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Undergraduate Voices, Volume 1 (2018)

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Undergraduate Voices

Reflections on the ethical, sociocultural, and historical dimensions of technical disciplines

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Undergraduate Voices is a series showcasing collections of student writing created in University of Dayton's writing seminars conducted by Professor Amir Kalan. The articles appearing in each issue have been written in order to highlight the *humanities sides* of the students' intended majors. The students, thus, have been writing in order to reflect on the ethical, sociocultural, and historical dimensions of their disciplines to complement the technical education they receive in the specialized courses.

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Editor's Page

Amir Kalan, University of Dayton

First-year undergraduate composition is often dominated by pedagogical practices that focus on persuasive writing and the rhetoric of assertion. Rooted in Anglo-American essayist literacy, college writing is traditionally treated as reporting facts in order to argue cases. In my writing seminars, my students and I decided to resist this dominant approach by employing writing to make sense of ourselves and the world around us. I invited the students to use writing as an epistemological medium in which students could think about their intended majors to comprehend the complexities involved in the disciplines and professions that they were about to enter. In this sense, we did not examine our textual products for their technical quality only, but we used writing as a tool for exploration and speculation; as a space where students were allowed to doubt and ask questions as well as prove and debate opinions.

The students specifically wrote about the *humanities sides* of their intended majors. They asked how their future professions would impact their communities and other communities. Also, they wrote about the people who were active in their fields and how their genders, ethnicities, cultural legacies, and so forth impacted their experiences in the field. Hence, the undergrad students who participated in the seminars employed writing in order to reflect on the ethical, sociocultural, and historical dimensions of their disciplines to complement the technical education they received in their specialized courses. The articles we present in this volume are examples of the students' engagement with the course.

In this volume, Grace Ports explores ethics education in engineering. She explains why engineering students need to engage with ethics and examines possibilities offered by formal and experiential learning of ethics for engineering students. Julia Weber asks why the field of engineering is male-dominated and why this condition should change. She discusses the proportion of men in the field in comparison with women and focuses on discrimination against women in the

workplace. Alec Raber presents his thoughts about sustainability in chemical engineering by highlighting concepts such as industrial ecology and green engineering. Seth Adams advocates for more experiential learning in medical schools and presents experiences of community-based learning and situated learning recommended in medical education literature. Katherine Theis compares student engineers' knowledge of ethics learned at college with ethical practices they acquire when they are embedded in their professional contexts after graduation. Bailey Reid reflects on how engineers interact with communities they enter for conducting their projects. Reid invites engineers to regard communities as potential partners rather than obstacles that professionals should work around. Matt Westman looks at various businesses and writes about how they view and deal with the idea of making their practice more environmentally sustainable. He explores the benefits for businesses that choose to "go green" to show the investment of being more environmentally conscious is worth the extra money. Finally, Jared Beach, in a reflective article, presents his philosophical speculations about the ethical considerations that entrepreneurs and business leaders need to engage with.

I sincerely thank all the contributors and admire their courage to share their thoughts with the world, although, as first-year students, they are still at the beginning of their academic journeys. I, also, wish to thank the writers' peers who reviewed these articles in the process. I would like to thank University of Dayton's Write Place—and its director Christina Klimo—for putting their consultants in conversation with the students about their projects. I am also appreciative of Maureen Schlangen, University of Dayton's E-scholarship manager, for making the Open Access publication of this collection possible.

LITERATURE REVIEWS

Literature Review

Formal and Informal Undergraduate Ethics Education in Engineering

Grace Ports, University of Dayton

Introduction

This literature review attempts to answer the question of whether formal education or informal education of ethics within civil engineering is more beneficial. If there is a lack of structured education of ethics in civil engineering, then another area of interest is to discover where engineers are being informally educated. Another area of inquiry is whether it is more beneficial to teach engineers ethics prior to the time when they are required to study the code of ethics for their certification exam, or should engineers wait until moments before the exam to study the code. This article examines the potential benefits of studying the code of ethics in a formal setting as well as the effectiveness of learning ethics informally.

The topic of a structured education in engineering ethics has been a controversial and somewhat confusing area of discussion (Li & Fu, 2012). As the field of engineering develops, interest in ethics education grows. An issue that many undergraduate institutions struggle with is determining the best way to teach ethics and professionalism in the field of engineering. Some even question whether or not ethics should be taught to undergraduates in a formal setting. This confusion stems from the lack of research conducted on finding the best way to teach ethics. Li and Fu (2012) address this confusion stating that "a critical gap still exists in what to teach and how to teach engineering ethics in order to produce the best possible ethical engineers in today's fast-changing environment" (p. 340). Not having a standard for all undergraduate engineering programs causes confusion.

Professors and faculty are unsure of what they are supposed to teach and what methods would be the most effective for teaching. As Li and Fu point out, engineers are required to keep up with a fast-paced, constantly changing environment, which makes it even more important for engineers to be taught ethics and professionalism.

This literature review has been written from my perspective as a first-year undergraduate student who plans to pursue a career in civil engineering in the future. I am interested in learning more about how I can optimize my education of ethical concepts, whether it would be through formal undergraduate courses or through experience-based opportunities. I understand the significance of engaging with ethics and professionalism and hope that this literature review will reveal the best ways of learning ethics for my own studies and for other engineers currently studying for their bachelor degree.

Methods

For this research project, I used information gathered from an interview to guide my review of literature. The interviewee, an experienced discipline insider, was prompted with questions which related civil engineering to the humanities. After being given several possible topics, brief research was done in order to discover which topic filled a gap in current literature. A topic of discussion which the interviewee did not know much about was formal and informal education of ethics within civil engineering, or on a broader scope, engineering in general. Once I found this topic to delve into, I found reliable sources which expanded upon this topic. When documents and articles were found which clarified the status of ethics education in engineering, they were then annotated and separated into different categories of thought to be compared and contrasted to other documents. These documents were separated into categories which focused on the current curriculum of ethics in engineering, the informal education of civil engineering, and ethics relating to civil engineering. By separating the literature into categories, commonalities and differences within the literature became evident. These trends were then analyzed in order to come to a conclusion.

Statement of the Problem

According to several studies, students actually have a desire to learn ethical codes which pertain to their field (Gil-Martiín, Hernández-Montes, Segura-Naya, 2010; Monteiro, 2016). Monteiro (2016) conducted a training session showing that

students consider it "necessary to incorporate ethics education in engineering courses" (para. 83). Some students, however, were hesitant to answer whether they thought ethics education was necessary or not because they did not "consider themselves informed about the subject in question" (para. 84). After Monterio revealed several themes of ethics education in a brief training session, the students agreed that it was indeed important to incorporate ethics into the engineering curriculum. This training also revealed that the students not only thought the curriculum would be necessary for their professional career but felt that the information would apply and improve their ability to respond to situations in their personal lives.

Along with Monteiro's findings, Gil-Martiín, Hernández-Montes, and Segura-Naya (2010) have also discovered undergraduates' thoughts after participating in a course which focused on ethics in engineering, specifically relating to civil engineering. The course, "went beyond professional aspects; with students seeking to include moral and ethical principles in their own ordinary lives as well as in their professional development" (p. 412). The researchers found that although the main focus of the course was the ethical dimensions which construct engineering standards, many of the students found that although they were engaging with law, they were more concerned about learning ethics to be moral citizens. They also found that this course prompted the students to seek more general knowledge about conscience.

Consistent with the students desiring to deepen their knowledge of ethics, Hoke (2012) points out the argument that, "ethics education is itself a means of meeting one's obligations under ASCE's Code of Ethics" (p. 41). The American Society of Civil Engineers' Code of Ethics (2012) states, "Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision" (Canon. 7). Accordingly, it is required that engineers be able to comprehend Code of Ethics and be able to apply their knowledge and ethics education to complex ethical dilemmas.

Engineering ethics can be taught to undergraduate students in various ways. However, these means of teaching ethics can be separated into two categories, formal education such as classroom-based learning, or informal education, which is an organic experiential means of education. In the following sections, I will address the benefits and shortcomings of these two means of teaching engineering ethics.

Formal Ethics Education

While the studies conducted by Monteiro (2016) and Gil-Martiín, Hernández-Montes, and Segura-Naya (2010) confirm students' desires to learn ethics in engineering, there are uncertainties across the field regarding the best methods and strategies for teaching ethics. There are two general schools of thought dealing with the education of ethics for engineers. One school argues that it is most beneficial for engineers to be taught ethics formally during their undergraduate academic career (Cao, 2015; Colby & Sullivan, 2008). The other school argues that this is not the best time to teach ethics; instead, it is more beneficial to wait until a student is participating in hands-on practices, such as co-ops or other employment, or studying for their master's degree (Bairaktarova & Woodcock, 2015; Berne & Briggs, 2003; Colby & Sullivan, 2008; Newberry, 2004)

As Cao (2015) mentions in the "Comparison of China-US Engineering Educations in Sino-Western Philosophies of Technology," as humans progress into the future, ethical dilemmas will not disappear, but continue to accumulate: "Old engineering ethics issues will become intensified, and new conflicts will continually emerge in the society" (p. 1632-1633) making engineering tasks more difficult for engineers who have not received a formal education in dealing with ethical dilemmas. Cao not only calls for engineering ethics to be implemented into the academic curriculum, but also for there to be "some consensus" (p. 1632) internationally which holds nations accountable for "codes of engineering ethics, accreditation of engineering programs, and the making of international technological and engineering laws" (p. 1632). Cao urges, "engineering ethics education should be given a proper disciplinary status" (p. 1632).

Colby and Sullivan (2008) also highlight the importance of teaching ethics in undergraduate education, suggesting that institutions need to make the ethics education more "intentional" (p. 333). "Ethics Teaching in Undergraduate Engineering Education" recommends that if institutions want to "strengthen their students' ethical development, they should consider tracking students' exposure to these issues, identifying where and how this learning takes place" (p.336). According to Colby and Sullivan (2008), documentation which looks to follow how and when undergraduates learn ethics shows that the curriculum is often unclear and "sometimes even seemed to be inaccurate" (p. 336).

A nonprofit, non-government organization, ABET, or Accreditation Board for Engineering and Technology, has been attempting to clear this confusion in

undergraduate education by creating criteria for programs at colleges or universities to become accredited. According to ABET's website, "ABET accreditation provides assurance that a college or university program meets the quality standards of the profession for which that program prepares graduates." ABET claims that there are several reasons why a program should consider the accreditation process. The first reason they suggest is for the students within the accredited programs. By being in these programs, the students are guaranteed to learn the global standards within their engineering field. By being a college or university that offers ABET-accredited programs, the school is able to boast that it offers a high-quality of education. The ABET also aids employers by guaranteeing that the student of ABET-accredited programs received all the necessary educational requirements (A Valued Credential). Part of the accreditation criteria focuses on student outcomes, including comprehension of ethical concepts. The Criteria for Accrediting Engineering Programs, 2016-2017 states that students should have the "ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability" as well as "an understanding of professional and ethical responsibility" (Criteria for Accrediting Engineering Programs, 2016-2017).

For instance, the University of Illinois is ABET-accredited in aerospace engineering, agricultural and biological engineering, bioengineering, chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, engineering mechanics, general engineering, industrial engineering, materials science and engineering, mechanical engineering, and nuclear, plasma, and radiological engineering. At the University of Illinois, they offer the course "Ethics and Engineering," open to students of all majors. This course teaches both normative ethics as well as ethical applications to the engineering field. The course will aim to lead the students to develop their moral character (ECE/PHIL 316: Ethics and Engineering). This class could ensure that engineering students are learning "professional and ethical responsibility", as the ABET requires (Criteria for Accrediting Engineering Programs, 2016-2017).

As Cao suggests, in order to keep up with new ethical complications, there needs to be an international consensus that holds the nations accountable for the engineering ethics education that they are providing. Cao expressed that engineering ethics is critical and "should be given a proper disciplinary status" (p. 1632). Colby and Sullivan agree, claiming that engineering ethics education needs

to be made more "intentional" (p. 333). ABET sees this need and has been working with engineering programs at 776 colleges or universities in 31 countries. ABET is making engineering ethics a requirement within its accredited programs.

Informal Ethics Education

Although formal ethics education is supposed to provide a substantial foundation of ethical education, an overwhelming number of articles suggest that the formal education of ethics is not necessary (see Bairaktarova & Woodcock, 2015; Berne & Briggs, 2003; Colby & Sullivan, 2008; Newberry, 2004). Their findings argue that the ethics education that engineers acquire outside of the institution are more beneficial and meaningful than within a classroom. The advocates of this view have several different reasons as to why they are against classroom-based undergraduate ethics education. The arguments vary from the lack of maturity of students to the impracticality of trying to fit another course into the already dense required academic classes. These arguments which counter formal education can be separated into three categories: lack of time, lack of maturity, and lack of experience.

Critiquing formal ethics education in undergraduate education, Colby and Sullivan (2008) also point out several shortcomings in undergraduate engineering studies regarding ethics education. They criticize the narrow definition of ethics and professional responsibility and suggest broadening the definition. Colby and Sullivan (2008) raise the point that ethics cannot be fully understood only within the frame of undergraduate education, "Competence in these and other aspects of engineering practice requires many years of on-the-job learning and professional development" (p. 335). While learning ethics during a student's undergraduate years might lay the foundation for their profession, it takes years of practice in order to fully understand the depth and breadth of ethics and professional responsibility. While having a basic understanding of engineering ethics taught in undergraduate classes could be beneficial, a strict curriculum should not be stressed considering complete comprehension requires several years of hands-on experience.

Another issue addressed is that undergraduate students might not necessarily be receiving the hands-on practice which learning ethics requires. Colby and Sullivan (2008) use the example of nursing and medicine to explain their argument:

> In both of these fields, professional responsibility is learned primarily in the context of practice-based education, in the parts of their training that involve supervised care of patients. This approach to teaching professional responsibility and ethics engages students with models of high quality work, supports the development of conscientious habits, makes clear to students the relevance and importance of ethical issues for their work, and deepens their understanding of complex issues within an institutional context. (p. 336)

Applying the same argument to engineering, it would be more beneficial for students to engage with activities such as "design courses, co-op experiences, summer or part-time engineering work, or project-focused extra-curricular activities" (p. 336), which are all considered informal methods of learning. Working in a setting surrounded by those who are experienced makes these types of informal, hands-on experiences more valuable than a formal, classroom education. Being surrounded by others who have several years of experience in the field will most likely make a greater impact than learning ethics from a textbook. Berne and Briggs (2003) exemplify this when they explain the results of taking undergraduate engineering students to visit "intelligent, well-read senior citizens" (p. 93). They suggest that we can look to those older and more experienced than us to shape our understanding of "what is right, what should happen and should not, relative to the way we will use and adapt to, and perhaps depend on, technological developments to come" (p. 94).

