Integrating Ethics by Using Cases

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Abstract

This paper examines integrating ethics into technical classes using a case approach. Specifically, the paper offers information on the background and efficacy of the case method, suggestions for appropriate cases and classroom activities, and resources for instructors.

Introduction

Since ABET introduced outcomes-based criteria in 2000, ethics has received a much-needed boost. Criterion 3f, which requires that students display "an understanding of professional and ethical responsibility" [1], translates into the need to either require an ethics class or include ethics instruction in technical classes. However, many technical programs are already very crowded, and squeezing in an extra class may prove difficult.

Using an ethics across the curriculum approach can effectively impress on students the need for understanding and following professional behavior expectations. This paper focuses on this approach, specifically addressing background on cases and efficacy, cases and activities for various engineering disciplines, and resources for instructors.

Of course, there are more compelling reasons for introducing ethics than simply meeting ABET requirements: as our students evolve intellectually and transition into professional life, ethics assumes a more prominent role. As instructors, we arm our students with technical knowledge for their future careers. But we should also give sufficient attention to the "soft" skills, including the values of honesty and integrity that so often appear on those lists of desirable employee characteristics.

Background and Efficacy

Using cases as a primary teaching methodology has roots dating back to antiquity. Indeed, for Socrates, cases provided a way to "sting" his students into deeper thought, as noted in the often-quoted gadfly paragraph in "The Apology of Socrates," where Socrates describes himself as a gadfly stinging the flanks of the lethargic horse of society [2]. All of the problems presented to students, as recounted in Plato's *Dialogues*, constitute cases of various sorts, although Socrates dealt with lofty metaphysical principles, such as the nature of truth or virtue or reality, in his goal of training the philosopher-king.

Cases also capture our inherent fascination with narratives. People, notes Jonathan Gottschall, author of *The Storytelling Animal*, are as much "*Homo fictus*" as they are *Homo*

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sapiens: “Humans live in a storm of stories. We live in stories all day long, and dream in stories all night long. We communicate through stories and learn from them. We collapse gratefully into stories after a long day at work. Without personal life stories to organize our experience, our own lives would lack coherence and meaning” [3]. Given our human penchant for narratives, it is natural that students would find them engaging.

In the educational arena, Christopher Columbus Langdell, dean of the Harvard Law School, is credited with introducing the case method in the early 1870s [4]. By the mid-1920s, the method was firmly entrenched in the Harvard Business School as well [5].

Currently, instructors in most academic disciplines use cases as an active learning technique that bridges the gap between theory and practice, offering a viable pedagogical method that encourages critical thinking and problem-solving skills [6]. In 1991, educator Kenneth Merseth identified a number of benefits that derive from a case-based approach:

- Develop skills of critical analysis and problem solving
- Encourage reflective practice and deliberate action
- Bring reality into the arena of theory
- Involve students in their own learning
- Promote the creation of a community of learners [7]

In current parlance, using cases as a primary pedagogical technique is an element of “flipping” the classroom, empowering students to be active participants in their own learning [8]. With its emphasis on activity, as opposed to passive listening, the technique mirrors the National Training Institute’s “learning pyramid,” which posits that retention increases as the learner’s activity increases. Whereas learners remember only about 5% of information presented in a typical lecture, retention increases to 50% for engaging in discussion groups, 75% for “practice by doing,” and 90% for teaching others [9]. Although controversial [10], the learning pyramid reflects those features of the case method that make it such an effective approach: teamwork, reflection, critical thinking and analysis, sharing results with others.

Cases also involve inductive reasoning and an attention to the particular, and, as Cruz and Frey explain, represent “the natural direction of learning” [11]. Rather than starting with abstract concepts, a case approach allows students to grapple with issues in a specific scenario and from that discover the larger principles or theories that are applicable to other similar circumstances.

The case method is not without its critics; however, most of the criticisms relate to fields other than engineering and technology. Ronald Yeaple of *Forbes* magazine, for example, suggests that lectures are a more “efficient way to present the fundamentals” in marketing classes [12], while Shugan notes that cases are inadequate for teaching quantitative skills required for business fields, such as accounting [13]. The Case Centre suggests that a case-based pedagogy involves too much preparation for the instructor, involving a significant investment of time to “read and understand the case, devise a teaching strategy, decide on critical questions and plan time management and other classroom issues" [14]. One might note, however, that time devoted to most of these items is characteristic of teaching any course.

