



## Exploring Team Social Responsibility in Multidisciplinary Design Teams

**Katharine E. Miller, Purdue University, West Lafayette**

Katharine E. Miller is a second-year doctoral student studying Organizational Communication and Public Relations at Purdue University, with minors in corporate social responsibility and research methods.

**Dr. Carla B. Zoltowski, Purdue University, West Lafayette**

Carla B. Zoltowski is an assistant professor of engineering practice in the Schools of Electrical and Computer Engineering and (by courtesy) Engineering Education at Purdue University. She holds a B.S.E.E., M.S.E.E., and Ph.D. in Engineering Education, all from Purdue. Prior to this she was Co-Director of the EPICS Program at Purdue where she was responsible for developing curriculum and assessment tools and overseeing the research efforts within EPICS. Her academic and research interests include the professional formation of engineers, diversity and inclusion in engineering, human-centered design, engineering ethics, leadership, service-learning, and accessibility and assistive-technology.

**Prof. Patrice Marie Buzzanell, University of South Florida**

Patrice M. Buzzanell is a Professor in the Brian Lamb School of Communication and the School of Engineering Education (courtesy) at Purdue University. Editor of three books and author of over 150 articles and chapters, her research centers on the intersections of career, gender communication, leadership, and resilience. Fellow and past president of the International Communication Association, she has received numerous awards for her research, teaching/mentoring, and engagement. She is working on Purdue-ADVANCE initiatives for institutional change, the Transforming Lives Building Global Communities (TLBGC) team in Ghana through EPICS, and individual engineering ethical development and team ethical climate scales as well as everyday negotiations of ethics in design through NSF funding as Co-PI. [Email: buzzanel@purdue.edu]

**David Torres, Purdue University, West Lafayette**

David is a fourth year doctoral candidate in the Brian Lamb School of Communication at Purdue University pursuing a PhD in Organizational Communication with a minor in data analysis and research methodology. His research interests reside at the intersection of organizational communication, identity, design, and organizational ethics.

**Danielle Corple, Purdue University**

Danielle Corple is a Ph.D. student in the Brian Lamb School of Communication at Purdue University. She studies organizational communication as well as qualitative and computational research methods. Her specific research interests are gender, organizing, and ethics in online and offline contexts.

**Dr. Megan Kenny Feister, California State University, Channel Islands**

Megan Kenny Feister is an Assistant Professor of Organizational Communication at California State University Channel Islands. She previously held a postdoctoral research position working on her grant funded research in Engineering Projects in Community Service at Purdue University. She is a recipient of the Purdue Research Foundation dissertation grant and co-wrote a National Science Foundation grant for her dissertation and postdoctoral work in Organizational Communication at Purdue. Her primary research interests include collaboration and innovation; negotiations of expertise in team-based organizational work; team processes and decision-making; ethical reasoning, constitution, and processes; engineering design; technology and its impacts on organizational and personal life; network analysis; as well as organizational identity, identification, and culture.

# Exploring Team Social Responsibility (TSR) in Multidisciplinary Design Teams

## Abstract

Corporate social responsibility (CSR) provides organizations with ways of contributing to social well-being over and above profit maximization and legal obligations by considering wider stakeholders' influences and interests. Similarly, we contend that teams within organizational contexts also have responsibilities and multilevel impacts to consider. This paper introduces our notion of team social responsibility (TSR) to enable us to examine how members perceive and enact their accountability to both internal and external stakeholders affected by their work. We focus on engineering design teams embedded within the EPICS service-learning program at Purdue University to explicate how TSR contributes to theory and practice in engineering education, particularly in preparing students for their professional endeavors beyond the classroom. Findings suggest tensions in student perceptions of self-vs-team responsibility, particularly in attributions of responsibilities or obligations to their project partners, to their team members through team dynamics and individual roles, and to multiple stakeholders. This study is unique in its goal of expanding work on social responsibility and moral decision-making, specifically in terms of engineering pedagogy.

