Bringing Corporate Social Responsibility into the Petroleum Engineering Classroom

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***Abstract*— The resource and energy industries present unique challenges to engineers, who must navigate sometimes competing responsibilities and codes of conduct, such as personal senses of right and wrong, professional ethics codes, and their employers' corporate social responsibility policies. This paper reports on preliminary research that seeks, first, to understand the relationship between engineering and corporate social responsibility (CSR), the current dominant framework used by industry to conceptualize firms' responsibilities to their stakeholders; and second, to better prepare engineering undergraduate students to critically appraise the strengths and limitations of CSR as an approach to reconciling the interests of industry and communities. We share results from an assessment of a pilot interdisciplinary pedagogical intervention in a required petroleum engineering course at the Colorado School of Mines. It suggests that classroom activities that use CSR to bring a sociotechnical perspective of engineering challenges, and are relevant to students' future careers, deepens students' complexity of thought in relation to social responsibility. It also provides a context to allow students to broaden their approach in their future careers.**

Keywords—corporate social responsibility; classroom activities; sociotechnical

I. Introduction

The growing significance of the energy and mining industries and their social and environmental effects pose special ethical challenges for engineers seeking to work at the intersection of corporate interests, the welfare of communities, environmental sustainability, and professional autonomy. Yet in interviews, practicing engineers routinely state that the most influential training and mentorship in managing these competing demands takes place primarily on the job, after a student has graduated with an engineering degree. Our NSF-funded research project seeks to push back that training and mentorship to the undergraduate experience by introducing educational innovations, informed by ethnographic research with practicing engineers. This paper reports on the preliminary results from a pilot project in required petroleum engineering senior seminar and capstone design courses.

II. Engineering and Corporate Social Responsibility

To help prepare engineering students to navigate the ethical and sociotechnical challenges of their future work, we offer a critical engagement with corporate social responsibility (CSR) as a crucial if contested field of practice, since the social and environmental dilemmas faced by the extractive industries are increasingly framed in relation to this concept or one of its close relatives, such as sustainability, creating shared value, triple-bottom-line, or health-safety-security-environment and social responsibility (HSSE-SR, most commonly used in the petroleum industry). There is no single definition of CSR that encompasses all of the policies and programs implemented in its name, inspiring two key scholars in the field to argue that the term has "become so broad as to allow people to interpret and adopt it for many different purposes." [1] We follow industry practitioners and academics alike in using it as an umbrella term to refer to policies and programs that seek to reconcile the pursuit of profit with the wellbeing of the environment and the people impacted by business operations.

As a concept, CSR first emerged in the extractive industries precisely because it offered a strategy for firms to address public criticism of the social and environmental impacts of their activities. It remains a controversial concept, with many academics and community activists arguing that it represents a change in public relations rather than a change in making businesses more accountable for their practices. Yet social science research within companies shows that CSR is not a panacea for reconciling ethics with economics, but neither is it simply a disingenuous attempt to cover up the continued ills of irresponsible business practice [2, 3, 4]. CSR is an increasingly influential suite of practices, concepts, organizations, and institutional frameworks that have transformed the ways in which firms organize their internal activities and their relationships with external entities such as government agencies, activist groups, and community stakeholders.

Most U.S. engineering undergraduates spend their professional lives working in corporations, and corporations present particular opportunities and challenges for engaging in ethical engineering practice. Engineering students must be trained to critically appraise the opportunities and limitations of CSR because it is the dominant framework they will encounter as employees for thinking about corporations' relationships with external stakeholders, as well as the social and environmental dimensions of their own professional practice. Engineers need a robust education of the complexities of CSR because they can (perhaps unintentionally) subvert important principles of social and environmental justice while ostensibly

pursuing the goals of CSR [2-6]. Our research therefore introduces students to the concept of corporate social responsibility and its critiques, and examines how their own thinking on the concept and its relevance to engineering evolves as a result of classroom activities and assignments. The intervention on which we report here is a pilot first attempt to work with petroleum engineering students.

III. Methods

A pilot study investigating how introducing CSR as a means to understand and account for the many sociotechnical aspects of projects was implemented in a senior-level seminar for petroleum engineering students. The course outcomes are focused on communication, ethics, and the broader impacts of engineering work. The co-authors of this study, including the professor of the course, designed and implemented a unit consisting of a series of assignments and activities focused on empathizing with stakeholders, CSR, public perception, and how engineering companies approach the more "human side" of engineering. Assignments and activities included a role-playing exercise, assigned readings and videos, and a guest speaker from the oil and gas industry who specializes in CSR.