Along with lacking experience in the field, Newberry (2004) suggests that young engineering students may also lack the maturity or time to attempt to learn ethics. Rather than aiming to thoroughly teach ethics to undergraduates, professors and faculty are providing the students with preliminary information, which they may later use as a base to build upon later in their careers. Newberry rationalizes that "after all, perhaps college-aged people are not yet primed for serious emotional engagement on these issues, so the task is simply to cultivate the soil in which it can later sprout" (p. 347). While this concept promotes education in ethics, it only proposes that a rudimentary level of education should be provided. This suggests that a basic level of ethics education should be introduced but should not be expected to be fully understood until the engineers have had experiences to further clarify ethical concepts. Newberry (2004) suggests instead that the most

appropriate time for engineers to formally learn ethics is while they are studying to obtain their master's degree. The American Society of Civil Engineers (2017) has responded to this topic by asserting that the four years of undergraduate studies is not sufficient enough for civil engineers. ASCE now recognizes a master's degree as being the first professional degree in the field. This statement by the ASCE shows that they acknowledge the difficult and extensive course load of undergraduate civil engineers.

One of the reasons why an undergraduate degree in engineering is not sufficient enough to be considered a professional degree for civil engineering is because the undergraduate education does not allow enough time for thorough learning of engineering ethics. Undergraduate engineering students already have a full curriculum, solely composed of technical content. If these students are already extremely busy with their other required classes, when will they squeeze ethics into their education? This also raises the concern about the legitimacy of ethics education if it is not considered or treated as equal to the other technical classes (Newberry, 2004).

Writers who are skeptical about the formal undergraduate education of ethics in engineering underline many problems with the lack of hands-on practice, the immaturity of undergraduate students, and already extensive course load. However, there was also a study conducted which shows that even if students do receive an ethics education, they would not show a better comprehension of professional responsibility than a student who has not taken any ethics class. Bairaktarova and Woodcock (2015) conducted a case study with 190 undergraduate students. The students were asked to read two vignettes dealing with ethical and moral decisions and choose the correct answer out of four choices. Only one of the answers was correct. While Bairaktarova and Woodcock (2015) predicted that those students who had taken ethics classes would perform better, they "found no impact of having previously taken an ethics class" (para. 10). Bairaktarova and Woodcock hypothesize, "It is possible that as engineers-in-training become more seasoned, their awareness of the range of volitional control they have across different ethical dilemmas may increase" (para. 24).

One way for an undergraduate student to become more experienced within the field of engineering is through cooperative education. A university that encourages experiential-based learning of engineering ethics is the University of Dayton. The Department of Engineering at the University of Dayton offers cooperative education. This program requires that students complete three work terms with the

same company. The University of Dayton lists the benefits of partaking in the cooperative education program:

> 1. Train in a chosen academic discipline. 2. Define career goals and evaluate career choices. 3. Earn money for educational expenses. 4. Gain maturity, develop self-confidence and learn money management. 5. Acquire work experience. 6. Develop understanding and appreciation of problems and diversities. 7. Ease the transition from graduation to full-time employment. (Cooperative Education: University of Dayton, Ohio).

Throughout the three work terms, students will be treated as employees of that company. It is through this experience that the students will acquire a greater understanding of the information they were taught in class as well as ethical concepts used in the workplace.

Though students state that they desire to learn ethics during their undergraduate academic career, the most efficient method of learning ethics is unclear. While most say that some kind of introduction to ethics is important, most evidence leads to the conclusion that ethics is best taught to engineers who are more mature and can learn from hands-on experiences.

Conclusion

From the information presented in various articles on the topic of ethical studies within engineering, those which attest to the informal education of ethics hold a stronger argument. Though some articles claim that the formal education of ethics is necessary for undergraduates, there are many other articles which challenge this position. While those who counter the argument for formal education would agree that some basic level of formal education of ethics might be helpful, many state that the most crucial time for students to learn ethics is during hands-on experience. Those who are for informal education argue that undergraduates lack three critical aspects of learning ethics. Undergraduates lack the proper amount of time, maturity, and opportunities for experience.

Colby and Sullivan (2008) and Newberry (2004) explain their position that undergraduates lack time to dedicate to the study of ethics. Colby and Sullivan (2008) raise the point that ethics cannot be fully understood during undergraduate

education. While the curriculum may lay a foundation, "competence in these and other aspects of engineering practice requires many years of on-the-job learning and professional development" (p. 335). It is extremely difficult to obtain these years of experience during undergraduate studies, as the students are already focused on their many classes. Newberry (2004) suggests that undergraduate studies are not the ideal time to teach young engineers ethics. Engineers already have a full curriculum, mainly composed of technical content. If an ethics class is squeezed into the already heavy course load, then the student might doubt the legitimacy or importance of the class.

Newberry (2004) also suggests undergraduates might lack the maturity that is required to fully comprehend ethics. He suggests that this is a time when students are not yet prepared to form "emotional engagements on these issues" (p. 347). Instead, the best time for a student to formally learn ethics is while they are studying to obtain their master's, as the American Society of Civil Engineers views a master's degree as being the first professional degree in the field.

Colby and Sullivan (2008) and Berne and Briggs (2003) argue that undergraduates lack the opportunities to gain the experience required to fully comprehend ethics. As Colby and Sullivan (2008) suggest- along with their argument that developing a comprehension curriculum of ethics requires ample time- ethics also requires years of practice and hands-on experiences. They even go as far as comparing the methods of learning engineering ethics to medical ethics. As it is extremely beneficial for medical students to involve themselves in the care of patients, it is equally as important for engineers to engage themselves in activities such as, "design courses, co-op experiences, summer or part-time engineering work, or project-focused extra-curricular activities" (p. 336). Berne and Briggs (2003) add that it would be impactful for engineers to learn ethics from those who have years of experience. They argue that hearing from other human beings' experiences is more influential than words from a textbook.

While this review of literature concludes that informal education of ethics for engineers might be more beneficial, this conclusion leads to several questions. If informal education is the best method of teaching ethics, then how can the information be regulated and taught to all engineers? If engineers are learning ethics through the experiences of those who are older, how can we make certain that the information they are being taught is still relevant to the current ethical dilemmas?

As a first-year undergraduate at University of Dayton's College of Engineering, I have learned that while learning a basic level of ethical concepts in the classroom

is valuable, participating in experience-based learning opportunities is critical. After learning from the two schools of thought, I plan to participate in the University of Dayton's Cooperative Education program in order to gain experiential-based education of engineering ethics.

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Literature Review

Discrimination against Women in the Field of Engineering

Julia Weber, University of Dayton

Introduction

This article focuses on the position of women in the field of engineering, specifically why the field is male-dominated and why this condition should change. When I state the field is male-dominated, I am addressing both the proportion of men in the field in comparison to women and discrimination towards women in the workplace.

Throughout this article, I will be focusing on women in the field of engineering. I will look into why the field is so male-dominated (Chu, 2005; Hunt, 2016; Ramirez & Wotipka, 2001) and how this has begun to change over time (Hill, Corbett, & St Rose, 2010; Morgan, 1992; Ramirez & Wotipka, 2001; Scandura & Ragins, 1993; Torre, 2014). Additionally, I will look into whether or not women within the field ever feel as though they are discriminated against for their gender, or if they feel they are treated equitably in comparison with their male counterparts. I will be looking at this topic through a feminist framework. Relevant themes of feminism in the underrepresentation of women in engineering include "who benefits and who is harmed, critically examining assumptions and presumptions that create injustice, and creatively and energetically working for our dreams of what could be" (p. 34) in the field of engineering (Riley, Pawley, Tucker, & Catalano, 2009). Research in feminism, as far as sex discrimination in the workplace, indicates that sex discrimination is *immune to challenge* (Thornton,

2006). Looking at this topic through a feminist lens will highlight the gender inequality in the workplace of engineers.

Through this research, I have concluded that many factors account for the lesser proportion of women in the field of engineering- and in similar science and math related careers. Overall, I hope to show that an increased number of women in fields of engineering would be beneficial to society. This societal change would help bridge the gap between men and women when it comes to treatment in the workplace. Ultimately, projects could look into how the number of women in the field of engineering can be increased. Also, this topic could potentially be looked at through a different framework, such as a phenomenological lens, looking into how women think about stereotypes in this profession. Overall, there are many gaps in literature that future researchers could delve into, as the research I conducted seems to be a popular topic in current literature.

The reasons why women have been, and continue to be, a minority in the field of engineering and how this can be changed have been addressed differently in recent years (see for instance, Hunt, 2016; Shahala, Agogino, Bailyn, et al., 2007; Torre, 2014). Many authors view this subject differently, as many different reasons for the lack of women in engineering are identified in different publications, such as a large number of female exits, a shortage of female mentors, and preexisting biases and stereotypes, among other reasons.

Female Exits

One reason as to why there are fewer women with engineering jobs than men is that a large number of women exit the field, finding other jobs. According to Jennifer Hunt (2016), "a lack of mentoring and networks, or discrimination by managers and coworkers, are the more promising of the existing explanations for excess female exits" (p. 23). This conclusion was reached by the finding that a lack of promotional opportunities and family-related issues were proportional between the male and female populations in the field. Hunt indicates that these reasons are still statistically significant; however, she finds they are not the biggest driving causes of female exits from engineering. Ultimately, as the numbers of females in the profession are lower, this perpetuates itself further, because fewer females in the professions means a lower number of female mentors, which is a major factor in why females leave male dominated fields (Hunt, 2016; Scandura & Ragins, 1993).

Margarita Torre (2014) opposes other researchers, explaining that the reason for female exits from traditionally male dominated fields is a "scar effect" (p. 1). Torre explains that there is a scarring effect of previous work in female fields by women, which drives them to leave male dominated fields. She found that women who had experience in a more female heavy field were more likely to leave a male dominated field after trying it out. This scar effect "hinders women's opportunities in the male sector and ends up increasing the likelihood of exit" (Torre, 2014, p. 1). This view accounts for the female exits in the profession as a driving cause of the numerical minority of females in a different way than other researchers.

Female Entries

In addition to focusing on the exits, I looked into whether or not there are fewer female entries into the field of engineering. Some research focuses on the reasons there are fewer females in engineering before even gaining jobs in the field. Donna Shalala, Alice Agogino, Lotte Bailyn, et al. (2007) find that women are very likely to face discrimination in the workplace, indicating that this could account for some exits. In addition, "women who are interested in science and engineering careers are lost at every educational transition" (Shahala, et al., 2007, p. 2). Not only are females exiting the field due to reasons once they have acquired a job, but they are changing their paths before even getting into it. For example, "as they move from high school to college, more women than men who have expressed an interest in science or engineering decide to major in something else" (Shahala, et al., 2007, p. 2). The same also reigns true in the transition into graduate school; the number of women in the field declines more and more as time in the educational system goes on (Hill, Corbett, & St Rose, 2010; Shahala, et al., 2007). Ultimately, the number of women graduating with an engineering degree is smaller, proving that factors at the workplace are not the only factors causing the numerical minority of women in engineering.

Stereotypes and Bias

Additionally, there are preexisting biases that account for the difference between the numbers of men and women in the field. Men and women are equally capable of performing in engineering; however, "most of us carry prejudices of which we are unaware but that nonetheless play a large role in our evaluations of people and their work" (Shahala, et al., 2007, p. 3). This plays into the main focus,

because ultimately people could be less likely to hire a woman over a man with the same qualifications for this reason. People hold preexisting biases, whether they are aware of them or not.

Evidently, there is a greater rate of female exits from undergraduate engineering majors than that of men (Jones, Ruff, & Paretti, 2013; Rubineau, Cech, Seron, & Silbey, 2011). Jones, Ruff, and Paretti (2013) explain, "The culture of engineering departments and negative stereotypes of women's engineering and mathematical ability have been identified as factors that inhibit women's entry into engineering and cause them to leave the major" (p. 471). A woman's decision to become an engineer is largely influenced by her skills in math and science (McIlwee & Robinson, 1992). As a result, negative stereotypes about their capability in these subjects lead to women doubting themselves and deciding to pursue a different career path.

Female Exits in Comparison to Men

Other research finds that the answer lies in the comparison of the exit rates of women to that of men. Fewer men leave the field because "men lose more future earnings by leaving engineering than do women" (Rubineau, Cech, Seron, & Silbey, 2011, p. 1). A study found that although women who stay in engineering generally make less than men who stay, for the most part men who leave the field make substantially lower than both men and women who stay (Rubineau et al., 2011). While researchers agree that fewer women entering the field of engineering is a reason for the numerical minority, there is debate as to why there are larger exit rates at an undergraduate level.

According to a study conducted by Carolyn Morgan, another major factor that leads to the underrepresentation of women is the fear of resentment from their colleagues (Morgan, 1992). This is a psychological cause, as women have this fear embedded in their mind. This is a major barrier to women's participation in science and engineering at all levels.

Sex Discrimination

Brush (1991) has found that "Universities and corporations have not dismantled the structural barriers that effectively deny rewards to women, ranging from the SAT to promotion systems that conflict with family life or allow women to rise no further than a glass ceiling" (p. 416). This indicates that a lack of reward for women

in technical fields, engineering included, is a factor in female exits from these majors at the university level. Brush (1991) explains that the leaders of these institutions need to make changes that would pull women into the field rather than pushing them into it.

Many researchers agree that sex discrimination is one of the major reasons the number of women in engineering is much smaller than that of men (Jones, Ruff, & Paretti, 2013; Hunt, 2016; Beasley, & Fischer, 2012; Shahala, Agogino, Bailyn, et al., 2007). Beasley and Fischer (2012) indicate that stereotype threat causes women to leave engineering, meaning that the expectation that they will be judged as less capable than men in the field causes women anxiety and drives them away. This stereotype threat is one driving cause as a result of discrimination. Additionally, sex discrimination in the workplace causes women to feel inadequate (Beaton, Tougas, Rinfret, & Monger, 2015). This feeling of inadequacy could be a factor that drives women to leave the field. These psychological results of sex discrimination are highlighted by researchers as major reasons engineering is such a male dominated field.

