



## **Ideologies of depoliticization in engineering education: A Mediated Discourse Analysis of student presentations in a first year projects course**

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## 1. Introduction

This paper works toward two goals. The first is to build on our previous work on “becoming an engineer”,<sup>1</sup> in which we have attempted to understand engineering learning within a broader framework that focuses not only on the development of knowledge or cognitive capacities, but also on additional dimensions, including the development of identities within social and organizational contexts. We aim to further explore how, through their participation in the routine practices of the undergraduate curriculum, students make themselves, and are made by others, into engineers. The specific focus here is on how a particular “ideology of engineering”<sup>2</sup> is reflected in the discourse of participants in presentations for a first year projects course. In particular, this paper details how engineering discourses serve to depoliticize complex social issues, and to reframe them as technical issues that can be resolved through design and refinement of innovative technologies. A second and related goal is to contribute to recent methodological discussions in engineering education<sup>3</sup>, and specifically to introduce the methodological approach of Mediated Discourse Analysis (MDA) as a way of exploring processes of becoming an engineer. MDA is a promising methodology for such work, in that it focuses on well-chosen instances of action in order to keep in sight both broad social issues and the local actions and interactions that bring these broader issues to life, in the process reproducing and potentially transforming existing systems. In so doing, MDA holds potential for developing a framework for interrogating and reformulating the discourses, and their attendant ideologies, that govern everyday practice in engineering education contexts, and for understanding and perhaps changing what it means to become an engineer.

## 2. Engineering as a Culture and the Ideology of Depoliticization

A number of authors have argued for the value of understanding the discipline and profession of engineering as a culture<sup>4, 5, 6, 7, 8, 9</sup>. Cech,<sup>2</sup> expressing this perspective, writes:

Engineering, like other professions, is not just a collection of knowledge, skills, and practices grouped into a set of jobs. Professions have rich and historically-rooted cultures that are built into and around their knowledge, skills, and practices. Professional cultures are the sets of beliefs, myths, and rituals that give meaning to the intellectual content and practices of a profession. (p. 69)

Cech goes on to argue that integral to engineering culture are its “cultural ideologies,” that is, “ways of understanding society and engineers’ roles and responsibilities therein,” including “how engineers understand their own work, their responsibility to the broader society, and what counts as ‘engineering work’ and what is superfluous to that work” (p.

69). For Cech, understanding engineering as a culture with ideological presuppositions and commitments has important implications for how we understand engineering education:

Those who wish to participate in the engineering profession must not only learn the proper skills and competencies required of practice in the field, they must learn to “fit in” with the culture of engineering by adhering to these ideologies ... The most concentrated presentation of professional culture is through professional socialization—the training process by which students move from being neophytes to professionals ... By taking classes, working in labs, engaging in design teams, and struggling through homework assignments, engineering students not only learn thermodynamics and circuits, they also learn to become a part of this culture. (p. 69)

Cech describes two interrelated ideologies of engineering, which she calls the ideologies of “meritocracy” and of “depoliticization.” It is the latter, the ideology of depoliticization, that will be of primary concern in this paper.

By “ideology of politicization,” Cech means “the belief that engineering work, by definition, should disconnect itself from social and cultural realms because such realms taint otherwise pure engineering design methodologies” (p. 71). This ideology is related to a set of commitments that maintain that engineering is a “purely ‘technical’ domain, and thus asocial and apolitical,” that “science and engineering work can be separated from messy ‘social’ concerns” provided that proper “objective” methodologies of inquiry and design are followed, and that, as “presumed ‘neutral’ actors, engineers defer to the objectivity and value neutrality that are assumed to be part of these methods” (pp. 70-71). That these are ideological commitments has been made clear by decades of research in Social Studies of Science and Technology, which has shown that “even the most seemingly objective and neutral realms of engineering practice and design have built into them social norms, culturally-informed judgments about what counts as ‘truth’; and ideologically-infused processes of problem definition and solution” (p. 71). This work has demonstrated that, regardless of the effectiveness of the methodologies of science and engineering in producing knowledge and technologies, the work that produces these are always imbued with social values, and are hence ideological.