Overall, the bulk of the literature examining a case-based approach agrees with the final assessment of University of Virginia engineering professors Richards and Gorman, who note that "Cases allow us to introduce problems and questions we could not otherwise consider, and they lead students to higher levels of cognitive functioning" [15].

Cases

Cases came in all varieties: hypothetical or reality-based, high profile or low, global or local. Real cases are preferable to confected textbook scenarios, which usually have an obvious and relatively simplistic "right" answer. Real ethics is messy and involves an element of ambiguity, with multiple possibilities for a "right" answer. It is important, note trainers Hill et al., that "the case be reasonably realistic and complex, and also stimulate intelligent discussion . . . in such a way that students will be better prepared for dealing with real world problems" [16]. In fact, the shift in ethics instruction in the 1990s from abstraction to practical cases resulted from the emergence of specific fields, such as bioethics, research ethics, and engineering ethics. According to Caroline Whitbeck, the context of an ethics problem became dominant, along with "the complex ethical presuppositions and commitments implicit in the practices of communities and social groups" [17].

Choosing appropriate cases depends on a number of variables: time available for ethics activities and discussion, instructor knowledge and interest, class content, course objectives.

Instructors pressed for time may choose to incorporate small cases, those with a low media profile that have limited information. Local cases can be very useful. For example, several years ago, our community was presented with a proposal, since withdrawn, to establish a hog farm—starting with 11,000 animals—on the outskirts of the city. Students in an environmental class examined the issues involved, including waste disposal and water rights; they investigated conditions in other states, especially Iowa, and concluded that the proposal was infeasible. For this particular class, this case was extremely helpful in helping students understand the potential effects of an engineering-related decision, which is a major class objective.

Small cases may also be more reflective of our students' career paths; they will probably face ethical challenges of the more mundane, garden variety. Engineering ethicist Michael Pritchard explains that emphasizing the role of engineers in "big" cases may actually be misleading: "While important and instructive, these cases focus on extraordinary rather than ordinary situations facing engineers. Exclusive concentration on such cases may give students a distorted picture of ethical concerns in engineering practice," as students may assume that engineering ethics simply consists of avoiding such situations [18]. In reality, most of our students will face challenges of lesser significance than whether or not to blow the whistle on corporate wrongdoing.

Big cases, however, can effectively support ABET Criterion 3h, which indicates that students display an understanding of "the impact of engineering solutions in a global, economic, environmental, and societal context" [1], while underscoring course goals. In a structural engineering class, for example, examining building collapses is a dramatic way to explore corporate social responsibility, both domestic and global.

The 1981 Hyatt Regency Walkways Collapse in Kansas City offers a disturbing example of engineering negligence and emphasizes the need for professional engineers to accept responsibility for their decisions—or lack of decisions. After the structural failure that killed 114 people and injured another 200, Jack Gillum (engineer of record) and Daniel Duncan (lead engineer) were adjudged by an ASCE panel to be "vicariously responsible" [19], stripped of their engineering licenses in the state of Missouri, and suspended from membership in the ASCE for three years [20]. They also became the subject of many engineering classroom discussions on responsibility.

In a global context, the 1995 collapse of Seoul's Sampoong Superstore provides a stunning instance of engineering negligence, coupled with faulty business decisions, that resulted in 500 killed and hundreds more injured, despite a closure recommendation from an investigative engineering team and clear signals, such as cracking and shivering, from the building itself [21]. The case effectively illustrates the negative interplay between business and engineering: initially conceived as a four-story office complex, owner Lee Joon changed his mind after the footings were poured, adding a fifth floor and converting the structure into an enormous shopping complex, with eight traditional Korean restaurants occupying the new fifth floor. The heavy heating slabs required for this style of dining, in addition to three 15-ton air conditioning units placed on the roof, increased the dead load by 35%, and a number of other modifications affected the building's stability [22, 23]. Although it somehow remained erect for nearly five years, on the evening of June 29, 1995, the building pancaked in 20 seconds, trapping nearly 1,500 shoppers and employees beneath hundreds of tons of concrete [22]. Post-disaster hearings found Lee and his son, who ran the construction company, guilty of gross negligence and bribery; both were sentenced to jail, along with 25 other public officials that the duo had bribed [24].