Taking this view in a slightly different direction, Bastalich, Franzway, Gill, Mills, and Sharp (2007) explain, "Within the engineering workplace culture 'women', or anyone who fails to conform to strict codes of masculine conduct, is cast as an 'outsider' or 'foreign'" (p. 397). Therefore, women exit the field, because they do not fit in with the masculine expectations (Bastalich, Franzway, Gill, Mills, & Sharp, 2007).

There is other research supporting Bastalich, Franzway, Gill, Mills, & Sharp's concept of the masculine conduct expected in engineering, taking this idea in a different direction. According to Powell, Bagilhole, and Dainty (2009), "In 'doing' engineering, women often 'undo' their gender" (p. 411). Ultimately, female engineers are conforming to their workplace expectations and becoming more masculine. This research suggests that women who do remain in engineering conform to fit a masculine role, leading to an environment that is hostile towards women (Powell, Bagilhole, Dainty, 2009). If women are not comfortable with giving up their femininity, they may decide to leave the field for one believed by society to be more appropriate for females.

Change Over Time

Although women are still a numerical minority in the field of engineering, over time the number of women in the field has increased (Hill, Corbett, & St Rose, 2010; Morgan, 1992; Ramirez & Wotipka, 2001; Scandura & Ragins, 1993; Torre, 2014). According to Morgan (1992), "In 1960… less than 1% of the engineers employed in the United States were women. Since that time, women have made progress. ... By 1988, they represented ... 4% of engineers" (p. 228). These numbers are still very small, but they are climbing. Although numbers of women are increasing in the field, this is a slow process, and it is important not to assume there is more inertia than what actually exists (Ramirez & Wotipka, 2001). We cannot just leave this issue to fix itself; something needs to be done to make women in engineering more comfortable in both the university and the workplace.

Discussion

There is much debate in current literature regarding the reason for a numerical minority of women in the field of engineering. There is a large focus on both the entry and exit of women into the field, as there are fewer women than men who enter (Shahala, Agogino, Bailyn, et al., 2007) and a larger proportion of women who exit the field (Hunt, 2016). Different researchers account for these differences in both entry and exiting of women engineers in different ways. Fewer women enter the field as a result of a greater number of exits at academic transitions (Shahala, Agogino, Bailyn, et al., 2007), and negative stereotypes of women's mathematical and engineering ability (Jones, Ruff, & Paretti, 2013). The greater number of female exits can be accounted for by a lack of female mentors within the field of engineering in general (Hunt, 2016; Scandura & Ragins, 1993), discrimination by male counterparts (Hunt, 2016), pre-existing biases (Shahala, Agogino, Bailyn, et al., 2007), and a "scar effect" (Torre, 2014). In addition, the number of women in engineering has been in an upward trend (Scandura & Ragins, 1993; Torre, 2014; Ramirez & Wotipka, 2001), but there is still a long way to go before there is equality in the workplace for female engineers.

After conducting this research, I concluded that it would be of value for future researchers to look into how the proportion of women in engineering and other STEM fields could potentially be increased. There is a large amount of research on why the difference between men and women in science and engineering fields exists, but not as much on how this could be changed in the future. What could be

implicated to ensure a larger number of women in these fields? Would changes made back in the schooling system be more helpful in increasing the proportion of women than changes made in the workplace? Why aren't any changes being made currently? Additionally, looking at this issue through another lens other than feminism, such as a phenomenological, ethical, or psychological framework could be of value in literature. Researchers could delve into how female engineers are affected psychologically by discrimination in the workplace and by negative stereotypes.

Ultimately, my research aims to prove that more women in the field of engineering would be beneficial to society. Feminists today focus largely on issues like the wage gap and creating equality in the workplace, and increasing the number of women in the field of engineering would be taking a step forward in this regard, as women are underrepresented in the field. Through my research, I found that literature has highlighted sex discrimination and negative stereotypes against women as major reasons for the lesser number of women in engineering. According to Carolyn Morgan (1992), "negative stereotypes of women scientists and engineers may be removed as the societal need for them becomes crucial" (p. 234), comparing this societal change to the change in the view of working mothers after World War II. If the negative stereotype against women engineers were eliminated, there would be more gender equality in engineering workplaces and in the university, and the number of women in these professions would likely increase.

It is clear that a society free of negative stereotypes and sex discrimination would be more ideal than the society we are a part of today; people would not be driven away from careers for this reason anymore. Women looking into engineering would no longer face this obstacle when choosing a career. As stated by Stephanie Blaisdell, "The time has come to change society's perception of women in science and engineering" (Blaisdell, 2006, p. 170).

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RESEARCH ARTICLES

Research Article

Sustainability in Chemical Engineering

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Introduction

For much of the past century, the world has seen industrial and technological progress that has helped make life better for humans but hurt the environment while doing so. Once people realized the damage that was being done, it was observed that this kind of development was not sustainable, meaning it did not "meet the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 3). While different experts may define the term "sustainability" (or "sustainable development"), differently, they will all share the substance of Brundtland's definition. Ever since the light was shed on the importance of sustainable development, professionals from a large array of fields have focused their attention on what can be done to ensure what humans from their generation do will not put future generations at a disadvantage.

In this article, I analyze what role chemical engineering and chemical processes have on striving towards sustainability. I will do this by first, looking at what sustainability means, and the different aspects of it, unpacking a number of concepts that have been created to help chemical engineers to operate in a sustainable way. These concepts include industrial ecology, green engineering, and looking at sustainability though an economic lens.

Being an aspiring chemical engineer starting to learn more about the field, I figured that chemical engineers could contribute towards sustainability. My thoughts were confirmed by Sikdar (2003), who wrote, "it is by creating economic value through the development of environmentally preferable technologies that

chemical engineers can participate in the process of sustainable development" (p. 1). Woinaroschy (2012) reinforces the idea, stating,

> In the sustainable development of society chemical engineers play a main role, due to the requirements to use renewable raw materials and energy resources, to reduce number and amounts of secondary undesirable products and the pollution risks, to realise new renewable materials with high properties, etc. (p. 1)

Overall, it appears that chemical engineers have the ability to contribute towards sustainability not only by coming up with processes to use resources more efficiently or reducing harmful waste, but primarily by making these processes economically favorable. This coincides with a common theme found throughout literature about sustainability: that it is part social, part environmental, and part economic (García-Serna, Pérez Barrigón, & Cocero, 2007; Sidkar, 2003; Woinaroschy, 2013). A specific example of what chemical engineers have done to make industrial processes greener comes from García-Serna et al. (2007). The industrial solvent ethyl acetate has increased in use in recent years because it has replaced more hazardous solvents. Chemical engineers and chemists have figured out a way to produce ethyl acetate from alcohol, such as ethanol, as opposed to acetic acid. This is much more environmentally friendly because ethanol can be produced by fermentation, which harnesses starch produced by plants from photosynthesis, which happens to use carbon dioxide (Garcia-Serna et al., 2007). Not only is this an environmentally friendly process (because it is using natural processes to produce resources), but it is economically sustainable as well because several operating plants have opened using the same process.

Industrial Ecology

There are many frameworks through which writers in sustainability in chemical engineering see environmental progress happening. One of these frameworks is industrial ecology, which is described by Jin, Wang, and Wei (2004) as a framework to integrate industry along with its products and wastes in a more organic connection with nature. This can be an effective way to set targets for the development of sustainability; an example is a type of recycling known as industrial ecology cycling. Industrial ecology cycling is using waste from one industry as fuel

for another industry (Jin, Wang, & Wei, 2004). One place where industrial ecology cycling can be seen is at an industrial complex in Lebei, China, where many different products are synthesized through chemical reactions. Here, a process has been implemented that uses sulfuric acid to make phosphate fertilizers, and fuel the production of sulfur dioxide and lime. The lime is used to make cement, and the sulfur dioxide is able to be transformed to sulfuric acid, which is used to start the cycle over again (Jin, Wang, & Wei, 2004). This is a good example of how industrial ecology can be successful because the complex was able to reduce their impact on the environment as well as be economically favorable. If chemical engineers could continue making developments within this template, that would reduce waste as well as the amount of raw materials needed for industries, both of which are obviously environmentally friendly practices.

Green Engineering

Another way to think about sustainability in relation to chemical engineering is green engineering (García-Serna, Pérez Barrigón, & Cocero, 2007; Jin, Wang & Wei, 2004). Green engineering can be defined as "the design, commercialization, and use of processes and products that are feasible and economical while minimizing pollution at the source and risk to human health and the environment" (Allen & Shonnard, 2002, p 2). Essentially it is optimizing processes and products so that they do not harm what is around them but are still profitable. This would generally be a useful format for chemical engineers to follow, as it would naturally make engineering more environmentally friendly. Also, it aligns nicely with a traditional definition of chemical engineering as "a broad discipline dealing with processes involving the transformation of matter or energy into forms useful for mankind, economically and without compromising environment, safety, or finite resources" (Worchester Polytechnic University, 2004, para. 1). This definition implies that green engineering is part of the job of chemical engineering, which is a solid philosophy for thinking about sustainability. One example of a green engineering project is the Holland Energy Park in Holland, MI. This park is part of a long-term plan for sustainable energy and will provide affordable energy for many years to come (Brumbaugh, 2017). The chemical engineering behind this plant is that it uses "combined cycle, natural gas generating technology to produce up to 145 megawatts of power to meet the needs of a growing community" (Brumbaugh, 2017, para. 6). By doing this, once fully functional, the plant will be twice as fuel

efficient as the past power generation system, thus cutting the carbon emissions in half (Brumbaugh, 2017). For its impressive showcase of sustainability, the plant became the first plant and park to be named an Envision Platinum award winner. Envision is a system designed by The Institute for Sustainable Infrastructure that measures the sustainability of infrastructure projects by using ratings (Platinum being the best) (Brumbaugh, 2017). Hopefully this award can help Holland Energy Park show other engineers and firms what favorable results could be achieved when they use green engineering. When many individual chemical engineers work within a framework that focuses on taking care of the environment as part of engineering, great progress will be made collectively.

Economics/Business in Sustainability

The literature on the topic makes it clear that chemical engineers have the ability to assist with the sustainable development of society. However, most chemical engineers work for a company whose main goal is to make a profit. This may be the main reason that being economically sustainable is one of the three branches of sustainability. The question then becomes: can chemical engineers develop environmentally friendly methods that reach all three aspects of sustainability, and if so how? Garcia Serna et al. (2007) answer this question by saying, "'Green' could even be profitable provided that it becomes a central strategy for those firms in terms of policy" (p. 3). What they appear to hold is that if a company goes "all in" on being green and makes it a part of their company identity, they can increase their profits by being environmentally friendly, thus reaching sustainability.

An applicable example of how a company committing to achieving all three aspects of sustainability is what the department store giant Wal-Mart has been doing since 2005. That year, Wal-Mart decided to make sustainability part of who they were are as a company. In a speech given that year to suppliers and employees, CEO Lee Scott clearly stated Wal-Mart's dedication to going green, and laid out ambitious goals going forward (Scott, 2005). He introduced the concept of being environmentally friendly first by saying, "As one of the largest companies in the world, with an expanding global presence, environmental problems are our problems" (Scott, 2005, para. 20). He then went on to lay out three bold, main idea type goals: For the company to be supplied completely by renewable energy in the near future, for the company to achieve zero waste, and to sell products that sustain their resources and the environment. These goals were followed by more specific,

short term goals, which Wal-Mart has done an at least reasonable job of following through on since, and benefited because of it. From 2010-2015, Wal-mart eliminated 28.2 million metric tons of greenhouse gas emissions from its supply chain, exceeding its goal of 20 million (Makower, 2015). One reason for this reduction is the improved fuel efficiency if its fleet, which has doubled since 2005, when the initiative began, and has saved the company an estimated one billion dollars. As of 2015, 26 percent of Wal-Mart's energy is now renewable, and in the year 2014 they diverted 82.4 percent of their waste in the United States (Makower, 2015). That second percentage is particularly impressive, and of central focus because less waste means less money spent on dealing with it. As mentioned before, another way Wal-Mart has become more sustainable is by trying to make the objects they sell more environmentally friendly. Mike Duke, the Wal-Mart CEO at the time, gave an example of this in an interview with *The Wall Street Journal.* Duke said that they worked with companies to try to make detergents and bleaches more concentrated. As a result, smaller bottles can be used but still do the same number of loads, which is better for the environment and saves money (Wall Street Journal, 2014). This is where chemical engineers can have an impact by working to make the detergent or bleach more concentrated without sacrificing quality or money. When Lee Scott started Wal-Mart's sustainability initiative, he did it believing that it would help the company all around, saying "being a good steward in the environment and in our communities, and being an efficient and profitable business are not mutually exclusive. In fact they are one in the same" (Peterson, 2012, p. 358). This statement is very similar to that of Garcia Serna et al. (2007) quoted earlier. In fact, it is essentially the theory being put to practice. In this case the theory seemed to be correct; as mentioned above, many of the environmentally friendly improvements benefitted the company monetarily as well.

More evidence for the focus on sustainability helping the company all around is the increase in stock value compared to the competition. From 2005 (when Wal-Mart devoted themselves to sustainability) until now, Wal-Mart's stock has gone up almost 100 percent. This is significantly more than their competitor Target, whose stock has gone up a mere 7.8 percent in the same time period. The reasons for this may be because once a company dedicates themselves to being green, they become more efficient at it and save money. Also, having a reputation of being a green company can increase marketability and make people more likely to buy your product.

In a company where the platform is clearly about being green and sustainable, or in a company supplying a company with such an attitude, chemical engineers on the ground level can feel a lot freer about implementing environmentally friendly practices. In fact, the philosophy of increased sustainability coming from the top seems to be a widely accepted idea. In an interview I asked Bruce Hitchens, Vice President of PUR Product manager of PET, and Global Operations PO for Convestro AG (a materials science company), how sustainability can be improved in the chemical industry. His response centered around the idea that for sustainable progress to happen within the company, "you need a strategic direction from the very very top." That is exactly what happened to Wal-Mart, as their CEO gave a speech making it very clear that they were going to make sustainability part of who they are. This sense of direction towards sustainability coming from the top allows the chemical engineers to commit fully to making processes and products more sustainable.