*Keywords:* social responsibility, embedded teams, human-centered design (HCD), engineering education

## Introduction

Since Corporate Social Responsibility (CSR) was first introduced in the 1950's to expand organizational bottom-lines from profit and legal considerations to issues of social impact, CSR has grown into a global force for linking corporations with the areas in which members live and work. Extant research has explored CSR on a broader organizational level, without necessarily considering how social responsibility manifests on the team level. Thus, we contend that feelings and understandings of responsibility experienced by students working on design teams specifically, those individuals who are part of university service-learning initiative in engineering—are analogous to CSR in principle, practice, and ethics. As a result, we expand on the concept of CSR to Team Social Responsibility to uncover how these students perceive and enact their responsibilities to their design teams, project partners, and broader stakeholders on individual and collective levels (i.e., how do they feel responsible to each other as well as to the user/community they are serving). Thus, we explore how students define and articulate their team and social responsibilities through their discussions of their work on engineering project teams as part of the EPICS Program at Purdue University. Additionally, we examine how students' experiences working in the service-learning context shapes how they view themselves as engineers contributing to the greater good. These teams are an ideal site to explore the micro-level processes, and we explore them by putting forward TSR as a way of understanding how social responsibility is enacted at multiple levels of organizing—thus filling a particular gap in social responsibility research, while focused within the context of engineering education.

In this study, we are particularly interested in the communicative and social team processes related to responsibility as part of human-centered design (HCD) approaches in which designers

focus on users to construct their products and services [1]. We argue that TSR considerations operate in the present but can have long-term consequences demanding sustained attention to responsibilities. As Krippendorff [2] noted: “Most artifacts—designed, assembled, and installed with good intentions—set ecological processes in motion whose social consequences may surface only in a distant future that will have forgotten its past.” We envision TSR as inherent in team ecologies as well as sustainable design and engineering education practices.

We contribute to both organizational communication and engineering education literatures by explicating and presenting what TSR means, for whom TSR is most salient, and how TSR operates in the day-to-day workings of teams—particularly in the engineering education design context of EPICS at Purdue where groups are multidisciplinary, vertically integrated (composed of first-year students through seniors), and primarily self-led. Pragmatically, a focus on TSR provides direction to engineering educators who aim to improve team members’ decision making on behalf of users in human-centered design.

## **Literature Review**

At a time of increased collaboration and project-based work, further research is necessary in exploring team processes—as these groups undoubtedly drive core processes in varied organizational settings, including educational contexts and engineering design. While much research has examined team effectiveness, processes and values [3], [4], [5], team scholarship has not explored team responsibility—in other words, how responsibility is understood, attributed to self and others, and integrated into various processes at the team level and with broader impacts. We introduce the process of Team Social Responsibility (TSR), as analogous to Corporate Social Responsibility (CSR), which provides organizations with a fundamental way to consider their societal and stakeholder influences. Similarly, teams embedded within organizations have responsibilities to consider their impacts to internal and external stakeholders on multiple levels.

In exploring how students on multidisciplinary, engineering design teams consider their social responsibility on various levels, we review literature on social responsibility in the context of engineering education and teams more broadly, and embedded teams in organizations. Throughout, we align these areas to human-centered design (HCD) approaches to engineering.

## **Social Responsibility**

By definition, CSR views companies as contributors to a broader social well-being beyond profit maximization and legal obligations by considering wider stakeholders [6], [7], [8], and integrating social and environmental concerns into business operations. CSR has been dominated by an instrumental paradigm [9], [10] but is expanding to incorporate broader social issues and new accountabilities to diverse stakeholders, offering different types of engagement including feminist appeals [10].

In light of these changes and CSR’s emphases or dedications to *stakeholders*, including people and the surrounding environment [11], we build in views of CSR as moral duties or obligations [12], suggesting an ethical concern on the part of organizations and the need for a deeper understanding of social responsibility processes [13]. In this respect, HCD, in which team

members design products to suit project partners' needs, operates as a pivotal link to contemporary CSR and design trends. As noted in Krippendorff's [2] discussions of ecological design and IDEO's [14], [15] definitions, HCD is both process and technique to "create new solutions for the world. Solutions include products, services, environments, organizations, and modes of interaction...[by] start[ing] with the people we are designing for."