This ubiquity of the ideology of depoliticization suggests that its effects on students are likely to be found even in seemingly mundane aspects of engineering education practice; indeed, these mundane aspects are likely to be a powerful part of the socialization process because they are seen as normal and unremarkable. Our aim in this paper is to examine a central but seemingly non-ideological practice—student presentations—in order to see whether and how the ideology of depoliticization appears.

### **3. Theoretical Perspective**

Our theoretical framework in this paper is the perspective of Mediated Discourse Analysis (MDA), which is rooted in neo-Vygotskian theories of mind and action, and particularly in Mediated Action (MA) theory<sup>10, 11</sup>. A central claim in Vygotsky’s theory

of mental development was that humans make use of semiotic and material artifacts that mediate and regulate action and interaction. According to this perspective, these “mediational means” or “cultural tools”<sup>10</sup> do not merely facilitate already existing mental processes; instead they are taken to fundamentally shape and transform the possibilities for thinking and action.

This mediated nature of mental functioning entails different approaches to their investigation from the ones that have been typical of much psychology. Most often psychology has attempted to study memory, problem-solving, and the like by decontextualizing them from the purportedly messy and uncontrolled conditions of action. In contrast, MA maintains that mental functioning cannot be studied apart from the forms of mediation that partly constitute it. Scribner<sup>12</sup>, on the basis of her studies of practical problem-solving in workplaces, developed this point with respect to problem-solving. She argued that the environment, through the ways in which it mediates thinking in the course of activity, plays a “constitutive role” in cognition: “skilled practical thinking incorporates features of the task environment (people, things, information) into the problem-solving system. It is as valid to describe the environment as part of the problem-solving system as it is to observe that problem-solving occurs ‘in’ the environment” (p. 329). This inseparability of mental functioning, action, and context is a fundamental tenet of neo-Vygotskian approaches.

Wertsch, following upon the central role of mediation for Vygotsky, has developed a theory of what he calls mediated action. This approach, like other contemporary approaches, aims to go beyond a primary focus on mental functioning in order to “explicate the relationships between human action ... and the cultural, institutional, and historical contexts in which this action occurs”<sup>10, p. 24</sup>. MA theory is concerned with moving beyond the isolated individual as a unit of analysis for social and psychological research and toward a relational unit of analysis. For Wertsch, this leads to a focus on “individuals-operating-with-mediational-means” as a unit that is irreducible while still allowing for analysis of its elements. MA theory is concerned with the tensions involved when individuals, each with their own histories of participation, engage in action using mediational means, which afford certain kinds of action while constraining others, and which have become historically associated with broader systems of relations. In this way action is located within historically situated, multiple, and often conflicting “chains” of action or communication, and is oriented to other participants in those chains. According to this perspective, action is the site at which “constancy and systematicity enter in contact and struggle with unique, situated performance”<sup>13, p. 50</sup>. By starting from action, mediated action theory aims to examine relevant aspects of their sociocultural and historical situatedness while remaining open to unexpected links that might be revealed through the analysis.

The MA perspective has subsequently been developed into an approach called Mediated Discourse Analysis (MDA)<sup>14</sup>, which combines the emphases of mediated action theory with techniques and concepts from social practice theory, critical discourse analysis, interactional sociolinguistics, and linguistic anthropology. MDA posits four kinds of entities that come together in an instance of action, or what Scollon calls “the nexus of practice”<sup>14</sup>. The first is the *meditational means* used to carry out the action. These

mediational means or cultural tools can be either semiotic—language, mathematical notation, illustrations or sketches, and the like—or material—computers, laser cutters, markers and paper, tables, rooms, etc. Central to the perspective is that there is no action that is not mediated by semiotic or material tools (or, most typically, by both). Methodologically, the task is to identify mediational means that are central to the specific forms of action that are to be investigated. The second entity that meets at the nexus of practice is the sociohistorical *institutions and discourses* that constrain the action. Institutions can be relatively local—for example, the specific project based learning lab at the specific institution that we studied—or broader—for example, higher education, the discipline of engineering, and the like. “Discourses,” as meant here, include general and identifiable constellations of talk and action. For example, there is a discourse of engineering design, a discourse of student parties, and a discourse of instructor meetings. The third entity that meets at the nexus of practice is the *interactional organization* that regulates the encounter in which the action takes place. There are typified forms of organization that characterize, for example, course lectures, student group work, and student presentations. Each of these are identifiable as routines, even while each instance of interactional organization is different. The fourth entity that meets at the nexus of practice is the *individual histories and biographical trajectories* of the actors involved in the action. Each of the actors involved in an instance of action brings their own histories of experience with them, some shared and some unique, and this matters for understanding how a specific action unfolds.

