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Petroleum Engineering Students' Views of Corporate Social Responsibility

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Abstract

The mining 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 CSR may be a fruitful arena from which to illustrate the profoundly sociotechnical dimensions of the engineering challenges relevant to students' future careers.

Introduction

The ongoing boom in energy and mineral development is calling increasing numbers of engineers into work in the mining and oil and gas industries, especially as the primary cohort of mining and petroleum engineers reaches retirement.[21] The Bureau of Labor Statistics forecasts that the ranks of petroleum engineers will expand 26% by 2022 and mining and geological engineers 12% by 2022, to say nothing of the increasing numbers of mechanical, chemical, and environmental engineers who work in extractive industries. Yet new technologies, such as hydraulic fracturing and directional drilling, unlock vast new resources at the same time as they raise public concern about potential risks to the environment and human health. Even the greenest of new economies will require mining to meet growing demands for the rare earth minerals required in smart phones, laptops, wind turbines, electric cars and LED lights. "Mining moves more earth than any other human endeavor,"[18] raising fundamental questions of how the industry's impacts on ecosystems and human populations should be managed.

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 a required petroleum engineering senior seminar.

Engineering and Corporate Social Responsibility

To help prepare engineering students to navigate the ethical 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 (CSV) 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."[3] 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 environments and people impacted by business.

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.[22, 23, 29] 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.

Engineering ethics, however, has been slow to include CSR. The current research on social responsibility and engineering education, for example, rarely engages *corporate* social responsibility. For example, a recent issue of *Science and Engineering Ethics* [31] dedicated to "teaching social responsibility to students in science and engineering" does not address CSR. Only one research article in the *Journal of Engineering Education* [17] includes the term corporate social responsibility, which comes in the form of a student quote arguing for its importance in thinking about the influence of engineers on society. A search of ASEE conference proceedings for the term corporate social responsibility returns 23 papers that reference it as a component of sustainability education that is valued by future employers, but do not empirically study CSR, education in CSR, or engineers' engagement with CSR.[1, 12, 14, 19, 26, 27] Finally, the book *Citizen Engineer: A Handbook for Socially Responsible Engineering* devotes three paragraphs to CSR, understood broadly as increased awareness of the ethical behavior of companies.[10]

Didier and Huet provide the most thorough study of CSR and engineering programs, finding that its integration into the French system is uneven and responds to differing motivations (civic, pedagogical, organizational, and strategic).[9] Despite this unevenness, administrators and faculty assume the necessary courses to engage with CSR "already exist in the curriculum." Their call for more clarification on what CSR is and how it should be addressed by engineering education remains to be taken up, likely because CSR itself is controversial among educators committed to a robust promotion of social justice in the profession.

The limited treatment of CSR within engineering ethics is a missed opportunity. First, the political, regulatory, environmental, and social dimensions of CSR directly open up the broader

macro-ethical concerns that are missing from undergraduate training that focuses on micro-ethical decisions made by individual engineers, which obscures broader questions about the collective ethics of the engineering profession and the environmental and social implications of technology.[2, 4, 30, 32] Second, 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. Corporations are complex sociotechnical systems that have developed sophisticated (if sometimes insidious) strategies of engagement with specific impacted communities as well as larger publics. They are characterized by internal dynamics and power struggles among personnel and divisions who debate the role of profit-making in relation to serving (or at least not harming) society. How is it possible to cultivate "ethical" engineers if their undergraduate training—their primary source of professional socialization—engages the dynamics of the institutions within which they work in only a limited way? 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 principles of environmental justice while ostensibly pursuing the goals of CSR. Ottinger's ethnographic study of CSR and engineering in relation to a petrochemical refinery raises crucial questions for understanding engineering and CSR in extractive industries more generally.[22] The "socially responsible" approach to community relations and environmental management that put to rest years of acrimonious company-community relations had the ironic effect of subverting environmental justice: the CSR practiced by the company placed scientific expertise firmly in the hands of their own technical experts, neutralizing the challenges to that expertise made by grassroots environmental groups that embodied a more democratic approach to environmental science and policy by collecting and analyzing their own data. This research solidifies a widespread critique of the asymmetries that persist in the "partnerships" celebrated in CSR.[1, 15, 23] Ottinger pushes social scientists and engineering educators alike to consider how technical knowledge—even believed to be in the service of responsibility to the "public good"—can shore up the power of corporations.

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.