Our proposed framework of exploring CSR in a team context fills a gap in understanding how members move past technical and inner team workings to broader social impacts, bridging micro through macro level concerns and stakeholder interests. We are interested in how students may feel responsibility to HCD throughout project and design process such that they also learn how to interact and work for broader social responsibilities. Thus, we expand on CSR by introducing TSR in embedded teams constituted within engineering programs and institutions of higher education.

### *In the context of teams*

The study of teams, namely those embedded in organizations, continues to receive scholarly attention from an organizational communication perspective. Previous literature has looked at CSR and leadership, as well as how CSR initiatives are integrated and communicated by those in managerial positions [16] and how CSR workers discursively position themselves as professionals and construct the meaningfulness of their work [17], [18]. CSR programs, particularly in PR, management, and marketing, rarely consider the internal dynamic within organizations (i.e., the sensemaking and understandings of CSR by internal stakeholders). Current research is lacking in examining social responsibility internally, particularly at the micro or team level—a crucial context to consider given increasing professional requests for the ability of engineering graduates to work in groups [19], [20]. Therefore, we argue for the exploration of social responsibility within individual teams by taking an interdisciplinary approach in focusing on students in a university service-learning program. Thus, we consider how social responsibility is enacted in the team processes in an academic context—both inside and outside the classroom or lab.

Additionally, research [21] has argued that CSR performance is not always most effective through external pressures. Therefore, CSR in a team context can be viewed as self-regulated policy, self-structuring process within a human-centered design model. In other words, simultaneous ethical consideration for the user and product through the design process requires self-regulated responsibility to both—on both an individual and team level. Additionally, students undoubtedly consider their ethicality and responsibility on a relational level with and to their teammates. We are interested in tensions that may exist between these considerations, and how students may negotiate these responsibilities by understanding how these are (or perhaps are not) systemically integrated into the processes, interactions, and decision-making practices in their design teams. Herkert [22] discussed micro-ethical issues in engineering as the individual level, and macro-level issues at the collective level, concerned with ethical or professional codes for engineers and obligation as a profession to social responsibility and societal impact, respectively, thus providing an opportunity to explore such levels through engineering teams. In this project, we explore how students individually consider and communicate their social responsibility in a team context.

### *In engineering education*

In the context of engineering, there is a growing concern for a more socially responsible discipline and profession. Conlon [23] argued that those in the engineering field are much too focused on productivity and efficiency—aligned with the scientific management perspective—and less on the quality of work [see 24]. This raises questions “about whose problems engineers are trying to solve and on what basis” [23]. As a result, those entering the field may believe they are responsible for solely themselves [25]. In short, engineers need to understand the wider social context in which they work [23].

From an engineering perspective, individuals have a collective responsibility in improving the lives of those around them [26]. Thus, Conlon [23] discussed the need for a “New Engineer”—one that is concerned with the relationship between engineers and society—and is characterized as a “professional who is socially and environmentally responsible” [23] or seeks to incorporate social justice goals into engineering design [see 27]. Extant research has considered the responsibility of the engineering profession in terms of technology and sustainability, particularly in the role engineers play in potentially damaging consequences of their work. Additionally, scholars are increasingly interested in students’ moral development and understanding of both ethical and social responsibility. Loui [28] explored how undergraduate engineering students conceive their professional identity, specifically related to ethics and responsibility. And Canney and Bielefeldt [29] developed a model to examine the development of personal and professional responsibility for individual engineers due to the profession’s growing need to address global problems challenging society.

In terms of engineering education, many argue that the socially responsible engineer starts in the classroom [30]. Specifically, the Accreditation Board for Engineering and Technology (ABET) Engineering Criteria 2000 requires future graduates of accredited institutions to have an understanding of their professional and ethical responsibility [31]. Thus, Bucciarelli [32] suggests a reorganization of engineering education in order to focus on and embed a more social dimension through a multidisciplinary approach in order for engineering educators to prepare their graduates for social responsibilities in their prospective fields. He argued for a more critical study of engineering, including its social dimension.

