and coding work. In calling his wiring and coding work "everything," Tony in effect minimizes or makes invisible all other forms of work, a step towards the dehumanization that we see later. Simultaneously, this elevates "efficiency" as a metric that should centrally justify their work routines.

In response, Theo say, "So do we- so, what I'm hearing is that we don't need 8 people to do the OSV. We may need like, I don't know, like four people." This talk turn continues with this efficiency narrative and begins to question whether teams even need 8 students on them to do the necessary work. Here we see Theo describing a more systemic reason for teammates not contributing—that there may not be enough work to go around—and he wonders whether minimizing inputs (e.g., people on a team) would require more engagement from non-contributing teammates in order to produce the same output (e.g., a functioning vehicle).

Tony continues, "It was me, one person building and one person doing my CADs for me (Theo: Ok.), and I just told them what to do (Theo: Right)." Here he further differentiates forms of work, stratifying labor into categories of building, CAD drawing, and his own work of coding and wiring, which he implies requires more expertise. His use of pronouns marks himself as having ownership over the entire project, and casts his peers as merely following his orders. In response, Theo says, "Right, so, I don't know. And then like the other

like four or like five people are just like dead weight." Here in a dehumanizing way, Theo casts the other 4-5 teammates as "dead weight," reducing some team members as inert and burdensome due to their limited work contribution.

Tony reacts by saying:

> No, they just did all- I told them I'm fine with you guys not doing anything, but you have to do like all the reports and PowerPoints and stuff (Theo: [laughs] Ok.). I said ok, I'll take this. And then one pers- one or two people like didn't do much and they got (Theo: Sure) destroyed on the peer reviews.

Tony disagrees with Theo's casting some team members as dead weight, but highlights their utility as limited to report writing and preparing presentations. While Tony distinguishes these team members from the one or two people who "didn't do much", he also describes these forms of work as "not doing anything," thus minimizing and erasing the presentation/report creation from the core work of designing the vehicle. Here, Tony describes himself as having a degree of authority to delegate tasks to peers, while simultaneously constructing those delegated tasks as menial and as requiring less expertise, which harkens back to "telling" others what to do.

Next, Theo affirms Tony's statement, by saying, "Right. Yup, yup, yup. The natural process." Tony follows on with agreement, "Yeah." Theo then turns and asks his classmates, "how many people were dead weight on your teams?" In response, Charlotte and Tony affirm that about half of their teams were "dead weight", thus contributing to the joint construction of some team members as "dead weight" and establishing it as a common problem in the engineering design course.

Responding to this co-constructed "problem" of "dead weight" teammates, Theo follows up with a few tentative solutions, which function to increase efficiency by either maximizing output (e.g., "more missions") or minimizing input (e.g., "cut groups into four" by which he means forming two 4-member groups). In this moment, Theo seems to be attending to systemic features which may create the conditions for "dead weight." While still dehumanizing for the individuals referenced, Theo isn't seeing this as a trait of a person but as something that could be produced from structural aspects of the environment in which teams are working.

At this point, there are some attempts to challenge the characterization of teammates as "dead weight." For instance, Quinn says, "But like for me like...none of my team was dead weight, it's just half the team finished their work early on and they were just done. So, like I don't think they were dead weight." Quinn reframes his peers' absences not as a problem of incompetence or work-avoidance, but as a function of how the labor was divided amongst team members. Agreeing with Quinn, Lexi says, "Yeah that was how it was for me too, but I think that everybody was necessary. Like, I think definitely not, we didn't need more work or less people." After a few turns of talk, Quinn reiterates that "eight people's very useful for like all the reports and presentations," re-casting report-writing and presentation preparation as necessary labor for the design work. Despite these attempts to contest and destabilize the "problem" of "dead weight," the rest of the conversation supports re-convergence around it. Charlotte does storytelling about her teammates' incompetence and Tony does storytelling about his failed attempts to "game" the system so that he would end up in a team with more competent teammates (by minimizing his own prior experience on instructors' pre-surveys).

We acknowledge that the instructor in this space is contributing to these local convergences as she does not interrupt and mark the "dead weight" language as dehumanizing in moment. This was partially due to the instructor's sense that the activity had taken much longer than planned, and she needed to wrap it up.

Discussion

Discursive co-construction of the sociotechnical divide and technocracy: Across this episode, we see Tony and Theo stratifying different kinds of labor and, in the process, reproducing the socio-technical divide. Labor is divided into (a) wiring, coding, and designing versus (b) building OSV transportation system, developing CAD diagrams, and report writing. Furthermore, (a) is valued over (b). In assigning more value to what's commonly seen as more technical work, we see Tony and Theo reproducing technocratic ideologies in these moments. The team members who contribute to lower status tasks never have access to the higher status work and therefore aren't seen as developing expertise in this higher status work. From this ideological stance of there being more or less valuable work, the people doing no work, or the less valuable work are cast as "dead weight."

Entangling meritocracy and technocracy: In this segment, we also see evidence of entanglement between technocracy and meritocracy, as others have theorized (Slaton, 2015). As LAs stratify labor and place differential value on some forms of labor, this lays the foundation for justifying the stratification and rank-ordering of people. In this episode, we see Tony describing himself as having authority to delegate lower-value tasks to peers. So, his construction of different forms of work as rank-ordered in terms of value goes along with a rank-ordering of *people* as more vs. less valuable to the team—more vs. less meritorious. This is further

perpetuated when multiple LAs report on the prevalence of "dead weight" team members within their own design teams. This constructs a meritocratic system where the warrants for merit are based on technocracy.