While high-profile cases consume more class time than smaller cases, they are effective in illustrating the larger impacts of engineering decisions: the Hyatt disaster affected nearly half of the residents of Kansas City [23], while the Sampoong collapse affected thousands [21]. For students who are just learning about ethics, these types of cases leave an indelible impression, one that they will hopefully carry into their professional lives.

Activities

Seamlessly integrating ethics discussion and activities is essential. While it may be convenient to make Friday the "ethics day," for example, this is tantamount to divorcing ethics from the course content. Not only does this approach defeat the purpose of integration, it also downplays the importance of ethics to engineering. As Michael Davis has noted, ethics is not an add-on but integral to the profession: "Knowing engineering ethics is as much a part of knowing how to engineer as knowing how to calculate stress or design a circuit . . . insofar as engineering is a profession, knowing how to calculate stress or design a circuit is in part knowing what the profession allows, forbids, or requires" [25].

Offering a structure for analysis is very helpful, especially if students have limited backgrounds in ethical analysis. Figure 1, from Illinois Institute of Technology, is a tried and true approach that includes elements of engineering problem solving, providing familiar ground for students:

1. **State problem** ("There's something about this decision that makes me uncomfortable"; "Do I have a conflict of interest?")

2. **Check facts** (many problems disappear upon closer examination of the situation, while others may change drastically)

3. **Identify relevant factors** (persons involved, laws, professional codes, other practical constraints)

4. **Develop list of options** (be imaginative; try to avoid "yes/no" dilemma; focus on who to go to, what to say)

5. **Test options**, using the following:
   - ***Harm:*** Does this option do less harm than any alternative?
   - ***Publicity:*** Would I want my choice of this option published in the newspaper?
   - ***Defensibility:*** Could I defend my choice of this option before a Congressional committee or committee of my peers?
   - ***Reversibility:*** Would I still think the choice of this option good if I were one of those adversely affected by it?
   - ***Colleague:*** What do my colleagues say when I describe my problem and suggest this option as my solution?
   - ***Professional:*** What might my profession's governing body or ethics committee say about this option?
   - ***Organization:*** What does the company's ethics officer or legal counsel say about this?

6. **Make a choice** based on steps 1-5.

7. **Review** steps 1-6: What could you do to make it less likely that you would have to make such a decision again?
   - ***Precautions*** you can take as an individual (change job, etc.)?
   - A way to have ***more support*** next time?
   - A way to ***change the organization*** (suggest policy change at next departmental meeting?

Figure 1. IIT ethical decision-making guide [26]

Developing a variety of activities is important, both to maintain student interest and to illustrate a number of different aspects to case analysis. Discussion is a primary technique, especially small group discussions that involve a large group report-out. Discussions tend to be very dynamic and offer a participation outlet to students who are reluctant to speak in the larger class setting, as well as being a way to deal with a larger number of case-related issues. But even discussion can grow tedious when it is the only method employed. To add variety, instructors can consult websites that offer advice on teaching ethics; for example, Computingcases.org offers a number of suggestions for enlivening class discussions:

- Write a social impact statement based on the case and use that as a basis for discussion
- Write a corrective action plan for a specific case, such as Therac-25 [Therac is an x-ray machine; in the 25 model, software coding errors resulted in massive overdoses, burning holes in a number of patients and killing three]
- Have students role-play [this technique has the added advantage of introducing the moral imagination, the ability to examine a situation from multiple perspectives]
- Have students write a script dramatizing the case problem
- Rewrite computer science textbook exercises to add an ethical dimension [27]

In addition to discussions, guest speakers can offer dramatic examples of the role of ethics in the professions. At my school, we were fortunate to have Roger Boisjoly, one of the Challenger disaster's whistle-blowers, as a speaker. Since he was familiar with my case approach, early in his presentation he declared, "I am a case." Students in my classes were stunned by his experiences, and in a debriefing during the next class period, many indicated dramatic perceptual changes because of Boisjoly's presentation: they were awestruck by the personal courage of whistleblowers, dismayed by the retaliatory actions of employers, and buoyed by the story of someone who truly made a difference. As Sean, a technical writing student, wrote, "I listened to a talk on ethics from a man I never heard of and will never forget."