Methods

The course for the pilot study is a required, 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 the 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. These assignments expanded the ways in which students viewed 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 asked students to respond to questions about whether and how corporations had responsibilities to society and what roles engineers fill in fulfilling 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 87 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.

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.

Students began the module by signaling environmental and social performance as the primary component of a corporation's social responsibility. There were 86 mentions of the environment (or specific elements of environmental performance, such as managing pollution or reclamation) and 72 mentions for social issues (primarily not disturbing nearby communities) in the pre-activity essays, compared with 38 for economic issues (primarily creating wealth for society and

sharing profits with communities) and 34 for safety issues. After the module, there were more mentions of social responsibilities (80) than environmental (73), economic (17) and safety (19). While mentions of social issues increased over the semester, mentions of all the others (environmental, economic and safety decreased.

Not only did students write about social responsibilities more often after the module, they also wrote about more specific social responsibilities. For example, only 3 students mentioned community development as a corporate social responsibility before the module, compared with 9 who did after the activities. Only 1 student mentioned sustainable development as a corporate social responsibility before the activity, but 8 did after it. Mentions of corporations assisting in local education increased from 6 to 11, and mentions of improving local quality of life jumped from 11 to 18. The number of students who included communicating with society as a part of a corporation's social responsibility almost doubled, from 10 to 17. 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. Interestingly, students were more likely to signal "educating society" as a part of corporate social responsibility after the activity: 3 before and 17 after the module.

Over the course of the semester, only one student argued that engineers did not have a role to play in relation to social responsibility. When writing about the specific role of engineers in relation to CSR, the rest of the students overwhelmingly pointed to safety (27 connections), the environment (40 connections) and a general sense of promoting the public good (19 connections). There were fewer connections between engineering responsibility and social issues: 9 connections to social issues in general, 5 to agreements/compromises with communities, 11 to communicating with society and 2 to informing society (but only 1 with *listening* to society), 14 to building relationships, 5 to cultural sensitivity, and 7 to promoting education. Students also signaled a special role for engineers designing in a responsible way (17 mentions) and making decisions in a responsible way (23 mentions), assigning a smaller role to the identification of community needs (6 mentions).

Students were also likely to connect the responsibilities of engineers to personal senses of right and wrong (5 connections), "values" (9 connections) and ethical codes (20 connections). They also clearly saw a role for engineers in minimizing risk (16 connections), creating economic value for their employers (11 connections), creating jobs (8 connections) and promoting local economic development (7 connections). Seven identified volunteering as a responsibility of engineers. There were 9 mentions of upholding laws and regulations as the responsibility of engineers. When discussing why engineers had responsibilities, 12 said they did because engineers are part of the corporation and 6 said they did because they are a part of communities. 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.

Some changes in student identification of links between CSR and engineers occurred over the course of the module, with students identifying fewer links at the end of the semester (272 versus 188). Students were more likely to identify links with educating society (11 more mentions after the module) and with making decisions that impact social responsibility (11 more). Students

were less likely to identify these links concerning promoting the public good (13 fewer mentions), environment (12 fewer), sharing wealth with communities or the public (9 fewer), and minimizing negative impacts (8 fewer).

Discussion

Although anecdotal, the authors believe that these patterns 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 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.

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. One fourth of the students enrolled in the course for this study are now enrolled in a capstone project course with the same professor. 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 more time for reflection and the opportunity to apply the concepts and lessons to an actual project.

Based on the outcomes of the CSR module and the observations of this group 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. 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.

Conclusion

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 better equipped to address them.[3] 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. We say that these are "more readily classified as social" because environmental and safety issues are also always "social"—or, more properly, *sociotechnical*—issues, even if they are framed as being technical issues. Conflicts between mines and communities, for example, are often correlated with environmental accidents.[8] Environmental incidents have profoundly "social" effects, perhaps seen most dramatically in disruptions to individual and community livelihoods. Furthermore, judgments of what constitutes sound environmental performance are deeply informed by cultural worldviews.

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. Rather, they viewed engineers' contribution to CSR to be ensuring sound environmental and safety performance and promoting the "public good," defined in a rather amorphous way. Again, this preference is likely linked to the students' own experience and comfort with environmental and safety issues and the sense that the social domain is properly 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 would help illuminate the *sociotechnical* dimensions of their professional practice, laying the foundation to challenge the depoliticization of engineering knowledge and practice into distinct social and technical realms.[6]

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