Past work has explored student perceptions of corporate social responsibility [33] and attitudes toward engineering professional and social responsibility [29], [34]. However, while future engineering graduates are argued to have both strong teamwork skills and broader awareness for their profession’s social and environmental issues [35] these have not been examined in practice. Additionally, the need for quality performance skills (i.e., communication, team performance, interpersonal) is a continuing concern for both educators and industry professionals [36]. Problem and project-based learning has been increasingly implemented in engineering programs through the employment of design teams meant to present students with collective, realistic application of what they have learned [37], [35].

In this study, we examine design teams in the EPICS Program at Purdue University. In short, programs like EPICS are a response to the call for students to understand the importance of professional and ethical responsibility and the societal/global impacts of engineering solutions [38]. Specifically, the service-learning element “combines service to the community with student

learning in a way that benefits both the student and the community” [38]. One of the fundamental learning outcomes and objectives from the course is for students to gain an awareness of professional ethics and responsibility [39].

### **Research Question**

Through our discussion and exploration of literature and our presentation of team social responsibility (TSR), we have identified gaps, providing an opportunity for our work on social responsibility in an engineering team context. Thus, we pose the following research question:

RQ: How do students in human-centered engineering design teams perceive their (social) responsibilities?

### **Participants and Context**

In this study we explore individual and team social responsibility in the context of the EPICS Program at Purdue University—a multi-disciplinary design course in which students work in a team setting to deliver solutions to a project partner using a human-centered design (HCD) approach [39]. In EPICS, students partner with local community members or organizations to define, design, build, test, deploy, and support engineering-centered projects that aim to significantly improve the organization’s ability to serve the community [38], [39]. These students vary in major, year in school, and background resulting in multi-disciplinary and diverse teams [39]. The program courses are electives but often can be used to fulfill degree requirements such as technical electives, university science and technology in society requirements, or capstone design requirements in a few engineering majors. Students can participate multiple semesters, and are able to select the team during registration. Many of the program teams have partnered with their community organization for several semesters and years, working on a variety of specific projects with their project partners over that time. Within the broader teams, students generally self-select which project team on which they would like to participate.

This study is part of a larger, NSF funded study [40]. We included 12 total students in this sample from two different teams over two semesters, fall 2014 (n = 8) and fall 2015 (n = 4). These participants were selected in order to focus in on one specific project team at two different time points. Both semester teams were made up of 50 percent first year and 50 percent senior students. Fall 2014 included six male students, and two female students. Fall 2015 included three female participants and one male. In general, both teams included a mix of majors. While the majority of students were enrolled in engineering majors (e.g., electrical and computer engineering, first year engineering), other majors included mathematics and exploratory studies.

### **Data Collection Procedures**

Upon receiving approval from the Institutional Review Board (IRB), we conducted in-depth, semi-structured interviews with the students. Interview questions centered on the description of the project, team values and goals, considerations for design, team processes and roles, and the role and consideration of ethics throughout various stages of the project [41]. The semi-structured composition of the interviews allowed for follow-up and probing questions. All interviews were transcribed and names were de-identified for confidentiality purposes.

## **Data Analysis**

We conducted a comparative, thematic analysis for two EPICS teams to explore how social and team responsibility is considered by students on two different projects and at two different time points (i.e., semesters). Following transcription, we examined the interviews through a thematic analysis, coding for 20 total categories, around instances of project description and design; team processes, values, roles, socialization, makeup, and structure; organizational contexts; disciplinary premise and discussion; human-centered design (HCD); moral intensity and feeling of responsibility; and the definition and identification of ethics.