Other possibilities for guest speakers include ethics/compliance officers from local businesses, alumni who have faced ethical challenges in the workplace, and faculty colleagues who have experienced ethical situations. Universities with the financial means can consult a number of speakers' bureaus for possibilities.

Using videos is another possibility that is particularly effective for visual learners. The National Academy of Engineering and Texas Tech University offer short videos that focus on engineering scenarios (see the resources section below for details). Feature films, which students view outside of class, can also offer insight on ethics cases and issues. In one of my classes, for example, students watch *A Civil Action*, a popular film that details the ethical journey of attorney Jan Schlichtmann as he engages in a water contamination case in Woburn, Massachusetts. Illegal dumping by Beatrice, UniFirst, and W.R. Grace resulted in 28 leukemia cases, a figure four times higher than average; six died, including several children [28]. It is a dramatic example of moral development, as Schlichtmann progresses from a rapacious personal injury lawyer, interested solely in money, to a caring individual who discovers the value of human suffering. Metaphorically, he morphs from moral bankruptcy and financial wealth to financial bankruptcy and moral wealth, as his initial greed is supplanted by compassion for others. The film can also be used as a vehicle for discussing engineering science issues and offers the possibility of introducing a mock trial similar to that developed by Carleton College professor Scott Bair: "students exercise their analytical skills by learning sufficient geology, hydrology, and aqueous chemistry to write an expert opinion and defend it during deposition by opposing counsel" [29]. Such an exercise gives students a taste of the expert witnessing that they may experience professionally.

Writing exercises are another effective way to integrate ethics into technical classes. Possibilities include the following:

- Personal narratives: Asking students to write a narrative of some personal incident that involves ethics offers an opportunity for them to engage in self-reflection, a prerequisite for ethical analysis; essentially, they are writing a case.
- Interview a professional: Have students interview a professional in their given field, avoiding potential conflicts of interest (relatives, friends). This will give them a sense of the role of ethics in the workplace.
- Professional codes: Develop exercises focusing on professional codes of ethics. These can derive from local or academic cases; Aarne Vesilind's *Hold Paramount* has a number of very useful scenarios [30].

The items above are just a few examples of the many possibilities for classroom activities that can enhance student understanding of engineering ethics. Creative instructors can devise many different activities to emphasize the symbiotic relationship of engineering and ethics.

Resources

Instructors integrating ethics need to engage in self-development to acquaint themselves with the field, both methodology and content. While having a philosophy degree is not a prerequisite for teaching ethics, knowledge of the field certainly is. The Web-based resources listed below include cases as well as teaching materials, case commentaries, annotated bibliographies, publications, and digital materials. Note that these are limited examples; literally thousands of Internet sites offer advice and materials for teaching ethics in the context of technical classes.

The Case Study Collection at Illinois Institute of Technology (http://ethics.iit.edu/eelibrary/case-study-collection) offers cases in research and engineering ethics, in addition to an assortment of links to other case-based sites. The Center for the Study of Ethics in the Professions also maintains an extensive collection of codes of ethics, as well as informative publications on codes in general and application of codes to specific cases. If instructors require students to locate their code of ethics, the CSEP site has codes of conduct, engineering creeds, and statements of ethical principles from all of the major engineering organizations.

The Ethics Center at Texas A&M University (http://ethics.tamu.edu/) includes quantitatively based cases, developed as a result of a 1995 NSF grant, in chemical, civil, electrical, and mechanical engineering. In addition, the site also houses 33 different cases developed in 1992; cases are accompanied by commentaries by individuals who have published widely in the field of engineering ethics. Although a number of these are hypothetical, they correlate to real-life situations experienced by practicing engineers.

The Markkula Center at Santa Clara University (http://www.scu.edu/ethics/practicing/ focusareas/cases.cfm) has enormous resources for teaching ethics in some 12 different fields; in engineering, its collection includes significant materials on the Internet, technology, and environmental ethics. In addition to printed materials, the site includes video interviews with leaders in various areas (for example, Silicon Valley pioneers) and downloadable podcasts. The "ethical decision making" section has excellent information on various approaches—utilitarian, rights, fairness, common good, and virtue—as well as a very useful guide to making ethical decisions, "A Framework for Thinking Ethically." For instructors who are new to the field, this is a very helpful first source.