The previously mentioned industrial ecology fits into this mold of reaching all three aspects of sustainability, as described by Sidkar (2003), "by co-locating manufacturing plants so as to minimize waste (so-called industrial ecology), or by establishing waste exchange, industries can achieve the three-fold goal of economic development, environmental stewardship, and social good" (p. 2).

Even though many writers agree with this optimistic theoretical idea that going green can be profitable, the issue of sustainability is seen in many different ways. Jin et al. look at the problem in a more realistic sense of what is currently occurring. The article brings up the tragedy of the commons that since the capacity of the Earth and its resources are limited, every use or damage of them decreases their availability to others (Hardin, 2009). This idea by Hardin goes along with the idea that industry today is producing negative externalities that hurt common property such as Earth's oceans and atmosphere. Jin et al. mention that this is a problem because there is yet no value on the Earth's services of dealing with these externalities. Jin et al. (2004) call the system of sustainability that seems to be most popular today *mainstream sustainability*, which is the idea that we can continue to focus on economic growth, but we will solve the issue of limited capacity and resources by increased efficiency through technological developments.

One pillar of the argument that pure integration of economic growth and sustainability can work is that economic growth in the end will lead to more sustainability. The thinking behind that being, once more of the world develops and gets out of poverty, people will have the luxury to care about the environment,

whereas now they do not. However, Jin et al. (2004) state the main belief or assumption of mainstream sustainability is that positive externalities in the future will be able to make for previous negative externalities. They say that technological advancements will improve ecology, come up with new resources, partially eliminate previous damages done, etc. to make up for the damage done before them. According to Jin et al. (2004), this system of mainstream sustainability is what is currently in place and has been for some time. This means that future generations will not only have to be sustainable themselves, but also make up for previous generations' damage.

Discussion

Through my research, I have discovered that chemical engineers do, in fact, have a large role to play in sustainable development. In general, the way in which they can improve sustainability is by optimizing chemical processes so that they are safe, environmentally friendly, and economically favorable (Sikdar, 2003; Woinaroschy, 2012). Naturally, the part of sustainable development that most people believe is often lacking is the process of being eco-friendly. That is probably because the negative effects are much less direct and short term when the environmental part of sustainability is neglected than when either of the other two parts are neglected. Two concepts that have been created to help facilitate environmentally sustainable development along with economic sustainability and societal safety are *industrial ecology* and *green engineering*. Both of these concepts are easily applied to chemical engineering. Industrial ecology creates a way for chemical engineers to make chemical processes efficient by using what would be waste to fuel other reactions (Jin, Wang, & Wei, 2004). Green engineering gives chemical engineers a framework to work through in order to make sure they do as little damage to the environment and society as possible (García-Serna, Pérez-Barrigón, & Cocero, 2007). As mentioned before, the definition of green engineering is very similar to the definition of chemical engineering. The similarity between them could imply that chemical engineers are not only *able* to contribute to environmental sustainability, but are expected to as part of their job. However, most chemical engineers do not get to operate however they want because they have people above them giving them expectations regarding costs and the quality of the products. This leads to another, possibly more effective way at looking at sustainability in chemical engineering: analyzing how the role of chemical

engineers is affected by economics and business. Though economics is clearly tied into the other frameworks, looking at suitability without all of the scientific details can be useful. From the success Wal-Mart experienced after the decision by their CEO to go green (Scott, 2005), it can be concluded that the most effective way for a company to improve sustainability is with a clear message from the top of the company. It makes sense that the executives of a company declaring that the company is focused on sustainability would allow chemical engineers on the ground to implement environmentally friendly ideas like industrial ecology and green engineering. Economics would still have to be a major aspect of what the chemical engineers do, but it would be clear that profits are not the sole focus. Once the company makes it clear that sustainability is the goal, it is up to the chemical engineer to successfully make chemical processes more environmentally friendly.

Jin et al. point out that with mainstream sustainability being the most popular form of sustainability right now, humankind is still doing more damage to the environment in hopes that scientific and technological advances in the future will be able to clean it up. That means that fields, such as chemical engineering, which are tasked with coming up with technologies, products, processes, etc. that are more environmentally friendly, will have an important role in sustainability for years to come. It will be up to chemical engineers to design and implement ways to not only make chemical systems sustainable, but also potentially make up for the lack of sustainability of many generations.

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Research Article

Advocating for More Experiential Learning Strategies in Medical School

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Introduction

When it comes to learning and teaching, there are many ways for teachers and students to maximize the amount of learning that happens in the schooling environment. The focus of this paper is the effects of experiential learning in medical education. This pedagogy is very common in many teaching strategies and is widely used, debated, and studied throughout academia. This paper will introduce experiential learning as it is seen broadly throughout all fields of study and practice, but will then specifically focus on experiential learning and its effects on medical education. Using two different types of experiential learning, community-based learning and situated learning, this paper will provide examples and advocate for the use of experiential learning in medical education today. The significance of this paper is to provide literature for the use of experiential learning in medicine and hopefully encourage educators throughout academia to turn to this method of teaching for a different approach to teaching medical students, who often have to engage with rote learning.

What is Experiential Learning?

A broad, loose definition would entail any sort of real world, hands-on experience that allows students to experience the topic that they are learning about directly. This can include many things such as internships, study-abroad programs, community service, and cross-cultural studies. All of these are great examples of

different ways a student can engage with experiential learning. In an article about Nepalese medical students and their learning experiences, a definition of experiential learning is provided: “In 1984 David Kolb described a four-stage experiential learning cycle, suggesting that a combination of experience and subsequent reflection is important for ‘real’ learning” (Dhital, 2015, p. 2). These four steps include concrete experience, reflective observation, abstract conceptualism, and active experimentation (Mcleod, 2013, p. 1). Experiential learning allows the student to gain this type of knowledge or skill that would be much more difficult to obtain in the typical classroom setting. For example, one of the unique benefits of experiential learning is the ability to reflect on an experience and build upon it. When the student uses this reflection of what they have experienced, they are able to “review the real experiences in order to understand their value” (Dhital, 2015, p. 2). Once this process of reflection is completed, the student can then transform the experience and reflection into knowledge that can be used for future circumstances through observation and application. This is just one example of a benefit of this type of learning.

Other scholars have also claimed more benefits of experiential learning. “It has been argued that experiential methods are more likely than didactic methods to lead to action or change in behaviour or attitude, and to result in experimentation with alternatives and in the development of skills and strategies” (Koponen, 2012, p. 205). Koponen advocates the use of experiential learning by stating that it is possible for these methods to be more productive at developing skills and strategies. Although the present article highlights the effects of this pedagogy in medical students, experiential learning is important for all types of education and has many different applications. “Experiential education... helps students both to bridge classroom study and life in the world and to transform inert knowledge into knowledge-in-use” (Eyler, 2009, p. 1). Both of these sources mention how experiential learning can impact the way students learn and retain information in a positive way. Frequently students will tend to memorize information learned in the classroom and simply repeat it back to the teacher for a grade. This does not allow for very much long-term information retention unless the gained knowledge is being put to use frequently. However, experiential learning has a much greater effect on long-term learning that “can also lead to more powerful academic learning and help students achieve intellectual goals” (Eyler, 2009, p. 1). Again, this is another example of a positive benefit of experiential learning. Overall, this type of learning is very important to the world of academics as it provides an alternative

and frequently more effective way for students to gain real-world knowledge about their particular field.

Experiential Learning in Medicine

At first glance it may be more difficult to envision what exactly students, including medical students, can learn while working in the field. Surely, communication and collaborative skills are essential and can be learned very quickly since these students will have to interact with many people on the job. Yet one term is mentioned in an article that talks about medical and nursing students' experiences in a clinical learning environment: "It consists of not only preferable skills and attitudes included in the formal curriculum, but also unintentional knowledge, often referred to in the medical education literature as the hidden curriculum" (Liljedahl, 2014, p. 766). Engaging with hidden curriculum is exactly the kind of value that can be extracted out of experiential learning. A formal definition of the hidden curriculum is given as "influences occurring within the culture of medicine that indirectly alter medical professionals' interactions, beliefs and clinical practices throughout their training" (Stanek, 2015, p 1). When further analyzing examples of the hidden curriculum, major themes such as discipline, unprofessionalism, dehumanization, role modeling, and more were recurring in this article's observations. Ideas such as those just listed are not literal, raw facts that can be taught right from the chalkboard, but are necessary and important parts of being in the medical field that will have an impact on the career of medical students. In other words, these themes and values can be learned effectively through experience and activity.

For medical students, experiential learning provides a new and alternative approach to learning that gives the best possible real world experience. In some cases, even students' attitude towards their subject changed positively, which some could argue as a sign of effective learning. Koponen's (2012) study showed that "a communication course based on experiential learning methods may have a positive effect on students' attitudes in a reasonable amount of time" (p. 8). Not only was it likely that the students of this study learned valuable information, but the learning process was also implemented in a positive way through this change in attitude.

Overall, I think that experiential learning can be essential when it comes to medical students gaining the experience that they need for when they enter into their careers as caregivers. If one student wishes to become a physician and work

with patients, it is critical that they have some sort of experiential knowledge with dealing and treating patients. For this article, I have chosen two specific types of experiential learning that "can enhance learner's knowledge and associated abilities through a variety of activities" (Feng, 2013, p. 174): *community-based learning* and *situated learning*. These learning strategies provide different circumstances for learning but are effective for medical education. For students wishing to pursue medicine, there are many examples of current and former medical students who participated in these types of learning.

Community-Based Learning

Community-based learning, like all types of experiential learning, aims to approach education from a perspective that is outside of the classroom and in the outside world. Megan Hertner (2016), in her article about community based research, states that community learning "runs against the grain of 'metrics obsessed' consumer model of higher education, in which 'learning outcomes are only meaningful if they are measurable'" (p.2). In a sense, students gain a type of knowledge that is not easily measured by taking a test and getting a grade. It is based on how they interact in the environment around them, and this comes from immersing themselves in the community of their field. Community-based learning is designed to provide challenges and situations that allow students to adapt and learn. "If one can challenge anyone to change, you have had an impact on the person. Both the medical students and the CHWs (community health worker) said they experienced personal growth through their interaction with each other" (Rooyen, 2017, p.75). This personal interaction is something that community-based learning provides that a textbook cannot.

Referring back to the article about the medical students in Nepal, we can look at some of the effects of community-based learning on these students. On traveling to Nepal, these students were working as medical assistants in a rural area that had very little access to any sort of health care. This is far from the ideal medical environment that you would normally find in a hospital or clinic, and this environment can more effectively help students learn valuable skills from working in such a different context. "I realized that it is not always possible to practice everything in the community that we have learnt in our hospital. So we should be cautious about resources available and their use" (Dhital, 2015, p 5). This is one example of the extended lessons learned by this particular student while working

in the field. In the classroom, ideas are typically thrown about under theoretical ideal circumstances; for example, hypothetical questions inside a classroom. A student would not be obligated to think about what kind of a situation the doctor or patient could be in. This particular student notes how they did not have all of the necessary resources that they needed, and from that they learned that in that particular setting, one needs to be cautious about the availability of resources in order to most efficiently treat patients. One of these students reflected on how this study pushed her out of her comfort zone and allowed her to change and learn about new environments:

> I was born a city girl and everything is totally different from what we are used to. This posting has certainly made me strong enough to adjust in different settings. These are not just part of the curriculum I am following, these are going to be the milestones towards my self development. (Dhital, 2015, p. 5)

It is extremely important to highlight this particular student's observation because it clearly shows how this venture into an unknown community affected her learning experience. She knows that she is getting more out of her experiences than she normally would and attributes that directly to her own self development. In this case, she feels more prepared to deal with situations that she may face in the future when practicing medicine.

An article by Sandra Carr and Dianne Carmody (2006) presents a study on the reflections of nursing students on their clinical experience. This is another instance where community-based learning takes place since the students are immersed into the world around them in order to learn, in this case the hospital. In the study, there were many recurring themes that the students reflected on, some examples being clinical reasoning skills, problem solving, communication skills, and overall knowledge. The students were able to learn skills such as "how to approach and communicate with a woman experiencing a miscarriage" (Carr & Carmody, 2006, p. 773) as well as more intellectual ideas that "may be instrumental in engaging them in the life-long learning process" (p. 773). It was from these experiences that the students were able to learn valuable skills involving personal interaction and communication that can be much more difficult to teach in a classroom setting. This particular study was able to "offer effective teaching and learning experiences for students to address the stated unit learning outcomes" (p. 773). In this setting, the

nursing students were able to experience a very close replication of what their careers would be like by participating in the hospital community setting.

Situated Learning

Situated learning is a form of experiential learning that encompasses the use of alternative strategies to transmit knowledge. Like all forms of experiential learning, situated learning uses new contexts to allow students to change their way of thinking. Joe Curnow (2013) gives a definition of situated learning in his study about situated learning and conscientisation: "Situated learning theory understands learning as 'a pervasive, embodied activity involving the acquisition, maintenance, and transformation of knowledge through processes of social interaction'" (p.826). Similar to community-based learning, situated learning frequently involves social interaction by students, and this learning strategy presents knowledge in real-life contexts.

Gillian Maudsley and Janet Strivens (1999) discussed this topic in a paragraph that is titled, "Situated Learning." Here, medical students, "learn what to observe, what interpretations to link to observations, and what words and actions to use when conveying these both to clients and colleagues" (p. 537). This reiterates that social interaction in an environment is essential to situated learning. Not only were these students learning content, they were also learning how to interact and deal with people inside the context of their learning. This article also talks about Kolb's work once again, stating that experiential learning is moving through the field and reflecting on the events and situations that occurred. This article also highlights one of the major reasons to advocate for situated learning, because it "challenges professional education by questioning the value of knowledge transmitted by instruction..."(Maudsley & Strivens, 1999, p 537). In order to keep improving ways of learning, one has to be able to question current strategies and advocate for new ones. Situated learning does this by giving students a new and different way to learn.