We took a modified grounded approach throughout the analysis stage in which data is simultaneously coded and analyzed, resulting in the generation of theory [42]. This approach is advantageous in developing theory and broader theoretical contributions that are unique to the data at hand. In other words, the generated theory is connected to the context or phenomenon it is developed to explain, and grounded theory coding is crucial in linking the collection of data to developing an emergent theory [43]. Through coding, the researcher begins to define and identify what is occurring within the data, and simultaneously analyze and consider its significance and meaning. We applied preexisting coding categories to the data through the development of a codebook we created in a previous study to conduct thematic coding. However, several iterations were made to this codebook based on themes emerging from the data through initial coding and calibration. Throughout analysis, we first completed descriptive, open coding whereby parts of the data are initially broken down into various distinct concepts or categories. This resulted in further alterations to the codebook. We then conducted axial coding in which codes and categories are related to each other and these connections are further explored in analysis. Thus, we used the constant comparative method throughout whereby prior data is continuously analyzed and compared with new and existing data [44]. We approached this method in various steps, namely through: drawing comparisons within a single interview, drawing comparisons between interviews within the same group (i.e., team), drawing comparisons of interviews from different groups (i.e., teams), and comparing individuals interviews or a collective of interviews at the coded or thematic level.

In short, this qualitative study explored the applicability of CSR at the team level. Thus, in furthering our analysis, we responsibility emerged on three levels from the data through two rounds of coding with a specific emphasis on how social or team responsibility is stated or conveyed, both implicitly and/or explicitly. First, we examined the student's view or feeling of responsibility toward his or her team. We looked for evidence of this through the student's discussion of roles, skills, and overall team processes. Second, we examined the student's view or feeling of responsibility toward the team's project partner. Relatedly, we examined the student's feeling of responsibility to human-centered design—as emphasized by the EPICS Program. We looked for evidence of this level of responsibility in the HCD-specific and context of the program codes. Additionally, we considered moral intensity and social responsibility at the coding level as a way in which students discuss the larger impact of their work to both their project partner and other stakeholders beyond the individual user. These considerations are explicated in the presentation and discussion of our results.

## **Results**

Throughout our analysis, we considered responsibility to be those considerations held by individuals or organizations (e.g., teams, programs) in making them more accountable for their practices, particularly in an engineering context. Following our research question and the levels of responsibilities that emerged from the data, we further explored internal feelings of responsibilities by individual students at the team level and then transitioned out into responsibility to the project partner as a stakeholder. The findings suggest tensions in student perceptions of self-vs-team responsibility, particularly in attributions of responsibilities or obligations to their project partners, to their team members through team dynamics and individual roles, and to multiple stakeholders. Throughout the presentation of results, we take a tensional approach to the data whereby students grapple with the various levels and considerations of their responsibilities. In our analysis, we looked for team responsibilities but found that such were key tensions that were productive insofar as they encouraged iterative questioning about optimal design, approaches to project partners and diverse stakeholders, and moral obligations.

### **Configurations of Social Responsibility**

Findings stem from students' considerations and explicit mention of other instances of responsibility beyond the EPICS team or project partner. These occurrences became apparent through further analysis of the interviews through a grounded approach to the data. Thus, we explored other ways in which the individual students discussed or mentioned their feeling of responsibility as an individual, student, and current or future engineer. These included a focus on the "social" aspect of the student's work in considering the larger impact beyond the project partner or course specifically, related to the idea of social responsibility as articulated in the literature. Additionally, included in this section are feelings of responsibility as motivated to or by a human-centered design (HCD) approach to engineering projects.

#### ***Responsibility as an Engineer***

Throughout the interviews, students often mentioned their responsibility as an engineer from a disciplinary or professional perspective—both on an individual and collective level. Thus, these individuals considered their work beyond their design team or course project partner. For example, when asked if ethics affects the design process, Shawn responded by emphasizing engineering as a profession:

Yes. I think especially in engineering, because a lot of what is engineered has an end user... a lot of trust is given to an engineer to be honest about what they're doing, so... I think any bad ethical decision made by someone in a position of power takes trust away from that group. So, as an engineer, I want people to trust me.

An additional finding related to this theme of responsibility as an engineer more broadly was the attribution of professional development to the service-learning program. For example, Sebastian discussed how his project and team has instilled in him certain responsibilities (e.g., leadership experience, consideration of the human side of design). Through this, he stated that the service-learning experience is, "making me a better engineer."

From this finding, we see how TSR includes the responsibilities of the profession in which one works whereby a tension between individual and collective responsibilities exists.