#### **4. Research Context and Methods**

In this paper, we illustrate the use of the MDA framework by examining how first year students frame their projects in presentations of their design work in an engineering projects course. We will argue that a mundane and seemingly minor example of project definition is representative of a pattern of developing engineers who treat social problems as abstract, technical challenges at the expense of a more humane treatment of those implicated in their designs. This is true even in project classes, which at the freshman level are designed to be less technical, less focused on content-knowledge, and more focused on developing innovative solutions to thorny issues. Since project-based courses such as Public University’s Freshman Projects class are intentionally designed as retention tools, it becomes worth considering how the discourses emphasized in these classes shape the engineers who have passed through them and remain identified with engineering.

Mediated Discourse Analysis was chosen as the methodological framework because it provides guidance on investigating how cultural tools and discourses shape, or mediate, activity in a given context; this is especially useful in engineering education, which has yet to develop a rigorous framework for understanding how the tools, materials, and valued ways of thinking and speaking produce new engineers. Additionally, many have called for an increase focus in engineering education on critical, qualitative approaches to analysis of engineering contexts<sup>15, 16</sup>, and MDA is one effective tool for undertaking this critical qualitative work.

Unlike many approaches to discourse analysis<sup>3, 17, 18</sup> that start from texts or transcripts of interaction, MDA begins from ethnographic fieldwork to identify the entities that are present in a given instance of mediated action. This allows the analyst to avoid being “obsessively narrowed to single moments, speech acts of events, or participants,” and to aim for seeing “how these connect to other moments, acts, events, and participants which make up the full nexus.”<sup>14, p. 9</sup>

We have drawn on ethnographic methods as we have been engaged in a multi-year, comparative study of engineering design processes in workplaces and in undergraduate engineering education. Following the recommendations of MDA, our initial fieldwork has aimed to identify key mediated actions that take place in engineering design. To this end, we have worked with and observed practicing engineers, faculty members in Public University’s Engineering College, and undergraduate engineering majors to establish and trace both major clusters of activity that members of the discipline mark as important and smaller, common practices that constitute the everyday activity of engineers in training. This approach has enabled us to identify “presentations”—formal or semi-formal demonstrations of progress in design and refinement of a project and the accompanying gains in knowledge that are generally expressed during the presentation process—as a key practice for socializing engineers. In most project-focused courses at Public University, including the Freshman Projects class that is the focus of this paper, presentations are graded and students receive written feedback from the instructors.

#### *4.1. Presentations in the Project Class*

Although the authors have conducted research in professional and classroom contexts, the present paper focuses only on the undergraduate context and the role of presentations in Freshman Projects class, a key course for freshman engineering students at Public University. Our fieldwork in the undergraduate curriculum, along with ongoing research with practicing engineers and recent graduates, has led us to identify project-focused courses as a crucial site for understanding how engineering students are recruited to engineering identities—that is, how students come to identify with engineering, how they become engineers. Projects courses are popular among students—both because they’re a common requirement across majors and because students tend to express that they prefer these courses to the more content-focused math and science courses that make up the core curriculum--and projects courses are framed by faculty in the engineering program as recruitment and retention tools that counteract the stress and frustration that can accompany other required courses. Projects classes are also positioned as the contexts in which students are participating in “authentic” engineering practices including collaborative problem-solving, working with a client, and carrying a project around the canonical design loop. Moreover, interviews with recent graduates from Public University revealed that presentation skills were viewed by most interviewees as an essential skill for a practicing engineer and one that they felt was strongly emphasized in the engineering program. Presentations were emphasized by the instructors of the Freshman Projects course, both in classroom discussions and in the rubric; students received group scores for their presentations and these scores constituted a large portion of students’ final grade in the course.