Zhu and Chiappini (2013) discuss further about situated learning and its effects outside of the classroom: "Situated learning is a type of learning embedded in activity, context, and culture" (p. 383). Like the previously discussed type of experiential learning, situated learning is important in "representing a major shift in learning theory from traditional views of learning as knowledge accumulation, toward a perspective of learning as emergent, social, and cultural" (p 383). Students

can benefit from going outside the classroom and learning by doing hands-on activities and engaging in the environments around them. This article also discusses how situated learning provides "authentic activities" (p 383). An example of such could be doctor-patient meetings in the medical field. These experiences help to provide skills necessary for one who is practicing in this field, such interactive skills and ways to effectively communicate information with patients. Essentially, students who have acquired these skills have gained valuable experience and are said to have achieved a deeper form of learning (Zhu & Chiappini, 2013, p 383).

Conclusion

Experiential learning is an important pedagogical approach when it comes to finding new ways to implement teaching strategies and effectively improve students' acquisition of knowledge. The literature presented in this article aims to support this pedagogy for all fields but particularly in the medical field through the use of community-based and situated learning strategies.

As Kolb (2005) states in his work, "To improve learning in higher education, the primary focus should be on engaging students in a process that best enhances their learning" (Kolb, 2005, p. 194). In this case for medical students, experiential learning can be an exceptional way for students to learn how to act, communicate, and perform in certain situations. By indulging in this kind of learning, whether it is community-based or situated, medical students can be overall better prepared for the careers that lie ahead of them.

One of the students that had the opportunity to study in the rural areas in Nepal from Dihtal's (2015) article gives a direct example of what they learned in the process of working as a medical service provider in a rural area. "*Today, I could do the urinalysis using my knowledge. Now I have the confidence of doing the urinalysis when I will be posted in rural areas*" (p. 5). This student was able to perform and practice a procedure that would be difficult to simulate in a classroom, and through this experience they gained the confidence to continue performing procedures.

In many cases besides that stated previously, experiential learning can provide these necessary learning opportunities that prepare students for real-life situations. It is my hope that educators around the world will continue to pursue the use of all types of experiential learning so that students emerging into their fields are as prepared and knowledgeable as humanly possible.

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Research Article

Ethics Education in Engineering: Practices on and off the Campus

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Introduction

This paper will focus on two major methods for educating engineers in ethics. It is important to realize that two sets of standards exist within the field of engineering, both from the professional standards set within industries and from the personal moral standards held by engineers themselves. This article first examines the education of ethics within the workplace as some engineers have no previous training in ethics. Second, it discusses how ethics is introduced to engineers through university undergraduate and graduate courses. It will also evaluate whether ethics courses are more effective than the real-world application found through the professional setting. It concludes that it is best to incorporate a part of all of these methods of ethical training, but the least useful is that of teaching ethics to students in undergraduate programs with the hope of measuring these results by tests and assessments. Rather, it is more important to build students' personal values, virtues, and then their ethical training will naturally occur, and result in engineers being more motivated to adhere to these ethical practices.

As for research methods, information was gathered through database searches for articles relating to ethics within the engineering workplace. These articles were studied to determine the multiple ways of creating ethical standards for engineers. This process was completed by consideration for the historical development of these standards for promoting more ethical engineering.

Importance of Ethics in the Workplace

Ethics are important in the workplace because those within the profession are expected to uphold virtues of honesty and integrity (Zhu & Jesiek, 2017, p. 2). These are critical factors as engineering focuses on projects and innovations. Especially within the disciplines of civil, chemical, and industrial engineering, ethics are important to environmental well-being in the industries. Lack of ethics can often threaten the lives, safety, and long term welfare of the general public and those engineers working on the projects (Basart & Serra, 2013, p. 3).

One specific example of failure to adhere to ethical practices and the catastrophic results that occur is the TV antenna failure of 1982 (Department of Philosophy and Department of Mechanical Engineering Texas A&M University, 2012). One engineering firm, Antenna Engineering Inc., built an antenna and another firm, Riggers Inc., was hired to implement and assemble the antenna. Antenna Inc. submitted the plans to Riggers Inc. The company approved the plans, which used lugs. As the crew was building the antenna, they used a makeshift extension. In short, the semantics of the design of the antenna along with the methods used for building the antenna failed, and the antenna collapsed. This resulted in the death of several riggers who fell over a thousand feet. This was an error of ethical behavior as the crew had used a makeshift extension to the lug. The outcome would not have been tragic if the crew had kept in mind their ethical responsibility to provide safety for the workers, and had made certain the mechanics of their building equipment were correct.

This example shows why ethics are critical for the profession of engineering. Therefore, to ensure that these ethical practices are adopted, engineers new to the field must be taught ethics through some path or another. The following section focuses on what those educational paths are and the effectiveness of each.

Ethics as Taught in the Workplace

It is a common trend within the field of engineering for newly hired engineers to have little experience or knowledge of ethics of their work. As a result, ethics are needed to be taught or introduced in the workplace. Without an introduction to ethics, the engineer is at a loss as how to work ethically on a team, on projects, or within their own ethical standards. There are multiple ideas and camps of thought on how this could be best done. Personal ethics are important so that the engineer can have a framework to draw from within their career.

Wang, Zhang, and Zhu (2015) examine how engineering ethics training often presents itself in purely professional ethics. Consequently, the professional side of things may seem unreachable and unrelatable to the common undergraduate engineer in that an engineer at that level of education will not have had exposure to real world experiences. Therefore, a more practical approach may be needed. An approach of teaching ethics within the professional workplace rather than relying on the university to be responsible for ethical training. One aspect of Wang, Zhang, and Zhu's work focuses on the interpretational approach, where the engineers concentrate on having a mindful interpretation of ethics in their work. As explained by the authors:

> Such an interpretative activity will expand the content and context of both ethics and engineering. In respect to content, ethical principles and moral norms, ethical feelings, ethical behaviours, and social impacts will all need to be clarified in the interpretational process. Engineering ethics education often emphasizes ethical principles and moral norms, but slights ethical feelings, ethical behaviours, and social impacts. The interpretational process needs to pay explicit attention to feelings and emotional factors along with such factors as moral consciousness, cognition, imagination, expectation, and intuition. (p. 66)

It is pointed out that engineers struggle to understand the effect of their project past the practical application. A resolution would be to widen this view so that the engineers could understand the effects on society would be particularly useful. This stance is partially significant in response to criticism from ethicists who view engineers as lacking an ethical perspective in their work (Wang, Zhang, & Zhu, 2015, p. 66). The same writers also suggest having a set model between a dialogue of engineers and ethicists:

> Dialogue additionally provides a platform for engineers to defend themselves, and helps ethicists and the public to better understand the professional activities of engineers, which is conducive to cultivating the moral ideal of engineers, making engineers more active in the construction of good engineering. (p. 67)

Such practice would open communication lines between the two main professions of engineers and ethicists in order to aid in this struggle. As engineers can become very involved and focused on the technical side of their projects, this communication would provide outside opinion and advice to keep other non-technical aspects of the project.

Another idea presented for providing ethical structure within the engineering workplace was that of drafting an established code of ethics for engineers. "Drafting a Code of Ethics for Engineering Education" by Cheville and Heywood (2015) attempts to study four different professional fields in order to create an ethical code for engineers. The article assumes that engineering education is a profession, and argues for a set of ethical codes that are common and standard between professions. After examining these codes, the authors suggest their own set of more specific rules. These rules can be altered to better suit the different professions of engineering, as suggested, "To be useful codes need to be written for a given audience; the code above was written for engineering educators to acknowledge the ethical dilemmas potentially introduced by the multiple roles they inhabit" (Cheville & Heyworth, 2015, p. 3).

Finally, the article puts weight on universities teaching engineers to provide a means of ethical education. This is taken to begin to look at providing guidelines for each specific discipline of engineering. This is done by breaking down the code into seven clauses to be the "common core" for ethics within engineering. Those seven clauses are then based upon what is usually referred to as a Paramountcy Clause, which focuses on engineering protecting the health, wellness, and safety of society. Other engineering disciplines maintain their own codes, including those of the National Society of Professional Engineers (NSPE), Institute of Electrical and Electronics Engineers (IEEE), and American Society of Mechanical Engineers (ASME). These codes all maintain the position of serving for a framework of the engineering profession to refer to. However, it is important to keep in mind that the use of these codes does not come without controversy; as stated by Eugene Schlossberger (2016) in his investigation of ethics within engineering, "Because the codes are brief and the language fairly general, most clauses in most societies' codes are widely accepted and relatively easy to justify" (p. 1336).

Another viewpoint argues for the use of virtue ethics (Han, 2015). Virtue ethics are ethics which are focused on the person creating the action and are based in character traits: As Virtue ethics "differs from deontology and consequentialism by focusing on the person who acts, rather than the action itself; the emphasis is on

being good, rather than just doing good" (Schmidt, 2013, p. 992). The idea suggests a structure for the use of virtue ethics within the field of engineering and puts forth a code specifically for virtuous engineering. This method leans more heavily on the idea of creating moral motivation to encourage engineers to uphold ethical standards. This is the use of intrinsic motivation, which is potentially the most reliable when instilled in the engineer:

> While the previous paradigm of science and engineering ethics education, which concentrated on rule-based ethics education, would be difficult to form a significant, strong, and direct conceptual connection between professional ethics and a successful career as virtues for being a successful scientist or engineer, this virtue-based positive approach to ethics education would easily associate the content of ethics education and professional career development. (Han, 2014, p. 3)

This virtue ethic method does not then benefit the engineer in terms of giving them structure, but gives them the tools for the engineers to comprehend, develop, and create their own ethical standards.

It is important to keep in mind that this motion for engineering ethics also specifies that this is not meant to replace the current ideas of ethics in engineering, but rather be added to them. Virtue ethics is not meant to replace a set standard of ethical rules such as codes, but rather provide ethical education from the other end of things, that being the engineer's own motivation and interests.

Essentially, there are multiple different ideas of how to change the current approach to ethics in engineering. An open dialogue between engineers and ethicists is suggested in order to bridge the gap of ethical awareness between the two professions, and therefore create a practical path for improvement (Wang, Zhang, & Zhu, 2015, p. 66). In drafting a code of ethics for engineering education, an established set of codes is also suggested (Schlossberger, 2016), and is derived from examining four separate professional fields and retaining the applicable parts to engineering. Finally, there are recommendations to introduce virtue ethics as a supplement to the existing code and methods of ethics (Han, 2015). After studying and reviewing the above articles, the blend of these studies seems to be the best approach to bridge the gap between ethics and engineering. The structure of the set of codes is useful and helpful to engineers, and could be used as a reference within

the professional field, and to develop and refine these through a communication of ethicists and engineering would be helpful to both parties.

Ethics Taught through Undergraduate and Graduate Studies

The other side of ethics training comes from students being introduced to it within their undergraduate or graduate studies. Some regard this approach as the more logical course of education, as the students enter the workplace with an idea of how ethics are used within the field of engineering (Keefer, Wilson, Dankowicz, & Loui, 2014, p. 2). This approach has been attributed such importance that all Accreditation Board of Engineering and Technology (ABET) programs are required to have ethics included within their course curriculum. This is partially because the introduction through coursework allows the students to consider how this will affect their professional lives, as well as making the transition from the university to the professional world easier for the students. It is important to remember for this method, however, that not all engineering students will have exposure to the ethics training at their university depending on the course and program of the specific university.

Another specific method of introducing ethics to students is that of whether or not it is the teacher's responsibility to teach not only professional ethics, but also the personal ethics of the students. The advocates of developing ethics from the personal values of students realize that with the quickly changing demands of technological and engineering jobs, it is quite impractical to attempt to teach students that would be job specific (Keefer, Wilson, Dankowicz, & Loui, 2014, p. 2); rather, the goal is to provide the students with foundational personal ethics and skills such as critical thinking that the student will be able to reference in the future. Specific implementations of the method could be found in several papers concerning preparation for career and college beginnings (see for instance, Rateau, Kaufman & Cletzer, 2015; Robles, 2012). When these papers were reviewed by Thomas Loveland (2017), six key characteristics were found: self-management, collaboration, integrity, communication, optimism, and adaptability. The students and future employees were then taught these traits by working on a design team, or by instructors altering deadlines in order to heighten the workload and perceived stress. Additionally, the article mentions that the optimism of the team or class self-management, collaboration, integrity, communication, optimism, and adaptability can be determined by that of the teacher, as the students would tend to imitate the

overall personality of the teacher. In terms of working in flexible work environments, “This experience of adjusting to new things and other ideas to accomplish goals can promote personal flexibility. Teachers should try to teach students that there is value in change” (Loveland, 2017, p. 18).

Overall, the goal of this school of thought is to promote personal values and goals within everyday life with the hopes that this will in turn create positive ethics in the workplace. A great deal of the responsibility, therefore, lies upon teachers to lead with their own attitude and ethics, while providing tasks and real world situations for students to experience stress and other elements of the workplace. While the limitation of this approach is that the success will not be apparent for years to come, teachers should realize that it is a part of their job to create moral consciousness within their students.

Some problems are created when the university makes it a point to attempt to teach students skills of ethics with results found in assessments and tests. Not only are these skills difficult to measure but the great variation in approaches, objectives, and assessments depending on the university’s education system allows for great ambiguity between what students are learning, and debates whether or not any of this information will actually assist students in the future. This is obvious in the article “The Importance of Formative Assessment in Science and Engineering Ethics Education: Some Evidence and Practical Advice” (Keefer, Wilson, Dankowicz, & Loui, 2013). In this publication, the issue of whether or not students are actually learning information in their course and the extend of actual application of the learned ethics is examined. The difference between the instructors can be an issue in itself: “[M]any instructors responsible for developing their own courses come from a wide variety of disciplines and are often teaching a subject that is not their primary area of expertise” (p. 2). These inconsistencies can cause students to be at a loss when instructors are trying to teach them things specific to their careers, as this will then create a gap in backgrounds for most students as they enter the workplace.

Attempting to Use This Information to Improve the Ethics within the Field of Engineering

For the most part, this paper focuses on the ethics of engineering of the new professionals within the field. These professionals tend to fall into two categories: those who were taught ethics through their studies at a university, and those who learn all of the ethics of their field at their job and through their professional

experience. While both of these groups provide for a great amount of ambiguity and difference between backgrounds and learning methods, those methods taught through the workplace tend to be more similar than those taught by the university. This conclusion comes from the basis that the students of a university will be greatly affected by not only their own background and pedigrees, but also by their professors' backgrounds. This would create a gap between all students of where they studied, what their teachers specifically taught them, and therefore create a negative difference in their abilities to work with and understand the methods of their peers. This process has begun through ABET accredited programs all requiring ethical education, but this leaves much room for ambiguity between the separate curriculums.