### ***Responsibility to Various Stakeholders***

In studies of CSR, a stakeholder approach [see 6] has been traditionally used in consider those groups and individuals who affect and are affected by corporate actions [45]. As evident in the interviews and as emphasized by a human-centered design (HCD) approach to design, the team's project partner was prioritized as the primary stakeholder. However, students clearly considered other additional stakeholders in reflecting on who the project was being design for or impacting on some level, and this in general related to the aforementioned feeling of responsibility as an engineer.

From a collective standpoint, when asked to further describe the team interactions specifically throughout the design process, Samantha discussed the difference between previous group experiences with her team:

You just need to have teamwork skills in each team that you are involved in. The difference is just the project that you're working on, that you serve the community, so you need to ensure that your team is working on that. You are not doing the project for yourself or even for the advisor, but for everyone else.

Thus, stakeholders potentially affected by the project are considered on a collective level. Similarly, Steve distinguished between two different stakeholder groups being simultaneously served by the team. According to him, "we [team] are developing our project for the community, like for the EPICS community, but then Pete Parks accidentally became our project partner, like how to advise and make it better so that we can have a double delivery, like one for EPICS and one for the students [being served]."

However, while considering wider stakeholder groups at the team level, this may have not been explicitly discussed as a collective and therefore, additionally, an individual consideration. As presented in the responsibility by a HCD approach, students considered stakeholders and/or potential users beyond their immediate project partner. With this, students described the stakeholder approach aligned and specific to their identity as engineers. For example, when asked to define ethics specific to an engineer in his interview, Sam responded by saying,

So for an engineer, you should be designing and developing for the greater good. If what you're working on is going to hurt somebody or could potentially hurt somebody or, you know, you find that somebody's lying about the product so that it can go, all these things, as an engineer, you need to step in and say no.

Similarly, when asked the same question, Sebastian stated:

...just doing the best for all parties involved, following moral guidelines, which [are] just, does it help everyone, is this going to work, is it going to remain effective. When it comes to engineering, I think of ethics as safety and maintainability and just [being] beneficial. If it'll work, if it'll remain working, and if it will work well for everyone involved.

Sebastian's response aligned with others in relating the responsibilities of an engineer to ethics and morality—considering groups potentially impacted by their actions as part of decision-making processes. From this finding, we consider how different stakeholder may invoke different responsibilities.

Finally, on a broader level, Steve echoes Sebastian's points by stating that "as an engineer, you have to examine all of your stakeholders." Throughout this last discussion of results, related to CSR, these aligned well with stakeholder theory in being aware of external collectives potentially affected by their current team in a service-learning program, like EPICS, and also as future engineers.

From this finding, we consider how different stakeholder may invoke different responsibilities.

### **Responsibility to Team**

**Fulfilling obligations and expectations.** In analyzing how individual students viewed their own responsibility to their EPICS team, we examined discussion of team processes, roles, communication, and decision-making through our examination of each interview. In short, our findings suggest that the responsibility held by students to their design team centered on fulfilling obligations or expectations set by both the team as a whole, the course, and/or their advisors or supervising professor. While not asked about their sense of responsibility to their team explicitly, findings from the interviews suggest that these are considered throughout various stages of the project and design process—specifically when describing individual roles and tasks. This was consistent between the two teams we interviewed. For example, in one instance, Shayna stated:

I think we all try to make sure we're individually getting to contribute so we can get a good grade. I think that's kind of key. But I feel like we also really want to get stuff done for other people to be able to do what they need to do. Because letting everyone down is kinda like embarrassing...everyone was relying on each other; we would push each other to finish things on deadlines we set for each other.

Similarly, when asked if the student felt his teammates were more focused on personal or team goals, Sebastian responded, "Um, it's more of a team thing. We are obviously, you know, focused on ourselves a lot, like getting our work done, what's assigned to us, but what is usually assigned to us is beneficial to the team." This suggests a feeling of responsibility to complete tasks or obligations ultimately benefiting the team and progressing the project or tasks at hand. Additionally, in terms of the class, students seem to consider their responsibility or desire to fulfill expectations on a personal level in order to succeed in the course, as Shayna stated,

I think it's kind of personal gain, individual...so you can get things done and get a good grade, and, um, I guess then the team you think about like as a whole you want to progress.