Presentations are used by instructors of the Freshman Projects course to deliver both explicit and implicit lessons on professionalism and to reinforce norms not only about engineering-appropriate discourse about engineering projects but also about elements such as professional dress, appropriate language register, and rhetorical strategies for catching and holding the audience’s attention. For these reasons, we chose in this analysis to focus on the first formal presentation of the Freshman Projects course, the Preliminary Design Review. This presentation took place during the seventh week of class. The class’s 29 students were divided into five groups of four students and one group of five students, and all groups presented their projects during the Preliminary Design Review.

## 5. Analysis

In the class session immediately preceding the Preliminary Design Review, students in Freshman Projects were given explicit instruction on how to design and execute their presentations. This instruction came in the form of a brief (10-minute) PowerPoint presentation delivered by the class’s two teaching assistants. Table 1 identifies each of the key elements discussed in the presentation. The table is organized chronologically, with each element that was identified by the teaching assistant placed into one of four categories discussed in the teaching assistants’ presentation: Introduction, visual rhetoric, delivery, and dress code.

Table 1. Key presentation elements discussed by teaching assistants

Item	Transcript
Introduction: · Attention getter · Introducing yourselves and team	Something that a lot of people forget is their introduction. They’ll just come up here and jump right into the meat and potatoes, going into this is our project blah blah blah. You really need to come up and introduce yourselves. A good idea is to do an attention getter. Now, think about you’re sitting in, you know, an auditorium or something like that and there’s a bunch of speakers as the day goes on. Everybody’s tired, nobody’s paying attention. This is why you want that attention getter. It can be like a major fact, you know the reason, the problem behind your project. Um, just something to grab those people’s attention, pull them into what you’re talking about. And then introduce yourselves and your team.
Visual rhetoric: Colors and text themes	The next thing you really need to worry about is the actual presentation itself. You need to pick colors and texts that work....
Visual rhetoric: Slide background	You don’t want something that has a background image. Something like that is way too busy.
Visual rhetoric:	It has to be short and to the point. You don’t want to be reading off

Amount of text per slide	your slide, you want to be talking to your audience, um, because it's more engaging when you're looking at people and trying to talk to them.
Delivery: Speaking to the audience	While you are presenting it's important to speak to the audience. You don't ever want to turn your back and be going off your slide and speaking to the board. Nobody's gonna hear you, you're just gonna be mumbling and you're gonna lose people's attention.... So make sure you're speaking to the audience. You can take a quick glimpse at your slides. That's why you just have them short quick talking points so that way you don't have to have your speech memorized. Another important thing to do is rehearse before you come up here and do your slides. This allows you to have good flow with your teammates and also, you have a time period to give your presentation in so you want to make sure you rehearse and you're hitting your timelines.
Visual rhetoric: Labeled images	All right, it's a good idea to put in pictures, right? Everybody likes pictures to look at.... SolidWorks images and animations are really good for this, but it's also a really good idea to label what your picture is so that way I don't have to come all the way across here, and if you look right here we have a red LED.
Dress code: Men	For men it's pretty easy...you want to wear a pair of slacks, belt, a long sleeved button up shirt. Um, either wearing a tie or without a tie still fits within business casual, so it's kind of your preference. And also dress shoes. Don't look all nice up top and then have a crummy pair of shoes on. And then also yeah, make sure it doesn't look like you just pulled it out of the hamper either.
Dress code: Girls	Girls it's a lot harder, there are so many options. Basically, slacks, skirts and dresses are ok, as long as they follow the correct things. No jeans, no jeanlike material. As far as the dress top or the dress shirt that you're wearing up top, you can't have um, straps they have to fully cover your shoulders. It should be a material that's nicer than t-shirt material, basically. So something that's a little bit finer quality. You don't want a lot of cleavage...And then shoes, you have to have nice shoes as well... If you wear skirts or dresses, make sure they go just above the knee. We don't want short skirts; those aren't business appropriate at all.

As highlighted above, and in a presentation slide used by the TAs, students were explicitly encouraged to integrate an “attention getter” into their presentations; the class’s TA’s described these attention getters on their slide as a “fact, joke, or greeting.”