The best way for students to learn about ethics while maintaining the option of personalizing the ethics to their own morals may then be through the example of attitude of the teachers, especially when the teacher creates simulated events like group projects, and then gently guides the students how to ethically work their issues and problems. This approach provides a type of framework for the students to refer to as they will face different types of stress and ethical problems as they each maintain different jobs in their professional lives.

This general teaching of ethics in the university coupled with the open lines of communication between engineers and ethicists would provide a viewpoint for the engineers outside of their field. These two methods combined would provide the engineer with references and examples of how their superiors handled ethical issues within the university, as well as the ongoing discussion between the two career fields to maintain current information and opinions on the projects and work conducted by the engineer. While a general code of ethics may also be recommendable, it would be advisable for this code to avoid becoming too restricting. This may sacrifice the liberty of the engineer to use their own judgment, views, and liberties when working within the field.

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Research Article

Engineering's Effects on Communities through an Ethical Framework

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Introduction

A research project was conducted in Canada involving the Mohawk community and its 7000 members. The goal of this project was prevention of Type 2 diabetes through the promotion of healthy activities such as better eating habits and increased physical activity in elementary-aged students. The significance of this project was its large dependence on community interaction and consultation, a significant departure from the typical research approach. In the research project conducted by Macaulay, Commanda, Freeman, Gibson, McCabe, Robbins, and Twohig (1999), community was involved in nearly every aspect of the project:

> It [the Mohawk community] participated in *(a)* developing the goal and objectives, *(b)* planning and implementing the intervention and evaluation, *(c)* outlining the obligations of researchers and community in the code of research ethics, *(d)* collecting and interpreting data, *(e)* reviewing lay and scientific publications, and *(f)* disseminating results. (para. 15)

The community was treated as a partner in the project's research, not an obstacle or problem for the researchers. This is significant in the adaptation of a "community-first" mindset, which is crucial when working with communities.

Communities are often treated as an obstacle or problem when conducting research or moving forward with a project. This mindset can lead to ethical issues involving the community and project leaders. This problem can lead to detrimental decisions that detract from progress for society as a whole. It is crucial that researchers and project leaders move away from this mindset and treat communities as collaborators when conducting research or implementing projects for the maximum effectiveness of the project.

One must also consider the different types of communities involved with a project. Communities aren't exclusively limited to the citizens that a project affects, but also include communities of professionals and practitioners. The communities within a professional field are also of importance when it comes to decision making and eventual effects on the communities a project directly affects. Ethical decision making is important in any community, not exclusively communities of citizens. It is within these communities of practitioners that guidelines for ethical treatment and approach to communities are established.

Within these professional communities, community-sensitive education that incorporates a multi-disciplinary ideal (Jamieson, Oakes, & Coyle, 2002; Strenecky & Ellis, 2012) is crucial to the adaptation of a "community-first" mindset. This article will highlight the approach of educating young engineering practitioners to be more sensitive to their effects on communities and to approach communities in an ethical manner. It is important that aspiring engineers be given an ethical basis for their interactions with communities to ensure that communities are not viewed as an obstacle, but rather partners within a project.

Engineering is at the forefront of innovation and progression in our society, but often has various impacts on the communities in which projects take place. This article focuses on several ethical guidelines established through education and engineering's effects on surrounding communities. Ethics inside of community actions and approach will also be explored.

Community

A community should not be defined only geographically, but by many factors such as common interests, ideologies, ancestry or history (Merriam-Webster, 2017). Communities feature relationships among its members whether new or previously established (Lucena, Schneider, & Leydens, 2010). Location is indeed a factor, but it can also be a virtual area such as a forum or organization. One must

also take into account the various levels of privilege. Qualities such as socioeconomic status, race, gender, etc. could possibly go against our ideals, but it is not the place of an engineer to relieve any such class of oppression. This project will not limit its exploration into community to strictly engineering. Other fields such as business and medical education feature many useful practices that could apply to engineering.

The idea of a community may seem fairly abstract, (Lucena, Schneider, & Leydens, 2010), but it is the task of the engineer to adapt and work with a community to let a project flourish properly. Community is a complex subject with many different aspects and complications. Engineers must be capable of taking these into account when attempting to progress forward with a project or an idea. Lucena, Schneider, and Leydens (2010) mention that engineers fail to see the complexity of the environments they operate in. Ideas and applications are often interpreted as universal. This causes an ignoring of the subtle differences among local, regional, or national contexts. These differences compromise the design and implementation of technologies for these areas. As stated previously, engineers must be able to adapt to the fluidity of a community to properly move forward with a project or an idea.

Education

An engineer's consciousness of community often has its roots in engineering education. A large portion of the material focused on engineering and community often include an engineer's perception of community being based in education. Engineering education has adapted to consider a wide range of factors: "Students are mandated to be able to function on multidisciplinary teams, to communicate effectively, and to understand a wide range of issues, including professional and ethical responsibility" (Jamieson, Oakes, & Coyle, 2002, p. 278). Many engineering curricula now require adaptive courses often revolving around a multidisciplinary approach to problems. "Students are taught the importance of developing contextual understanding and of recognizing that lived experiences generate different perceptions of reality" (Hopple & Choi-Fitzpatrick, 2017, para. 1). This instruction directly contributes to an engineer's foundation for community practices that adhere to ethical standards such as realizing different experiences create different conditions for different people (Hopple & Choi-Fitzpatrick, 2017).

It is important that an engineer going out into the field have some sort of basis on how they will interact with the communities that they will be influencing.

An interesting college course on the topic of complexity of engineering community practices is titled "Real Communities, Real Problems, Real Solutions An Interdisciplinary Approach" (Strenecky & Ellis, 2012). This course details that social problems faced by communities cannot be approached and solved effectively by one single discipline. "By bringing multiple perspectives, an interdisciplinary approach can frame and solve community problems in a rich, sustainable, and satisfactory way" (Strenecky & Ellis, 2012, p. 1). This multidisciplinary approach highlights that the field of engineering can in fact learn from other fields and incorporate practices instituted by several fields to create a more sustainable and stable set of community practices and standards.

Professional Communities

The medical education field displays some aspects of community that could possibly be beneficial for the field of engineering. "Medical education is thriving because it is shaped and nourished within a community of practice of collaborating teachers, practitioners and researchers" (Vleuten, 2014, p. 761). The medical research community has realized that research results and practice have been separated for far too long. A proper mixture of teachers, education practice, and research have allowed for "mutually stimulating bond" (Vleuten, 2014, p. 765). The field of engineering could utilize a method such as this by creating a closer connection between researchers, practitioners, and education. Creating this community could allow for a more stimulating conversation on proper engineering ethics. Streamlining this bond between areas of the field and creating closer connections would provide an environment in which community can be a focus and could be discussed. The unification of the various aspects of the engineering field and the opening of a dialogue for community practices in engineering could be pulled from this practice seen in the medical education field.

Philosophy professor at the University of Texas, Robert Solomon made interesting associations between communities and businesses, "He [Solomon] argues that, as members of a community, both business practitioners and the businesses themselves are subject to the general purposes of the community in which they are embedded" (King, 2001, p. 448). Solomon highlights that businesses are subject to the needs of communities as if they are members of the

communities themselves. As they are embedded in communities, they must be on the lookout for what is best for the community. “Solomon believes that the goal of business is not to make a profit, but to contribute to the prosperity of the community” (King, 2001, p. 487). Businesses are to forgo their necessity for profit if their actions on a community are questionable in nature. Community becomes the top priority for businesses involved in them.

Engineers in Community

This process of thinking could prove invaluable to the conscious engineer. This “community-first” state-of-mind would ensure that community would remain a focal point in the decision making of firms and for projects. What would best benefit the community? Are my actions impacting the surrounding area negatively? These are important questions that need to be asked when progressing with decisions that involve engineering. Engineers are not involved with a community to make profit. They are involved with a community for the betterment of the area as a whole. This community-conscious thinking would prove beneficial for the well-being of the community as a whole and the image of the engineers involved.

Engineers have recognized the need for their expertise in their surrounding communities. “They [community service agencies] must rely to a great extent upon technology for the delivery, coordination, accounting and improvement of the services they provide to the community. … They thus need the help of people with strong technical backgrounds” (Coyle, Jamieson & Oakes, 2005, p. 139). Communities now rely on not only the logistics provided by engineers, but their input and expertise on topics beyond their understanding. Museums, schools, etc. need engineers with strong backgrounds to support themselves.

An engineer’s input to a community is invaluable. There are often many areas that most citizens wouldn’t have a great understanding of and engineers must be willing to embrace their ability to fulfill this role as a bridge to what citizens of a community may not be able to understand. Engineers provide a missing link in the knowledge chain of a community. Barring one’s knowledge and practice from a community could prove detrimental to not-for-profits inside of a community and as a whole. Engineers play a key role in communities by providing time, services, and knowledge to their surrounding communities allowing them to grow and flourish.

The engineering field plays a complicated, important role in the communities the field is present in. Community importance has made its way into many

engineering education curricula. Engineering could utilize the practices of unification of aspects of the field as displayed by the medical education community and could establish a "community-first" mentality as displayed by the business community. Providing knowledge and valuable input is one of the greatest effects engineering has on their home communities.

Ethics in Community

Engineering's ethical impact on an area, community, or group of people is often brought into question when exploring engineering's effects on communities. Carl Mitcham (2009), professor of philosophy of technology from the Colorado School of Mines, believes in an interesting outlook on ethics in engineering. The ethical guidelines of engineers are established not by the actual engineers, but by those around them. This has inspired a change in engineering from "use and convenience" to "public safety, health, and welfare" (Mitcham, 2009, para. 1), as if engineers now hold a role more akin to civil servants. We see the establishment of an engineer's ethical bounds throughout past experiences typically involving failure or a breach in ethics.

Engineering disciplines often follow a common core of ethics typically containing seven clauses. Some variation of each clause is usually evident across engineering disciplines. These clauses include a Paramountcy Clause, which calls for engineers to uphold the health, safety and welfare of the public, (Schlossberger, 2012, p. 1334). The second clause involves consciousness of the environmental impact of the engineer's actions. A Competency Clause (p. 1334) exists outlining that an engineer is liable to only perform in areas of competence. The next clause reflects the honesty of engineers and integrity of their actions, (avoiding bribes or deceptive practices). Engineers are to work with colleagues in professional development and are to remain faithful as agents of their employers. And lastly, engineers are to increase the "competence" (Schlossberger, 2012, p. 1334) of the field as a whole. These basic clauses outline the ethical practices involved in the engineering field. These clauses are recognized by the National Society of Professional Engineers (NSPE), the American Society of Civil Engineers (ASCE), the American Society of Mechanical Engineers (ASME), and the Institute of Electrical and Electronics Engineers (IEEE).

The significance of these clauses is that their basis is in morality or standards of human behavior previously established as what we see as acceptable. Engineers

must be capable of decisions that have a moral basis rather than decisions purely focused on profit or economics. Many of these clauses have a basis on protecting groups of people or areas, what many would call communities.

While every clause has the well-being of those surrounding engineering in mind, the first two clauses, The Paramountcy Clause and the Environment/Sustainability Clause, display a notable focus on our typical understanding of community. The Paramountcy Clause mentions the welfare of the public. The decisions made by an engineer must have a basis in what is best for the community. This displays a direct correlation between how an engineer affects the community and the ethical basis behind this decision. The Environment/Sustainability Clause, while broader than the community itself, has a direct impact on the community. If the decision greatly impacts the community environment (literal environment or community life), extra care must be taken. These clauses have a basis on the engineer's community-conscious decision making established from early engineering education.

Conclusion

The complexity of how engineering affects surrounding communities is undoubtable. A conscious engineer must be prepared to examine these complexities and move forward with their practice in an ethical manner. There are valuable insights on community practices available to engineers from other fields such as the business field and the medical education field. These insights coupled with an education that embraces community involvement and focus allow for an engineer to make valuable, ethical decisions that benefit the communities they're involved in. Proper progression through engineering endeavors includes a large extent of community involvement and input to properly ensure the project is being executed in an ethical manner. These decisions conscious of ethical impact on the surrounding community prove pivotal and favorable for society as a whole.

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Research Article

Positive Effects of Sustainability in Businesses

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Introduction

This study aims to look at various businesses and address how they view and deal with the idea of making their practice more environmentally friendly and sustainable. More specifically, it will focus on how businesses spend money to make sure they are "green." It will show whether or not businesses are more focused on earning money and making profit or about making the transition to being more environmentally concerned even if that includes spending more money to do so. This study also explores the benefits for businesses that choose to "go green" to see if the investment of being more environmentally conscious is worth the extra money. It will also look at the differences between what the larger businesses do compared to what smaller locally run businesses do by looking at the amount of revenue they pull in and how much of that goes to either fixing their own practices and making them more sustainable and what they do to educate or help the community improve the surrounding areas. Some areas of interest that the study will go into in length are the monetary effects of consciously making an effort to recycle or not. This study addresses the lack of knowledge that consumers have about the stance of the businesses that they use about an important topic such as the impact of the business on the environment. I will be addressing this topic by looking at what the Environmental Protection Agency (EPA) requires as a minimum for environmental regulations. Most of my research would be looking at businesses' reports to figure out how much they spend and how important making their business more environmentally conscious and compare them between each other.

To conduct this research, I adopted an ethical framework from the viewpoint of greed of businesses. As Michael Gerber, founder of the Michael E. Gerber Companies, said:

> If your thinking is sloppy, your business will be sloppy. If you are disorganized, your business will be disorganized. If you are greedy, your employees will be greedy, giving you less and less of themselves and always asking for more. (Gerber, 2009, p. 2)

The same framework can be applied to any business large or small. If humanity is always greedy, asking for more and more, then eventually the Earth will no longer be able to sustain the demands of humans and we won't have resources that are necessary to sustain life. This article plans to address questions such as, whether or not businesses choose to save money rather than to help the environment. Is money more important than helping to replenish and trying to save the Earth? Do businesses care about the current course of the consumption of nonrenewable resources and what that means for future generations and the future of the Earth? Is it worth it to spend a little more money to ensure the longevity of the world in which the businesses operate and participate?