From this, it appears that students simultaneously consider both team and personal goals and responsibilities—particularly when referencing class expectations and achievement—resulting in a tension between personal (i.e., grades) and project success. However, when asked to elaborate

on responses regarding decisions, goals, motivations specific to the project, students exhibit feelings of responsibility to their project partner.

### **Responsibility to Project Partner**

In discussing or expressing responsibilities beyond the individual team or other members, students had clear feelings of these or obligations to their project partner—undoubtedly as a result from the human-centered design (HCD) approach incorporated by EPICS in which the end user is considered throughout the entire process. These were evident throughout the interviews as students discussed delivering the product, making decisions specific to the project, and responsibility by the self versus the team to the partner(s).

**Responsibility by human-centered design (HCD).** One finding revolving around the project partner was the desire, motivation, or responsibility by the team to tangibly deliver the finished project at the end of the course or semester. For example, when asked what his team's priorities are, Saul firmly answered with, "Priority is to deliver what the user—what the client wants." However, the consideration and prioritization of delivery was where the two teams we analyzed differ. For one team, as emphasized by Sara, delivery was connected to ethics and whether or not the team could fully satisfy the project partner by delivering a failed or ineffective product. Thus, resulting in a tension between outcomes (i.e., delivery) and process (i.e., ethical considerations throughout).

In describing her team's decision to not deliver rather than giving a faulty invention, Sara stated, "I mean, it wouldn't make us look good, the project partner probably wouldn't be satisfied, [and] neither would the kids. So, I think for this project, either do it right or don't deliver it." A considering factor to this could have been the dynamic and structure of this particular collective, due to the fact that this group was made up of both students from the service-learning class and a disciplinary senior design team who was working with the service-learning students on the project. Additionally, Sara's colleague, Shayna, attributed the option and decision to not deliver to the team's advisors. She also distanced the responsibility from her particular demographic as a first year member of the team. Thus, there appeared to be a tension of responsibilities between seniors and freshmen participants on the project. When asked if there were any ethical implications to this decision, Shayna responded:

I feel like since we had the freedom not to deliver and since we had the one member kinda drop out and kinda slow the whole process down to where we didn't finish, I feel like... I feel like it wasn't really that much of an issue, because we had a reason and the advisors even said that there was a possibility we wouldn't deliver, so we knew it was okay not to. And then really since we're not—like the freshmen aren't really in charge of the robots, and it doesn't really fall under our responsibility since it's mostly seniors who have to worry about that...

In general, considerations of various constraints including time and feasibility surfaced when students discussed the probability of delivering to their project partners.

Relatedly, this particular finding aligned with the responsibility to or by a HCD approach in which the product is designed with a particular user in mind. Students were explicit in their

discussion of the project partner when describing the project, goals, tasks, and outcomes. For example, when discussing her team's priorities throughout the semester and how these in particular became a focus for the group, Sally discussed the assigned, direct project partner for the course as well as her team's supervisors as stakeholders by stating: "It's what the project partner wants... and that's what the advisors want us to get done for the project partner. So, I'd say it's pretty much client-based."

Similarly, when describing the design process, Sebastian emphasized the human aspect by stating,

...that's what I really like about EPICS. It makes you think about the user. It adds a constraint to all your designs, which usually ends up improving it because eventually, even if you did design something without the human aspect in mind, you would have to incorporate that eventually because humans are usually always the users.

Here, Sebastian emphasizes HCD as part of EPICS when considering both immediate and hypothetical or future users. Also related to design, Sara discussed the change in thought regarding engineering from a HCD perspective. When asked if there is anything inherently ethical about approaching design in this way, Sara responded: "Maybe in human-centered design you would say, 'oh there are different users, they have different needs, they are different heights, whatever, you know, the pedals need to be different,' so you would design thinking about those specific needs." Thus, these responses suggest the heavy emphasis put on the users through the decision-making and design processes.