Of the six groups, three chose to begin with a joke; of the remaining three groups, two began with a fact and one did not include any of the three possible attention getters. Because of the relative prevalence of humor, and because of humor’s role in communicating social values in general<sup>19</sup> and shared workplace and disciplinary values in particular<sup>2, 20</sup>, and because of our interest in exploring how engineering education communicates norms through routine practices, we chose to focus in on how these jokes reflected shared norms about engineering and its role in the world. Transcripts of each humorous attention getter are included in Table 2.

Table 2. Transcripts of students groups’ use of jokes as “attention getters”

Project	Humorous icebreaker	Possible social issues
Lift chair for emergency responders	<p>Presentation begins with students showing a YouTube video clip: an elderly woman lying on the floor, and saying in a frail voice, “I’ve fallen, and I can’t get up.”  <i>(laughter from student audience)</i>  <b>Ahmad:</b> Helping others is really important. It’s even one of [our school’s] principles. But firefighters get injured while helping others. But we found a solution.</p>	Societally organized social isolation of the elderly and infirm
Automated chicken coop door opener	<p><b>Baahir:</b> We are working in Small Private Farm. It’s located in City and the farmer there has told us a problem he is having, and so before I say the problem, I think that everyone here like, like, likes chicken. So we would like to care, we would like to care about them and, so in the future we can eat them. <i>(laughter from student audience)</i></p>	Food politics, localizing access to food resources
Skateboard lock	<p>Student-created video featuring team members as security guard, skateboard owner, and skateboard thief.            Security guard: Excuse me. You’re not supposed to have skateboards in here. If you take that out to the racks outside.   <b>Skateboard owner:</b> I don’t have a lock.  <b>Guard:</b> I don’t know what to tell you  <b>Skateboard owner:</b> ok.  <i>Skateboard thief takes R’s board</i>  <b>Skateboard owner:</b> oh MAN, somebody took my board!  <i>(laughter from student audience)</i></p>	Community trust and economic disparities, private property and property rights

	<b>Tyler:</b> That was all done in one take, we all read the script. So you laughed--that's huge.	
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### 5.1 Detailed description: *The Chair Lift and I've fallen and I can't get up*

We have selected one presentation, of a project called the Lift Chair, as a representative example of the use of humor as an icebreaker during the Preliminary Design Review day. This presentation was chosen for three reasons. First, this presentation was in many ways typical for this classroom—that is, several features of this presentation were common to other presentations delivered on this day. The use of humor as a “hook,” the effort to use popular culture reference in order to make the presentation relevant to classmates, the effort to present and offer a solution to a technical problem: These were patterns across student presentations. Second, this illustration highlights some of the ways in which engineering classrooms are hybrid spaces in which non-engineering discourse is at times recruited. Third, it makes visible some ways in which humor, used as an attention-getter during presentations, reflects and reproduces both tacit and explicit norms for “professional” engineering behavior and beliefs about engineering’s relationship to complex social problems.

*It is “preliminary design review” day in a freshman design course in an undergraduate engineering program at a large public university. Five students stand at the front of the room. Others are filtering in from taking a break while the instructors score the previous group’s presentation on the scoring rubric. The students at the front of the room are instructed to begin. “Go ahead and start,” an instructor tells them, “They’ll enter quietly.”*

*The students begin their presentation, projecting a YouTube video of a woman lying on the floor, and saying in a frail voice, “I’ve fallen, and I can’t get up.” The room erupts in laughter—the class recognizes and appreciates the video clip, a remix of a segment from a late-1980s television commercial for LifeCall, a personal medical alarm marketed primarily to the elderly and disabled.*

*Ahmad, one of the group members, explains: “Helping others is really important. It’s even one of [our school’s] principles. But firefighters get injured while helping others. But we found a solution.” The group then presents their project, the Lift Chair. Paula explains:*

*“Injured people or overweight people fall down in strange places.... Firefighters really have trouble lifting up, um, overweight people. It puts a lot of strain on them, um, and it’s hard to get them out of weird places.”*