The sources that I consulted were a combination of other writers' research results, businesses' personal viewpoints on the topic, the regulations imposed on businesses by the Environmental Protection Agency (EPA) and, legislation the U.S. government forces businesses to follow. This article will only look at businesses in the United States and legislation for businesses in the United States for the purpose of brevity and consistency. Each country has its own regulations and personal beliefs about environmental standards for businesses, so this review will just focus on the policies and beliefs in the United States.

I will first look at the certain practices adopted by successful companies. By looking at the successful practices many companies choose to adopt it is possible to come up with possible suggestions for other business that are just starting or that want to become more successful. By looking at these possible business practices, I will transition into looking at the benefits that come from adopting such practices. I will be looking at why there is such a large movement towards sustainability and why this idea is so appealing to business owners. I will also touch on how the public has reacted to businesses making the movement to being more conscious about their impact on the environment and how it will affect future generations.

Business Practices

To enjoy the benefits of joining the American business world there are some regulations that companies have to follow. These regulations and laws are set by the Environmental Protection Agency, whose sole purpose is to protect the environment along with ensuring good human health. To become a prosperous business one might have to spend a little more money to ensure that your business is in accordance with all the environmental protection laws, but in the end profits increase. "Green" companies often require their employees to obtain special certification and attend training sessions to ensure that their practices are in line with the mission of the company.

The EPA and the U.S. government have made sure that businesses move toward becoming environmentally friendly by forcing them to abide by regulations such as the National Environmental Policy Act (1970), whose purpose is "to declare national policy which will encourage productive and enjoyable harmony between man and his environment" (para. 1); the Nuclear Waste Policy Act (1982), which addressed the proper storage and disposal of "high level radioactive waste and spent nuclear fuel" (EPA, 2017, para. 1); and the Pollution Prevention Act (1990), which focused on "reducing the amount of pollution through cost-effective changes in production, operation, and raw materials use" (EPA, 2017, para. 1), to name a few. The policies were implemented to make sure that businesses cannot do whatever they want and have the Earth suffer the consequences. These policies are enforced by Occupational Safety and Health (OSHA) and the EPA.

Environmentalists have come up with a few steps companies can take in hopes to limit their effect on the environment. The first step, "Limiting Pollution" (Hart, 1997, p. 71) starts for most companies by simply watching what comes out of their factories and limit the amount of pollution that seeps out. Many factories have worked to combat these airborne pollutants by updating their waste disposal techniques. For instance, a General Electric factory in Orlando has put air scrubbers at the top of their exhaust pipes to decrease air pollution by collecting the harmful materials in water which can then be separated from the pollutants and disposed of properly. The next step, "Product Stewardship" (Hart, 1997, p. 72) means that companies need to look at the impact that their products have on the environment throughout their lifecycles and make it so they have a minimal negative impact. Companies like Eco-Products have created a biodegradable cup that is 100% renewable and compostable so that it does not sit in a landfill and seep harmful

materials into the environment. Finally, the last step, "Clean Technology" (Hart, 1997, p. 73) means that companies that truly care about the environment would invest in tomorrow's technology. Companies that use renewable resources are setting an example for companies around the U.S. about how to limit their impact and reliance on the environment. Companies like Rentech turn municipal waste into everyday useful products such as helpful chemicals and fuel (Damas, 2011). They believe that this will drastically decrease their reliance on fossil fuels, which in turn decreases their impact on the environment.

A popular reason that companies, large and small, are attracted to the idea of becoming "green" is to save money by cutting costs, and by doing so it puts companies in good standing with consumers. According to Kotler (2003), "It is estimated that as much as 42% of customers in the U.S. are willing to pay more for "green" products" (p.148). Not only does becoming more environmentally friendly help businesses cut cost but it can also help them increase their profits. The benefits of becoming more sustainable as a business are so great that 90% of CSOs (Chief Sustainability Officers) report that sustainability is directly involved with corporate strategy and innovation (Sweeney, 2012, p.34). The thought of a business becoming environmentally friendly and receiving the benefits that go along with it is so important that sustainability is a big part of the company's production strategy and how they innovate their products to fit certain criteria. By making the switch, companies often save money because of the costs they were able to cut by reducing inputs. Companies also generate additional revenue from the new, and better, products along with the ability to create new businesses, which is the ultimate goal of innovation (Nidumolu, Prahalad, & Rangaswami, 2009, para. 4). The business world is a highly competitive field to either have the most coveted good or service to beat out your competitors. As shown above one of the best ways to do this is by adopting sustainable business practices.

Many of the brands that are popular today are some of the most sustainable companies in the U.S. The United States has three of the top ten most sustainable companies in the world. These are companies like Cisco, Johnson & Johnson, and McCormick. For example, Cisco takes its impact on the environment very seriously. They train their employees on how to update product designs, limit carbon emissions, and make packaging more environmentally friendly (Cisco Systems, 2017). Cisco consistently looks at the life cycle of their products and improves wherever they can. The materials that Cisco uses are designed to minimize waste and maintain performance.

Financial Benefits of Sustainability

Small businesses also are driven to participate in becoming sustainable. They do this because it helps them save costs, gain a competitive advantage over other larger businesses that do not choose to become sustainable, and it helps them gain support and recognition in their communities. While less of their income goes to environmental outlets, the effects of what does go to improving the environment is seen more rapidly. With the growing popularity of sustainability, businesses must conform to the rapidly growing idea to be able to compete with larger businesses and to grow as a company (Miller, 2010). By showing a concern for the environment, local entrepreneurs are more likely to receive support from the local community.

By adopting the sustainable practices outlined previously, companies are able to endure great benefits. These benefits of saving money, a preferable choice for consumers, and a greater longevity of the business, are just a few of the reasons that more and more companies choose to "go green." By choosing to turn a business practice into a more sustainable one, businesses are able to cut some of their resource costs and in turn save money (Green Infrastructure, 2017). Businesses also see an improved response from their respective communities when they become more environmentally conscientious (Wolf, 2016, para. 23). Additionally, when companies make the switch, the life of their company is extended because they no longer rely on limited resources (Snyder, 2008).

One of the main reasons that companies choose to become sustainable is that in the long run it will save their company money. This business decision does not show many results in the short run but in the long run the financial benefits are worth the wait. According to Zack Mansdorf, an environmental consultant for BSI (a firm that helps companies improve their results in environmental performances),

> The return on investments for a new product or factory will be much better than the return on investment for sustainability on a purely financial basis. Investments for sustainability are usually made for strategic reasons like the success of the business in the long term instead of short term financial gain. (Mansdorf, 2010, para.2)

Social Benefits of Sustainability

When companies look to make the move to a more sustainable practice they are thinking about the benefits in the long run rather than the short run. While adopting some environmental practices may lead to economic growth within the business, the World Commission on Environment and Development (WCED) claims that "achieving sustainability will require an approach that de-emphasizes growth and that explicitly embraces environmental and social goals as a core and self-standing dimensions of development" (Howarth, 2012, p.38). This is why companies spend more money to convert a once unsustainable and environmentally unfriendly business into one that is more conscious about its impact on the local community it is located in and how it impacts the earth. This is evident in an increasing number of companies making the transition to becoming "green." One such example is the house remodeling company Pacific Home Remodeling. With "green" architecture becoming more popular, Pacific Home Remodeling decided in 1999 to incorporate sustainable features in their work (Pacific Home Remodeling, 2014). In 2014 they were ranked the 24th most prestigious remodeling company in the United States. They claim that their success is because they "leave the world a bit better than the way they found it" (Pacific Home Remodeling, 2014, para. 6), which is the basic goal of companies that adopt "green" business practices.

Another large benefit for companies that choose to become more sustainable is the overall positive community response. Consumers often find that companies that are environmentally friendly are preferable to those who are not. For mainstream customers, they often will not purchase a more expensive "green" product unless they see a valuable benefit for purchasing it. To reach these customers, the companies must focus on fulfilling the customers' needs and focuses. Harvard Business professor, Theodore Levitt, explained that the common pitfall of companies is that they focused more on the features and the function of the product instead of on the needs of the customer. One such example of a business caring too much about the "greenness" of their product instead of it performance is Whirlpool. In 1987 in response to the Montreal Protocol, which called for companies to get rid of chlorofluorocarbons (CFCs) by 2000, Whirlpool released a new refrigerator which had the first ever CFC-free cooler and was 30% more efficient than the standard model. Despite having the most environmentally friendly refrigerator on the market their sales declined because the benefits of the fridges did not offset the $100 to $150 premium on the refrigerators. A product that fulfilled its goal in

becoming a popular "green" product was the Toyota Prius, a hybrid car that extended its MPG consumption by combining gas and electric power to lessen the reliance on gas alone. Although the Prius is a bit more expensive, it fills a consumer need of being able to limit the times they fill up their car with gas while also making consumers feel like they are doing their part to protect the life of the Earth (Ottman, Stafford, & Hartman, 2006). The purpose of showing these cases is to show that consumers prefer to have "green" products as long as they fulfill the daily needs of the average person without compromising any of the usefulness they can get from non-environmentally friendly companies.

The last big benefit for companies that choose to become sustainable is it increases the longevity of their business. Businesses that do not have to rely on coal and other nonrenewable resources do not have to worry about the declining quantity of such resources. One of the most popular uses of renewable energy is solar water heating to reduce utility bills and rely less on nonrenewable methods. According to the Solar Energy Industries Association, more than 200,000 businesses in the United States use solar thermal systems to reduce utility bills (Bull, 2001, sect. F). Another possibility is the use of distributed power (Bull, 2001, sect. H). The excess power that companies generate and do not use could then be sold to the "grid", which is an interconnected network where electricity is delivered from producers to consumers, where consumers could purchase if necessary. This would decrease the use of coal-fired power plants, which release 350 million tons of CO_2 every year, the greatest cause of the "greenhouse" effect, the term used to designate the rising temperature of the Earth (Riebeek, 2011). From this data it can be concluded that using renewable resources increases the length that a business can operate efficiently and that consumers could also benefit from these sustainable practices.

In a study done with Yale University, the founder of Patagonia, and the Vice President of GE, determined if sustainability really matters to customers (Dhar, Comstock, & Chouinard, 2016). It was found that it is important to think of the customer's perspective when buying products. The majority of consumers want to do something to be a part of the "green" movement but are unsure of what they can do. It has been shown that consumers prefer to purchase the "green" product but it must pass a cost-benefit equation. A study in 2008 showed that 56% of people said they were more willing to buy from companies that "are doing what they can to cause the least amount of harm in making their products." (Dhar, Comstock, & Chouinard, 2016, para.8). So consumers prefer to buy from environmentally responsible companies as long as it is practical in terms of its cost and its benefits.

Public Response to Sustainability

After looking at the benefits for companies which are environmentally friendly and the opinions of the public in terms of sales, it also matters what the public response to the sustainability movement has been and what the future looks like. I looked at how the movement towards sustainability was driven by the public, how having a better relationship with the public is beneficial for companies, and how having community support behind your business helps both parties and how the support can change the dynamic between community, the companies, and the environment.

The movement to buy products from sustainable companies is driven by the public and those who know the benefits they provide. Eric Ries, an entrepreneur and author of "The Lean Startup", gives four ways customers drive sustainable growth (Reis, 2011, p.36). The first way the public has driven the sustainable business market is through word of mouth. If people truly love a product, they tell all their friends about how great it is, and their friends also try the product. With the age of social media, this type of advertising has become even more successful. A recent study from Anna University has shown that 77% of customers interact with brands through Facebook and 56% of consumers are more likely to recommend a brand after becoming a fan on Facebook (Saravanakumar & SuganthaLakshmi, 2012). The second way the public drives the market is simply a side effect of product usage. By this Reis (2011) means that by seeing your neighbor or friend using a certain product is another form of productive advertisement, you also might want to use the product. Take water bottles for example: You see your friend using a reusable water bottle, and that makes you want to stop using disposable plastic water bottles, which end up in dumps and release harmful BPAs into the environment, disrupting the body's natural production of estrogen and endocrine (Cooper, Kendig, & Belcher, 2011, para.1). The third way is through funded advertisements; to initially put their name out in public a company will pay for an ad. As long as the revenue generated by this ad is greater than what the company paid for it then the excess profits can be used to attract more customers. The fourth and final way by which, Reis claims, consumers drive the sustainable growth is through repeat purchases and use. When a company has a product that requires repeated purchases, you have the first step to foster brand loyalty between the producer and the consumer. Products like biodegradable cups from companies like Eco-Products require consumers to buy more when they run out. This starts the

beginnings of brand loyalty between Eco-Products and their customers. These steps show that when a product passes a cost benefit analysis and adds to the betterment of daily life, then the public will do its part in advertising it through different means.

A big part of sustainable companies being able to compete with other larger brands is their relationship with their customers. By receiving the community's support and by making their members lifelong customers, smaller, environmentally conscious companies are able to not only compete with larger companies, but also thrive in a very competitive market. In a survey done by the Nielsen Company, it was found that globally the most influencing driving force to buy a product is to buy from a company that the consumer trusts. It was found that 62% of the world believes that a company that can be trusted is important and 72% of those consumers are willing to pay more for their products (Green Generation, 2015). From the same study it was found that 57% of consumers say that the materials that go into their products matter to them and 69% say that they are willing to pay more for products that are made from fresh, natural, and organic ingredients. From this it can be concluded that customer approval goes a long way when determining a company's success. It has been shown that consumers are willing to pay more for products that come from a "green" background and from companies that the consumer can trust. This is a great incentive for companies to become a part of the sustainable business world and it could even help them generate more revenue. By following suggestions like these a company is more likely to create lifelong supporters and have a group of consumers they can rely on to purchase their products.

The support from communities goes a long way for sustainable businesses. With cooperation from businesses and communities, improvements and trusting relationships can be made between the two that are mutually beneficial. In an interview I conducted with a former Safety, Health, Environmental, and Compliance Manager for Haviland Chemical Company, he told me that keeping a trusting relationship with the community was important to the company. To keep this trusting relationship with the community and businesses, business leaders would have to keep the number of mishaps at a minimum and teach the first responders how to deal with the dangerous chemicals and where everything was stored so it could be easily identified and cleaned up. To generate a working relationship that was beneficial for both parties Haviland would host the local fire departments ball to help them raise funds. They would also get involved in the community. They would sponsor different events to make sure the area was clean

and free of harmful pollutants. They would sponsor a leg of the annual 5K run and make sure the area was clean and looked presentable. This helped Haviland build trusting relationships with the community and in turn the surrounding area was kept cleaner and Haviland was trusted that they could be counted on in any possible incident that may occur.