Murdough Center for Engineering Professionalism/National Institute of Engineering Ethics (http://www.niee.org/murdoughCenter/index.php). Housed at Texas Tech University, these two centers collectively offer a wealth of materials on ethics across the curriculum, as well as study guides to the three NIEE-sponsored ethics videos: *Gilbane Gold*, *Incident at Morales*, and *Henry's Daughters*. In addition, the NIEE has produced a useful casebook, *Engineering Ethics—Concepts, Viewpoints, Cases, and Codes* (2008). The centers also offer various professional development courses and workshops in teaching ethics and ethics across the curriculum.

National Society of Professional Engineers, Board of Ethical Review (http://www.nspe.org/ resources/ethics/ethics-resources/board-of-ethical-review-cases) includes real, but sanitized, cases that deal with issues engineers encounter in their professional lives, such as conflicts of interest, gift-giving/bribery, confidentiality, expert witnessing, and public health and safety, to name but a few. Cases incorporate all of the pertinent data, the BER's decisions and rationales, and citations of code violations. In addition, the "Ethics Resources" section of this site includes a number of materials useful for class, such as a true-false exam based on the NSPE Code of Ethics and various short videos focusing on issues in professional engineering. The NSPE also sponsors an annual essay contest for students and PEs throughout the country; the winner receives $1,000, a certificate, and recognition in *PE Magazine*.

Online Ethics Center for Engineering and Science (http://www.onlineethics.org/) is an immense repository of information managed by the National Academy of Engineering's Center for Engineering, Ethics, and Society. The site includes 495 cases, as well as case commentaries, scholarly articles, bibliographies, teaching resources, and ethics codes. Like the NSPE site, most cases are reality-based (those that are not are clearly labeled "hypothetical"), and many deal with larger societal concerns and responsibilities, such as the issues emanating from the aftermath of Hurricane Katrina, bioterrorism, and risk assessment.

Especially useful are the historical cases, including the Tuskegee Syphilis Study, Love Canal, and the Tacoma Narrows Bridge Collapse, among others.

Discipline-specific cases are available on the websites of professional organizations or via local engineering examining board sites. In Oregon, for example, the newsletter of the Oregon State Board of Examiners for Engineering and Land Surveying includes a section on "Investigation and Enforcement," which lists all infractions and sanctions for a specified period of time [31].

And, finally, the *Association for Practical and Professional Ethics*, an interdisciplinary group that focuses on applied ethics, has, for many years, sponsored an annual student competition, the Ethics Bowl. Modeled after the old *College Bowl* television program, teams of students representing schools from across the United States debate a variety of cases, ranging from water rights to sexual ambiguity to environmental issues to consumer safety. While many of the cases do not deal specifically with engineering, they are useful for introducing students to ethical thinking and modes of analysis. Cases for the past 14 years are archived at Illinois Institute of Technology (http://ethics.iit.edu/teaching/ethics-case-archive).

Conclusions

Ethics is a natural for integration into technical classes, and using a case-based method is very effective for engaging students in a discussion of issues in the various engineering disciplines. As the literature indicates, cases are innately appealing due to their narrative structure and provide fertile ground for exploration. The emotional aspect of cases, especially those involving whistle-blowing, augments student interest and facilitates "knowledge acquisition" [32].

Numerous resources for teaching ethics are readily available, and creative instructors can devise novel classroom activities that ensure the ethics material is relevant to course goals and objectives while simultaneously linking it to professional life. Introducing ethics can result in classroom discussions that are vibrant, energetic, and meaningful.

Most importantly, integrating ethics in technical classes acquaints students with issues in professional engineering and reinforces Michael Davis' observation that ethics is part of the discipline, that thinking like an engineer is thinking ethically about decision making, responsibility, and the impact of those decisions. As Sharon Beder states, "If engineers are to be more than technical functionaries in the next millennium, there is a need to provide young engineers with an understanding of the social context within which they will work, together with skills in critical analysis and ethical judgment and an ability to assess the long-term consequences of their work" [33].

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Biography

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