*The Lift Chair is designed to solve the problem of firefighters sustaining injuries while lifting people who have fallen and can’t get up. This group has designed a prototype chair, equipped with winches and a manual lift system so that firefighters can offload much of the weight onto this device.*

At its core, the Lift Chair targets a complex social problem—the challenge of providing emergency support for some of our society’s most vulnerable people—and reframes it as a technical, vocational concern. Although more than one-third of all American adults are classified as obese<sup>21</sup>, America is ill-equipped to support the physical and medical needs of these populations<sup>22, 23</sup> (Cornwell & Waite, 2009; Thorpe, Florence, Howard, & Joski, 2004). Additionally, the elderly (people aged 65 and older) make up just over 15 percent of the American population<sup>24</sup>. Thirty percent of America’s elderly population lives alone, and many of these older Americans lack a close network of family and friends who could help them should they fall or need urgent medical assistance<sup>25</sup>. Firefighters—commonly first responders to medical emergency calls—fill the gap. Among the most common types of medical call is the “lift assist,” a request for help when someone has fallen and cannot get up without additional help<sup>26</sup>. Lift assists are expensive and often humiliating; often, the patient who has fallen is injured and may be in a great deal of pain.

Solving the problems hinted at above—widespread shifts in Americans’ health and mobility, the challenge of caring for our elderly citizens when they choose or are forced to live alone, providing emergency care that preserves the dignity and the physical and mental well-being of patients—would likely take longer than one semester. It would also require moving past the immediate needs of the client—in this group’s case, a local fire service whose leaders have requested a more effective device for providing lift assists to obese and elderly patients. The group does not broach these broader social concerns in their presentation, or at any point in the semester; instead, group members focus on practical concerns: How to make a stable, functional chair that improves upon the functionality of current devices used by firefighters.

In aiming to solve the firefighters’ problem, the students in this group technicize the problem and reframe it as a well-defined issue with a finite and simple set of possible solutions. Indeed, this group makes light of the concerns of another set of stakeholders—those who have fallen and need medical assistance—with the video clip described above. The “I’ve fallen and I can’t get up” video is a well-known cultural phenomenon. It was ranked first in USA Today’s list of most unforgettable ad campaigns<sup>27</sup>, and has been referenced in a wide range of film, television, and print media artifacts—Dilbert, Roseanne, Family Matters, Adventures of Sonic the Hedgehog, The Office, Married with Children, and many others. Its popularity, or notoriety, is ongoing, as the light and appreciate laughter of students in the class suggests.

How did these students get here? How did they so quickly and seamlessly turn away from the underlying social concerns that produced the phenomenon of firefighters straining themselves during lift assists, and toward the technical question of how to build a better lifting system? How did the classroom produce an opportunity for students to take it one step further, to turn the medical concerns of the elderly and the obese into a humorous attention-getter? How is the decision to make a joke at the expense of that group of stakeholders authorized by the people and the resources that guide activity—the students, the rubric, the constraints of the course, and its position within a broader undergraduate engineering program at a large public university?

Mediated Discourse Analysis provides tools for answering the questions above. An MDA methodology begins by situating participants in a research site at the *nexus of practice*: The intersection of the historical bodies of participants in a given action, the interaction order that is produced by participants, and the discourses that are used by participants to mediate their activity. In order to situate activity at the nexus of practice, the researcher asks the following questions:

1. *What are the primary mediational means?*
2. *Who are the primary actors?* (where “who” means both who they are in the sense of their identities and social roles and what are their individual histories)
3. *What is the interaction order? What is the structure of a given category of interactions* (in this case, the ‘preliminary design review’ presentation)?
4. *What are the significant cycles of discourse? That is, what different discourses are at play in a given action, and how do these discourses intersect with each other?*

Providing answers to these questions enables the researcher to elaborate on the four categories described earlier in this paper. Those four categories—mediational means, institutions and discourses, interactional organization, and individual histories and biographical trajectories--will be elaborated in the following section.