## **Discussion**

Extant literature provides an understanding of Corporate Social Responsibility throughout various organizational settings and contexts. However, no prior work has explored its applicability at the micro or team level. Thus, we introduce Team Social Responsibility (TSR) as a way for teams and their members, similar to broader organizational systems, to consider the larger impact of their work. In taking an engineering approach to examining social responsibility held by members of student design teams, this work contributes to organizational communication and engineering education. Specifically, we found that team members consider their responsibility at multiple levels—from their own team members in the context of the course to broader stakeholders they anticipate but may not even see their work initially or directly impacting. Thus, we present specific contributions to both engineering educators and the social responsibility more broadly.

**Engineering education.** This study presented significant considerations and implications for engineering pedagogy, particularly in service-learning or community service settings. From an educational perspective, EPICS as a specific service-learning program aims to provide a variety of learning outcomes to students applicable to their future careers including disciplinary knowledge, customer awareness, communication, teamwork, and the appreciation of their work in social contexts [39]. In short, EPICS is meant to provide an experience reflecting a human-centered approach to engineering design through which students take part in realistic and authentic scenarios they will most likely face in their professional work. This project explored feelings of responsibility held by individuals in a team setting, perhaps comparable to corporate

employees in considering stakeholder perspectives on CSR. However, the nature of the service-learning course as an academic program based on specific curriculum and requirements may impose certain responsibilities onto its students. Thus, future work may attempt to distinguish those responsibilities that are imposed upon individuals through various constraints, and those independently created on both the individual and team level. Thus, we propose the term “student social responsibility” in these educational, programmatic or disciplinary settings.

Additional implications expand on prior work and the call for a more socially responsible engineer and the role of engineering educators in preparing students to fulfill this role [23], [30]. Our findings suggest that students do in fact consider the larger impact of their work, as well as the responsibilities they hold and will face as future engineers. Thus, these individuals contemplated and, in some cases, enacted decisions or outcomes that were not necessarily required of them. This relates to Davis’ [46] work on professional responsibility in questioning whether engineers are responsible if they only act on what is legally required or expected of them in their job and place of employment. Therefore, engineering educators may work to further this conversation in the professional development of their students to become more “socially responsible” and further consider their larger, social impact.

**Social responsibility.** This study explored the potential applicability of CSR at the team level—thus providing an opportunity to introduce the theoretical development of Team Social Responsibility (TSR). Through discussion of our findings, we see that students consider their responsibilities to both internal and external organizational groups including their team members, the specific program advisors, immediate project partner, potential end users, and the larger community. In other words, there appears to be a hierarchy of stakeholders as described by individual students as members of the service-learning program and as current and future engineering professionals. These results can align with, and could be potentially expanded upon, current work on responsibility from a disciplinary perspective. In relation to engineering specifically, Bielefeld and Canney [34] proposed a professional social responsibility development model through exploring the changing attitudes of social responsibility by engineering students over time. This approach contains three elements: personal social awareness, professional development, and professional connectedness. Together, these account for the awareness and acknowledgment students may feel through the development of their own social responsibility. Our findings align with several of the components proposed in Bielefeld and Canney’s [34] model in suggesting that engineering students: (a) feel they have an ability to help contribute to an unfulfilled need, (b) have a sense of connectedness to external groups, (c) recognize that their skills as engineers can address societal problems, and (d) are aware of both the costs and benefits to helping others. Thus, the HCD approach to engineering may have fostered these perceptions in considering potential users and stakeholders.

More broadly, this study contributes to limited work on the study of social responsibility at both the individual and team level. These different responsibilities (and considerations of) may shift during design processes and depending on the composition of team membership (class standing, years in program, majors and so on). but this paper offers an intriguing and pragmatic way of examining how members embedded teams situated in different organizations or institutions would perceive and be encouraged to view their responsibilities. Like Deetz [47] with regard to how individuals learn to communicate in a democratic organization and translate that to society, members' constitution or enactment of their team membership has implications for team

productivity and satisfaction but also for their abilities to transfer such responsibilities and skills to their employment.

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