The role-playing exercise spanned several classes, and focused on a fictitious nation with prolific, yet undeveloped oil and gas resources. The students assumed the roles of various stakeholders in a government meeting, and then conducted a basic analysis of these stakeholders. The final deliverable from the role-playing exercise was an oil and gas development plan for the nation that would win the approval of all of the identified stakeholders.

The assigned readings, videos, and guest speakers were interspersed with the role-playing exercise to provide background knowledge and context. The goal of these assignments was to expand the ways in which students view oil and gas development in general, as well as the individual people and groups the development may affect. Furthermore these assignments demonstrated some of the ways engineers and corporations address the social aspects of projects.

To gauge how students' views changed (or did not change) as a result of the activities, we asked students to write their responses to an identical prompt at the beginning and end of the module. The prompt was as follows: "*Do corporations have responsibilities to society? Why or why not? If they do have responsibilities, what are those responsibilities? Do you as an engineer have a role in fulfilling any of those responsibilities?*"

The preliminary essay was an in-class writing assignment that students completed for an attendance quiz. After over two weeks of activities, the post-essay was assigned as one of a number of prompts in a reflective exercise. To prevent students from using the pre-write to complete the post-essay assignment, the pre-writes were not handed back until after the post-write was turned in. A comparison of the writings showed that the pre-and post-writes were unique for all participants.

For this study, the initial and final essays answering these questions were evaluated as follows. Each student who gave informed consent to have his or her work included in the research was assigned a random number. Their essays were anonymized and assigned that number, and then uploaded into Atlas.ti for coding. Out of 154 students, 107 gave informed consent and completed both the pre and post writing assignments. The three co-authors of this paper collectively developed a codebook after an initial read through of the essays. They then collectively coded half of the essays, and one author coded the other half individually, with the other two checking her work for consistency.

IV. Results

The students overwhelmingly argued that corporations do have responsibilities to society, with only one student out of 87 saying that they did not. Yet the students' thinking about what exactly those responsibilities were and how they connected (or not) with engineering did change.

A. *Corporate Responsibilities to Society.*

Before students participated in the CSR classroom module, many of them identified environmental performance (managing pollution, reclamation, and following regulations); economics (creating wealth for society and sharing profits with communities); and maintaining health and safety as the primary components of a corporation's social responsibility. They also mentioned social issues such as promoting the public good, not disturbing those who are near to the project and ensuring that affected stakeholders share in the benefits of a project. Figure 1 below shows a comparison of how many times certain themes were mentioned by students in the pre- and post-responses. Notice that the number of mentions for environmental, economic, and safety remarks decreased, while those for society increased.

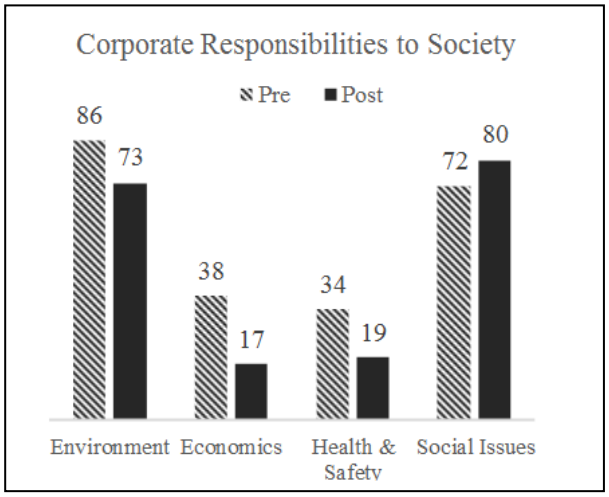

Fig. 1. Number of mentions in pre- and post-response exercises regarding the environmental, economic, health and safety, and social aspects of the responsibilities held by corporations

In addition to the numbers of responses, it is also important to note how the verbiage changed. Not only did the students discuss environmental issues, economics, and safety less, the complexity and specificity of some of their responses increased. When discussing economics, the comments changed from making profits, sharing wealth, satisfying

shareholders, and creating jobs to protecting reputation, mitigating risk, and maintaining a social license to operate. Before the class unit, social issue discussions centered around providing shared benefits and being philanthropic. After the unit, social responsibilities became more complex such as maintaining transparency and seeking mutual understanding. These changes are summarized in Table 1.