**Mediational means.** The most clearly evident mediational means for executing presentations include the material resources available to them: The projector, with its accompanying control system located in a desktop computer in one corner of the classroom; the PowerPoint and SolidWorks programs presenters used to design the visual resources that accompanied their presentations; and internet resources including, for the Lift Chair group, the video sharing site YouTube.com. Additionally, this team drew on a combination of shared cultural references and shared engineering knowledge as semiotic resources. Without any introduction or explanation, they played the “I’ve fallen and I can’t get up!” video; most students laughed appreciatively and even those who did not laugh did not express confusion or an interest in learning more about the video. This suggests the video was a part of students’ shared repertoires of knowledge; the presenters drew on this shared repertoire in order to start with a joke, as suggested by their TAs.

**Institutions and discourses.** In the case of the example described above, multiple discourses were at play. The presentation was governed by a combination of engineering discourse—presentations were described as a “preliminary design review,” a common practice both in student projects and in the engineering workplaces in which we’ve conducted fieldwork—and classroom-based discourse. Although students were prompted to address their classmates and to deliver a presentation that would get and retain the attention of their peers, students tended to make eye contact primarily with the instructors, and generally waited to present their work until the instructors indicated that they were ready to listen.

**Interactional organization.** The presentation format was governed by a fairly inflexible set of actions: In each of the class's six presentations, one student stood at the computer station at the front of the room to advance the presentation slides, while group members took pre-determined turns at reading and elaborating on each slide. Presentations began, per the instructions provided by the TAs during the previous class, with a usually humorous, sometimes factual, attention-getter; this was followed by a description of the problem and presentation of the solution. Students were expected to describe their process in getting to a solution, as well as to present a completed representation of their prototype, developed through a CAD software program. They were also expected to present their anticipated timeline for completing the project, from prototype to final product.

**Individual histories and biographical trajectories.** The actors in the example described above are five freshman engineering students of various backgrounds—the details of which were largely not available to the research team, whose interactions were limited to the classroom setting. These students' identities in the classroom, however, were hybrid identities. They were not simply young adults becoming engineers; they were also young adults developing new friendships in a new, post-high school context. They were developing engineers whose bodies did not quite know how to behave according to the norms of their profession; in a previous class, the instructors delivered a tutorial on the design and execution of a professional presentation, along with detailed guidelines on how to dress professionally.

## **6. Discussion.**

The field of engineering education has long focused on instilling a set of core ethical principles in developing engineers<sup>28, 29, 30</sup>. Guided by the U.S. Accreditation Board for Engineering and Technology (ABET), undergraduate engineering programs aim to help students develop “an understanding of professional and ethical responsibility”<sup>31</sup>. In general, however, engineering ethics have emphasized principles such as accountability to the client—defined as the people or organizations who have retained the engineer's services, not as the broader public for whom a given product or innovation will result in either benefit or harm<sup>30</sup>. Some have critiqued this approach as insufficient for producing engineers who think critically about the social implications of their work and the ways in which their profession writ large enacts discourses of power that at times reinforces social inequalities<sup>32, 33, 34</sup>. An ethic of care<sup>35, 36</sup>, when applied to engineering, calls for a shift away from a framing of engineering work as the practice of solving well-defined technical problems and toward a view of engineers as participants in and shapers of broad social concerns<sup>30, 35</sup>.

The phenomenon illustrated in the example above—that of depoliticizing a complex social problem in order to frame it as a simple problem with a feasible technical solution that can be designed within the time and resource constraints of a semester-long Freshman Projects course—demonstrates one way in which students are permitted to move quickly toward a technical framing of a problem, and away from the ethic of care promoted by some engineering educators. From one perspective, attempts at humorous “attention getters,” audience laughter in response, and the lack of critical response by the

teaching staff might be viewed as innocuous, as barely worthy of analytic attention. We would note, however, that students and teaching staff did clearly orient to and respond to other non-technical aspects of the presentations, such as student attire and grooming. Students spent a good deal of time at the beginning of the class commenting on how one another were dressed and groomed, and the teaching staff made deductions from presentation scores from groups with members wearing jeans, or sleeveless dresses. The failure to comment on or engage with the jokes described above can readily be seen as a manifestation in this context of the ideology of depoliticization discussed by Cech. We suggest that attention to ways in which ideologies enter into the socialization process should be an important focus of future work on becoming an engineer.

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