Conclusion

The movement for businesses to become more environmentally conscious has grown in recent years. The regulations that companies are required to follow serve as a starting point to making a positive difference in the world. By following some steps suggested by experts, companies are able to receive many different benefits. These benefits include financial incentives, a stronger positive community response, and increasing the life of the business. A big part of the environmental business world is the response from the public. The movement towards sustainability has been pushed by the public; people would rather purchase items from environmentally conscious companies. The consumer relationship and support allow for these businesses to maintain good standing with the public and business from life-long customers because they know that they are contributing to a company that is looking to make a positive impact on the world.

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RESEARCH REFLECTION

Research Reflection

The People and Purpose of Business: The Philosophical View of the Workings of a Corporation from a First-Year Business Student

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Introduction

A person with a goal needs careful and thoughtful planning and execution if he or she is to attain success. There exist multiple layers of decision making, management, and maintenance to provide continuity, growth, and prosperity (McCormack, 1990). While in theory everything should run smoothly, the real may not function to the sights we envision. In the instance of running businesses, the process of turning thoughts on paper into profit will never be as easy as inhaling and exhaling. It takes a large investment of time and resources to guide a company towards achieving what one sets out to accomplish. One must plan amongst multiple facets; there are numerous variations of details that require attention. Perhaps the most important aspect falls toward the living, the working: the people. Businesses need a workforce, and the workforce helps a business attain its goals. Standards of work are set and to be followed to protect the workers. Hypothetically, the happiness of the workers should have a positive correlation with the output and production of themselves and the company.

The ideas that follow are a compilation of my outlook on how businesses should operate following from my own limited experiences, conversations with others, presentations by speakers, and research on related topics. I have written this piece

to provide an example of the viewpoint of a first-year college student, one who has been searching for what his future career may hold. I entail both a thoughtful introspection of my inner beliefs and outside examinations toward how firms should run and how people should work. I do not know where my education and career may go, or which business degree I graduate with, but I wish to write for my future self and for the current minds of others, so that we may always remember to keep to high standards, withstand temptations, and be a leader for others in an ever-changing world that, as current headlines can attest to, are not as simple as we, as a society, would hope.

Business Ethics: Standards for Work and Community

The first place to start on this cognitive journey falls upon one of the basic markers for work within a corporation: the ethics of the people. The ideas of ethics and morals can be approached along the lines as "(1) concern for others and respect for oneself and (2) a desire to achieve an appropriate balance between the two" (Clark & Lattal, 1993, p.11). These are justifiably for the greater good; there are certainly people who have weaker standards and are quite likely to act in a different direction. Within every person, their specific moral code drives their actions and judgements. The alignment we hold as a society pertains to the concept of "doing the right thing," but decisions frequently do not follow a simple reckoning.

In relation to business decision making, those who make more ethical decisions typically hold stronger moral principles (Trevino, 1992). Generally, this correlation builds into the concept of moral integrity. Namely, moral integrity composes reflecting on questioning oneself along the aforementioned "doing the right thing," interests of self and others, following moral principles, why we have them, and what to value when in conflict (Clark & Lattal, 1993). The people with a firm grip on their morals maintain their beliefs through their showings of integrity. In a business scenario, this becomes amplified amongst higher decision making and human relations divisions.

The concept of business ethics is fundamental to a grand picture. The simple truth for people and companies is unavoidable: "Business cannot exist without society and that society cannot go forward without business. Thus, business must acknowledge society's existence and society's growing demand for more ethically responsible business practice" (Joyner & Payne, 2002, p.298). By and large, there exists societal pressure on businesses to maintain good ethical practices.

Theoretically, this public eye should eliminate any malpractice. However, instances such as discrepancies in earnings, dehumanizing, forgery, fraud, employee mistreatment and harassment, demeaning sales techniques, and labor wrongdoings happen in more abundance than one would hope to find (see for instance, Alexander, 2007; Christensen, 2005; Magrath & Weld, 2002; Meckenstock, 2016; Trevino, 1992; Vranceanu, 2014). Nearly all of these acts are illegal, but many are not brought to light, as people with weaker ethics either say nothing for fear of repercussions or take part in for a piece of personal gain.

Correspondingly, another approach to business ethics comes from the rules and laws that regulate the economy and corporations. Standards put in place by the government "can be interpreted as codified ethics" (Vranceanu, 2014, p.55), which provide a legal structure for businesses to adhere to. Corporations must follow these rules, which include regulations for how business can be conducted, how employees are treated, and how a building must be up to certain codes and specifications. In like manner, companies also have to respect and maintain their corporate social responsibility. Corporate social responsibility is defined as categories or levels of economic, legal, ethical and discretionary activities of a business entity as adapted to the values and expectations of society (Joyner & Payne, 2002). Corporate social responsibility acts well as a baseline for how businesses should act: their actions revolve around society and people, and there is a two-way relationship for how they treat each other.

People and Employees

A firm's ethical stance and practices are directly tied into the people who work in the firm (Clark & Lattal, 1993), and how it acts in relation to the public.

Employees and Workplace Culture

The ties to people within a business begins with the CEO or owner and works down the chain to department heads, managers, employees, and even utility workers. An important part to consider when hiring a potential employee is how they might fit into the office or company mission and culture. A company can help maximize its outputs when it finds a person who fits or works well in the company's styles (Bowen, Ledford, & Nathan, 1991). While certainly they must be qualified for the position and possess the right skills for the job, they must also be able to work well within the environment created by the company. This is something that

can be oversighted when hiring or acquiring employees. Some people for example may be uncomfortable working in groups, would prefer to have more feedback, or be intimidated by certain processes. Different personality traits also may be looked for in certain positions that would help one succeed (Jonsson & Rancano, 2013). Human resources and those in charge of the final hiring processes and interviews must be sure to ask the right questions and find the right information about each individual so to find who can work well or not. There is a level of disappointment felt by many when a person decides to leave due to unrest of how things run; a mistake should be admitted, understood, and learned from. Such selective hiring helps make all the difference in screening out people with attitude problems, as told in a story where for Southwest Airlines "a top pilot working for another airline who actually did stunt work for movie studios was rejected because he was rude to a receptionist" (Pfeffer, 1998, p. 71). The idea for companies looking to hire is that learning the skills is the easy part, but what takes longer to change are behaviors and attitudes (Pfeffer, 1998).

People at the Center

It is often understated, but one of the most important things a business should focus on is the people. This includes all relationships with people, whether customers, employees, shareholders or others, who should always be considered in any sort of business decisions (Jackson & Nelson, 2004). People are integral to the functions of any company, no matter what product or service. If you look anywhere within a firm, people will appear on any role. A consumer buys a product that is produced by another person using a different person's equipment that was designed by someone else, and the product is transported by a person, marketed by another, and sold by someone else, all the way with different people overseeing operations and giving instructions, not the least to consider all of the other countless interactions along the way. This broad scope must always be considered as people are found on every stage and determine whether your company succeeds or fails. An additional relation can be viewed through the social corporate theory, where there exists a necessary relationship between the public and the business (Joyner & Payne, 2002). With people always on the mind, we can now turn to how to operate the company.

Management and Leadership

In order for a company to run properly, there requires a certain level of consistency in management (Trevino, 1992). Such levels include achievable practices that are focused company-wide, and internal composition in the form of governance.

Core Management Practices

Good techniques for companies to use can be simplified and summarized in four main practices: strategy, execution, innovation, and structure (Joyce, Nohria, & Roberson, 2003). These points also follow with secondary practices, which include talent, innovation, leadership, and mergers and partnerships. The practices arose from careful examination of The Evergreen Project, an examination to "identify, collate, and analyze the experience of dozens of companies over a ten-year period (1986-1996)" (Joyce, Nohria, & Roberson, 2003, p. 6). Chiefly, the companies that use the main techniques successfully "consistently outperformed their competitors and delivered shareholder value" (Joyce, Nohria, & Roberson, 2003, p. 14). Although the study may now be a little dated, the correlating values can still be applied to today's companies. The authors of the method suggest doing such practices: "a clearly stated, focused strategy," "flawless operational execution," "a performance-oriented culture," and "a fast, flexible, flat organization" (Joyce, Nohria, & Roberson, 2003, p. 16-18). In practice, a strategy will create a plan and guidelines for a company to move forward under.

Operating with good execution will allow for a greater output in both quantity and quality. A performance-oriented culture will ensure that work and output take priority over the lesser important jovial enjoyment at times. Lastly, with a solid structure, the people within the corporation know all have an idea of who is in charge and quick communication throughout. When these strategies are all in good and quality use, a company is able to outperform others.

Superior Governance

An identifiable source of strength from a company comes from its leadership. A leader within a business should be able to guide, advise, communicate, delegate, and enforce, which are enacted under practicing governance. Governance can be defined as including 'the rules, regulations, relationships, and norms that determine how societies and organizations, including companies, are led and governed"

(Jackson & Nelson, 2004, p. 260). Notably, the better a company and people can practice superior governance, the better off the company will be. This translates into the financial section, where practicing superior governance almost certainly leads to positive economic output, both in short and long-term (Cummings et. al., 2017), and for maintaining a strong and sturdy business culture amongst the employees and other people. Governance revolves around power, more specifically distribution, and with that, accountability. Similarly, everybody needs to maintain some level of transparency between one another, across all vertical or horizontal levels of employees. The responsibility for handling tasks must not be taken for granted; superior governance expects everyone to do their job and take fault if something goes wrong or is not completed. Comparatively, superior governance relates well to moral integrity, where the values of responsibility, transparency, and accountability should be upheld and followed (Clark & Lattal, 1993).

Governance can fall upon three different lenses, all of which are important to follow and consider: corporate, sustainability, and public (Jackson & Nelson, 2004). The corporate governance focuses on separating the financial and managerial/personnel power (Cummings et. al., 2017). To put it another way, corporate governance divides the decision making and running of the company to the money invested. The second view, sustainability, applies the same values but in addition to the financial side to an environmental and social performance as well (Meckenstock, 2016). The third lens, public governance, revolves around the relationship of the company with the government and the public (Jackson & Nelson, 2004). Practicing good public governance includes taking a stand against bribery, forgery, and corruption. The cost of bad governance results in companies taking part in illegal actions, poisoning and destroying the environment, and taking advantage of the people. It is possible to find correlation between firms with proper moral integrity and superior governance and financial growth (Joyner & Payne, 2002).

Defining Success

After all of the other components of a company are dealt with, people always have to look to the end results: have you attained success? There are important discretions to consider, including the definition of success, the valuation and use of profits, and the twofold purposes of a firm.

Profits

Every business knows it has to at least break even to continue production. For many people and companies, the view of success comes from making the most money. This simple, monetary position makes sense in economic terms, where you want to minimize your costs and maximize your revenue to achieve maximum profits. However, once a company collects the profits, it faces a few different options (Vranceanu, 2014). The first, and the one many view businesses as striving for, is for capital gain by the higher-ups. The idea goes that the people who own the company should collect the additional revenue after paying off the costs within the company, for they own and control the direction the company goes in. This basic economic model works so long as all the other factions of the firm are cared for and not stripped down to lower costs. It is fair for the owners/shareholders to receive the profits, although the difference makers in industries differ in how they use their extra wealth. The stand-still, gain-only companies take their profits and move on with business as without extra regard. In comparison, a good owner allows for reinvestments within the company for improvements and additional benefits. They take a percent of the extra revenue and spend it on worthwhile investments. These could include anything from updated technology, building repairs, expansion, employee benefits, or as little a thing as new office chairs. With such improvements, there can be additional productivity, comfort, output, and more money to make. These considerations relate to the idea of putting people at the center: when you care for your workers and customers, they tend to reward your generosity and attention. Another part of reinvesting is sustainability spending. This has become of greater importance within the last decade or two, as we have begun to see the research and results of global warming and the changing environment (Meckenstock, 2016). Short-term sacrifices are to be made by companies for the greater long- term benefits of the world and all of its people. Less money might be made, but the caring for the well-being of the planet should outweigh large monetary gain.

Purpose

Every company needs a purpose; without one, they are lost, with little internal structure. Those running a firm should always ask questions of themselves such as “What is the purpose of your business?” and “What do you stand for?” (Jackson & Nelson, 2004, p. 300). When it can answer these questions on perspective, a

company can move forward to work toward the newfound and understood answers. In particular, these ideas come together in the form of the firm's mission statement, where it lists its goals and purpose for work that everyone within the company should strive for. This considerate side of purpose involves principles that people all agree is good to do but takes real leadership and initiative to complete. This exists in having purpose beyond profit, something overlooked with a purely economic view on business: "Profits are a *means* rather than an *end*--they're not the real reason that business exists, or the ultimate purpose for what it does" (Jackson & Nelson, 2004, p. 301). The companies that succeed implement the values and goals of their purpose into actions.

Conclusion

While my paper may not be filled with numbers that prove statistical growth, the ideas which I have discussed are used and considered by many. These are all applicable to any type of business, and even to some aspects of one's own life. The fundamentals of ethics apply not only to daily life but to higher standards in the workplace. Moral integrity should be of the utmost attention. Adhering to these ethical standards, as well as government regulations and understanding public relations will provide a firm well-being that will prevent illegal actions and immoral deeds. When shifting focus to the people, multiple considerations go into who to hire: skill, attitude, and fit. Companies work hard to find employees that will contribute to the culture they try to establish. In overall decisions, it is important to put people at the center, as to not forget who receives ramifications and benefits of decisions. To maintain the relations and care of the employees and people, companies should develop strong strategies, execution, culture, and structure. Amongst these ideas leaders need to practice superior governance to keep accountability and distribute power.

The end of the day revolves around profits and purpose. While profits from revenue are important, true success seems to come out of finding and fulfilling a purpose beyond profits. When a company works toward a purpose, all of the other ideas come together. A business functions on multiple levels, and each piece needs its own consideration and care. When we take a moment of introspection, we can find what we value and believe in. It is unfortunate that everyone does not want to make a difference and adhere to morals. I write this paper to provide a thought for others, as a view of a younger mind searching for his calling.

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