When writing about why corporations had responsibilities, 14 argued it was because corporations are people, 7 argued it was because they are a part of society, and 2 argued it was because corporations are the community.

B. *Engineers' Roles in Corporate Responsibility*

Many students discussed that they have responsibilities because engineers are part of the corporation (12 occurrences), and that they are also part of the community (6 occurrences). Only one student argued that engineers did not have any role to play in relation to corporate social responsibility.

When writing about the specific role of engineers in relation to CSR before the unit, they built on the corporate roles they identified. In regards to health safety and the environment, students identified upholding laws and regulations and minimizing multiple types of pollution as their key responsibilities. They also felt that one of their main roles was to create responsible designs. Promoting the public good, participating in corporate philanthropy, creating local jobs and economic development, and providing benefits to stakeholders were also prevalent economic and social discussions.

After the CSR unit, the number of engineer responsibilities and the complexity of student views increased. Discussions of safety and the environment decreased by over half. Whereas the number of social responsibilities increased significantly. There was a prevalent idea that engineers need to make responsible decisions and engage with society in multiple ways. Being aware of what is occurring in the community, being sensitive cultural differences, communicating, maintaining transparency, and building relationships were all identified as being very important. The number of students mentioning identifying and working with the needs of the community quadrupled, and the responsibility to educate society had an even greater increase. Table 2 summarizes the key responsibilities identified by students and how the frequency of discussion changed from before the unit to after.

TABLE 1 CHANGES IN DISCUSSIONS OF SOCIAL ISSUES

Topic	Mentions Before Unit	Mentions After Unit
Promote the Public Good	38	12
Philanthropy/Donations	7	1
Sharing Benefits	13	11
Social License to Operate	6	8
Balance stakeholder needs	0	3
Find mutual understanding	0	3
Community Development	3	9
Minimize negative impacts	30	35
Sustainable Development	1	8
Improving Quality of Life	11	18
Manage Reputational Risk	2	10

TABLE 2 SUMMARY OF KEY RESPONSIBILITIES MENTIONED BY STUDENTS

Topic	Mentions Before Unit	Mentions After Unit
ENVIRONMENT & SAFETY		
Uphold Laws & Regs.	21	10
Minimizing Pollution	26	22
Maintain Health/Wellness	7	13
ECON / BUSINESS		
Responsible Design	13	5
Maintain Positive Engineering Work Culture	0	2
Work with non-technical personnel	0	2
Make Responsible Decisions	8	18
SOCIAL		
Cultural Sensitivity	5	7
Agreements, Compromises with Community	7	6
Relationship Building	8	12
Awareness	2	7
Transparency	3	8
Communicate with Society	10	17
Identify Community Needs	2	10
Educate Society	9	28

Many students connected the responsibilities of engineers to personal senses of right and wrong (5 connections), "values" (9 connections) and ethical codes (20 connections).

V. DISCUSSION

Overall, this exercise was valuable for the students. The professor of the course observed that this group of students appears to understand that CSR is a part of their job, and that engineering projects involve many more stakeholders beyond the company and the client.

Although anecdotal, the authors believe that the response patterns in the pre- and post-write may emerge from various factors. The lower number of links mentioned at the end of the unit as compared to the beginning of the semester (272 versus 188) may be a result of the post-write being assigned as a part of a larger assignment versus the pre-write being a standalone essay. The students may have been fatigued by that point in the assignment and wrote much less. It is also possible that the pre-writes were longer because these particular engineering students tend to write more and use "flowery" language when they are uncertain about what they are discussing. In addition, after the unit, students were more familiar with more specific language regarding CSR, and thus were able to express their thoughts more concisely. At the same time, mentions of a very vague responsibility to "promote the public good" decreased from 38 to 12, perhaps signaling that students could speak more specifically about social responsibilities.

A. *Further CSR Interventions in Subsequent Course*

Thirty-nine of the original participants enrolled the following semester in a senior capstone design course that focused on creating an oil and gas development plan in a field that sits partially in a metropolitan area Due to the nature of this project, the students received further exposure to CSR aspects, including listening to professionals working in CSR in the field the project is located in, conducting stakeholder analyses, and creating stakeholder engagement plans. To

investigate how the seminar classroom interventions affected the work of these students in their capstone course, they were asked to reflect upon their experiences. Additionally, the students were asked to contribute their ideas about how to better prepare them for CSR while they were still in school.