Ideological Dynamics, convergence with moments of divergence: Throughout the semester, a multiplicity of technocratic and non-technocratic stances emerged. Early in the semester, the stances often resulted in convergences towards technocratic stances. In this episode, as Theo and Tony construct their teammates as "dead weight", there are some divergences from the technocratic, meritocratic convergence. Quinn frames his story in a non-technocratic, non-meritocratic stance and he and Lexi contest the class's convergence. In some of the immediate exchanges that follow, some LAs, who did not speak in the moments documented above, and the seminar instructor offer reframings that at times challenge aspects of technocracy. In future work, we hope to analyze these discourse dynamics in more detail to illustrate how non-technocratic and technocratic stances emerge in classroom discourse and how these stances converge in collective dialogue. These future analyses may provide other educators with fruitful insights into how to set up classroom contexts that actively disrupt convergence on technocratic stances.

Pursuing a design-based research agenda for the LA seminar space: We have started to reflect on aspects of the instructional design that are part of understanding this phenomenon of ideological convergences and divergences around technocratic and meritocratic stances, towards further iterative refinements of the seminar. For instance, we think it will be important to revisit how and what formative feedback was given to the LAs about their participation in seminar discussions. After providing such feedback, different patterns of in-class participation emerged. The LAs who were most vocal at the beginning of the term were still contributing later on but became less discursively dominating; quieter students were speaking up more and their voices were substantial in episodes of non-technocratic convergence. We wonder if these changes in discourse participation patterns contributed to different convergences later in the seminar.

For many LAs, even at the end of the course, influencing team dynamics was seen as outside the scope of their role. There was often more buy-in from LAs on the need to attend to social dynamics within their students' team when these dynamics seemed to be getting in the way of producing a functional vehicle. We found it to be harder to get LAs' buy-in on the need for noticing and intervening in problematic social dynamics perceived to be disrupting access to learning opportunities but not interrupting the vehicle production. We also observed many moments when LAs were seemingly caring for students and empathizing with them by imagining what might be happening in their personal lives that may influence their participation in the engineering design course. However, we felt that LAs made less progress in thinking about and identifying structural patterns of inequities, including race, class, and gender-based inequities, and seeing how they play out in engineering education in unjust ways. While this pattern indicates some success in moving people away from "individual accountability" narratives that cast students as lazy, etc., and towards more "emergent systems" explanations (Turpen et al., 2018), this shift did not uniformly produce humanizing accounts.

In subsequent offerings of the course, we want to design classroom routines for LAs to become aware of their own buy-in and develop motivation and facility towards noticing and addressing inequitable dynamics in their students' teams. We are also considering how changes to other aspects of the broader ecosystem of LAs' work, such as the framing of the LAs' job description (foreground supporting learning, rather than just offering technical support), recruitment processes and selection criteria for hiring LAs, and potential changes to the introduction to engineering design course itself, might influence their ideological orientations.

Conclusions

Meritocracy and technocratic ideologies structure most STEM learning environments in the US and constrain the possibilities for the classroom as a space that challenges the historical and ongoing inequities in the US. Meritocracy and technocracy are linked to racial, class, and gender injustices, not just in terms of representational equity, but also in terms of the very construction of racism, classism, and sexism in our society (Davis, 2011; Swim et al., 1995) and in our educational systems (Slaton, 2015; Augoustinos et al., 2005). Our analysis has offered examples of what it looks like for engineering LAs to ideologically diverge from technocratic stances (e.g. Quinn's launching story, and later micro-constestations from Quinn and Lexi) as well as how LAs can co-construct ideological convergences around entangled technocratic and meritocratic stances (e.g. categorizing and ranking kinds of work, and casting some people as "dead weight"). In doing so, it contributes to the emerging line of research on the role of ideology in learning (Philip, 2011; Philip et al., 2018). Such empirical examples are important for helping readers to see moments of contestation and reproduction of technocracy in educators' talk and how technocracy lays the foundation for flawed claims of meritocracy. While our current analysis hasn't explicitly linked these ideological stances to stances towards race, class, and gender, we aim to pursue the identification and analysis of these links within our data corpus.

Analyses of episodes from later in the pedagogy semester suggest that these LA do (at times) converge

around stances that contest technocracy. The non-technocratic stances expressed later in the pedagogy seminar were one marker of success for our pedagogy seminar design team and seminar instructors. We continue to work to design activities and course experiences in this pedagogy seminar that allow for ideological expansiveness away from technocracy and meritocracy.

While we are somewhat hopeful about the convergences around less technocratic stances that occurred toward the end of the semester, we want to acknowledge that the construction of non-technocratic stances is importantly different than (1) seeing technocracy and meritocracy in the discursive construction of others around you, (2) building raced, classed, and gendered understanding of technocracy and meritocracy, and (3) coming to acknowledge the harm that these ideologies are doing to engineering students. In this way, we have only shown what it might look like for engineering students to produce non-technocratic stances, but not what it would look like for engineering students to be well-versed in critical social theory such that they could see technocracy at play, map its resultant harm, and achieve robust stability in non-technocratic stances. It is likely that additional skills in social critique as well as changes in the instructional ecosystem would be necessary for challenging technocracy and meritocracy more fully and disrupting them as a mechanism of marginalization.

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