Many students felt that the capstone project reinforced what had been covered in the seminar course discussed here. After a visit from the community relations engineer from the client company, many students expressed complex, insightful thoughts about CSR in reflection papers. Their comments showed that some students' views of CSR became more sophisticated after they had more time for reflection and the opportunity to apply the concepts and lessons to an actual project. Many mentioned that they had a new appreciation for how important it is to build lasting relationships with the stakeholders, and to follow up and maintain these relationships for the long term. Students were also surprised at the number of possible stakeholders and how geographically spread out they can be. Half of the students also remarked that they now appreciate how important it is to be professional, engaged, and transparent when they are at work and out in the community.

At the end of the capstone design course, students were asked to reflect on the experience and to suggest ways they felt we could better help them to learn CSR. Their answers focused on how they thought they could be better prepared for the project they just did, as well as what they foresee to need when they are professionals. The majority of answers encompassed involving CSR throughout the curriculum, providing more "real world" exercises in class, and providing opportunities to engage people outside the oil and gas industry. Several students also suggested making one of the CSR courses currently on campus a required course.

One student summarized many of the views that students shared at the end of the capstone. They stated, "I didn't realize the magnitude of issues and concerns the public had toward the petroleum industry." One student summarized many student views well. They stated, "I think (the capstone) helped me to take some of these issues out of theory and into practice, even if it's all still hypothetical. In a classroom setting, I think it's easy to put a mental wall between the engineering side and the human side of things. So while I knew what the issues were and maybe a little about how they're handled, I usually always thought of them as fully separate and usually as someone else's problem. But in going through the field development project I definitely have a deeper understanding of how closely married the two sides really are and how frequently one directly influences the other. With a deeper appreciation of their interconnectedness, I'd like to think I'll be more conscious that I'm not just an engineer making minor decision on paper, but that those decisions have the capacity to really alter someone's livelihood."

B. Plans to Continue CSR Module

Based on the outcomes of the CSR module and the observations of students in the capstone project course the following semester, the CSR unit will be a part of the senior seminar course when it is offered again next fall semester. The role-playing exercise allowed students to get a sense of the number of stakeholders that may potentially be affected by oil and gas development. The guest speaker and videos helped make CSR a relevant topic for their careers, and the readings aided the students in grasping concepts and learning applicable vocabulary. Each component added value to the unit. The students were more engaged in the active role-playing exercises than in the other activities, which is to be expected since they were required to participate. Initially, they were skeptical about the guest speaker. Students felt that it was going to be irrelevant to their careers. However, by the end of the presentation, most students learned more than they thought they would and found some relevance. The reading assignments were met with the least enthusiasm and engagement. The final essays reflected that many students merely skimmed for usable quotes for their essays.

When this unit is offered again, the authors intend to use all of the same components, with the addition of a structured discussion focused on the assigned readings. One goal will be to address the prevalent stance among students that social licensing problems can be addressed by engineers "educating" communities, rather than by listening to them and addressing their concerns. It would also be interesting to expand the unit and include aspects during the capstone project course that tie directly back to the activities completed in the seminar course. Extending the unit to two semesters will allow for students to begin formulating ways to engage CSR that go beyond educating society, and focus more on understanding societal needs and shaping business practices to help meet some of those needs.

VI. CONCLUSIONS

Students began the course module focusing on the environmental and safety dimensions of CSR. This focus is not surprising, given that these are issues that play a large role in the undergraduate engineering curriculum and can be framed in quantitative terms. In fact, scholars of CSR in the extractive industries argue that corporate efforts in these areas are more successful because employees, the majority of them engineers, are more comfortable with and better equipped to address them [1]. After the module, however, students were more able to identify the dimensions of CSR that are more readily classified as "social," such as community development or communication. Yet even though students became more familiar with the "social" dimensions of CSR, they did not as readily identify a role for engineers in this area, possibly because many students still feel dealing with the social domain is the role of people with different forms of expertise. This represents an opportunity for engineering educators. While it is important for students to recognize the limitations of their own training and seek out expertise from other disciplines, helping students to see how engineers and engineering are directly implicated in issues that are viewed as primarily "social" ones will help illuminate the sociotechnical dimensions of their professional practice. This in turn, will help to lay the foundation for challenging the division of engineering knowledge and practice into distinct social and technical realms [7].

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