Four Reasons for Including an Ethics Component in Engineering Classes

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ABET Criterion 3 requires that engineering programs pay some attention to ethics and professionalism. For already jam-packed curricula, however, simply adding a required ethics course might not be feasible.

This paper examines several reasons encouraging instructors to consider an ethics across the curriculum approach in lieu of a stand-alone course. These include acquainting students with professional expectations, fostering an awareness of ethics in the workplace, making students aware of ethical issues in the professions, and providing students with decision-making processes for ethical situations.

Background

Ethics across the curriculum (EAC), similar to the writing across the curriculum movement of two decades ago, attempts to place ethics squarely in the context of a given course. The rationale is that students do not necessarily transfer information from an ethics course into their technical classes. By offering ethics via a technical course, students can more clearly understand the relevance of ethics to their major. While the amount of time spent on ethics in any course will vary according to course goals and objectives, it should be closely tied to core course material and, ideally, be integrated seamlessly.

A number of colleges and universities across the nation have well-developed, formal EAC programs, for example, Dartmouth College, Fairfield University, Rochester Institute of Technology, Towson University, University of Nevada at Las Vegas, Western Illinois University, Western Michigan University, and Youngstown State University. [1] Others, such as my institution, Oregon Institute of Technology, have taken a more informal approach: for five years, I offered a series of seminars designed to prepare faculty to incorporate ethics into their technical classes. Most of the 60 faculty who completed the eight-week series have gone on to include ethics cases and issues in their regular classes.

Integrating ethics into technical classes, notes Michael Davis of Illinois Institute of Technology's Center for the Study of Ethics in the Professions, does not require different pedagogical techniques: "The mechanism is much the same as for teaching students to see technical problems. Knowledge and practice sharpen perception, making it easier both to see a particular decision in context and to imagine what the context might contribute." [2] While the content may require research and preparation, engineering faculty are certainly capable of teaching ethics in addition to technical content.

It is important to note that the reason for integrating ethics is *not* to make students more ethical, although that certainly is a pleasant consequence. It is preparation for their professional lives. As Davis states, "Knowing engineering ethics is as much a part of knowing how to engineer as knowing how to calculate stress or design a circuit is. Indeed, 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." [2]

Acquainting Students with Professional Expectations

Students need to know, prior to employment, what ethical obligations and responsibilities they will have in the workplace. One easy method for accomplishing this is to have students locate their professional code and perform a short content analysis, commenting on currency, comprehensiveness, and their reaction. This is the first assignment in my professional ethics class, and, typically, about 25% have never seen their professional code; some, indeed, are unaware that such documents exist. These students tend to view ethics as something esoteric and secret, to be somehow absorbed once they are on the job.

When students read their codes, they discover the boundaries of professional behavior. Engineering codes, for example, derive from a common source and note that engineers perform "a service to society," and "hold paramount the safety, health, and welfare of the public." [3] Codes broadly explain acceptable and unacceptable behavior, although they are not necessarily detailed, and addressing codes in a technical course, rather than an ethics course, underscores the importance of understanding workplace behavior.

Another way to acquaint students with professional expectations is to invite guest speakers to class. Every term, I ask colleagues if they would be interested in speaking to my ethics students. Typically, they recount challenging situations they have encountered on the job and even share their bad decisions. Not only does this help students see teachers in a different light, as practitioners as well as educators, it gives them a foretaste of the ethical feast to come.

Still another possibility is to have students interview professionals in the field for their views on ethics in the workplace and generate a memo for class discussion. They could ask questions such as the following: Are they familiar with their professional code? Does the company maintain ethical behavior as described in the code? What ethical situations do they face and how severe are those problems? How do they resolve them? Does the company have a formal outlet, such as an ethics office, to investigate ethical concerns reported by employees?

Fostering an Awareness of Ethics in the Workplace

Given the current press on unethical business practices, many students might be skeptical that workplace ethics exist at all. Certainly corporate leaders such as Ken Lay and Jeff Skilling are not exactly role models for professional behavior. While such unethical behavior may jade students, it

is all the more important to help them understand that ethics plays a major role in the engineering workplace. Indeed, in the wake of engineering and corporate misconduct in the 1980s (Challenger, Bhopal, etc.), many companies have established ethics offices and hotlines, which offer ways for employees to express their concerns, often anonymously.

Examining major cases, such as the Hyatt Regency Walkways Collapse in a structural design class, is a dramatic and interesting way to introduce the consequences of unethical behavior, but it is also helpful to have students conduct a little research on prospective employers. Ideally, they could talk to the ethics compliance officer at a firm that they are considering applying to. If that is not possible, students can visit corporate websites. At the Lockheed Martin site, for example, students can read about Lockheed's corporate ethics program and even e-mail the compliance officer with questions they have as potential employees. [4]

Another approach could dovetail the professional codes assignment: Have students examine corporate codes and core values statements in firms that they might apply to. Ask them to compare the business code with their professional code for consistency: Are there areas where the two are incompatible? Which code should an employee follow? Where does loyalty lie? As an in-class follow-up, students could discuss, for example, Enron's 64-page guidelines on ethics, required reading for all employees, which include statements such as the following: "Compliance with the law and ethical standards are conditions of employment, and violations will result in disciplinary action, which may include termination. New employees are asked to sign a statement, and employees are periodically asked to reaffirm their commitment to these principles."[5] Given the outrageous behavior of Enron management, they apparently did not even read their own ethics statements.

Making Students Aware of Ethical Issues in the Professions

Professionally, our engineering students will be part of and answerable to a larger community. Thus, they need to understand the issues in their particular discipline that will affect the broad spectrum of society. While a stand-alone ethics course can certainly achieve this goal, including such issues in a technical class might make a much greater impact on students.

To accomplish this, faculty can take a number of routes: they can examine short cases in class which illustrate ethical issues, they can utilize guest speakers who have been involved in ethical conflict, or they could use a short supplementary text, such as Gunn and Vesilind's recent *Hold Paramount*,[6] a very student-oriented text which includes a number of thought-provoking examples and cases that would be easy to implement in class.

Using short cases is a good methodology to stimulate class discussion. To underscore the importance of maintaining confidentiality, for example, I use this case in software engineering, from Martin and Schinzinger's *Ethics in Engineering*, adapted from a real situation:

> An engineer working as a computer programmer played a minor role in developing a computer system for a state department of health. The system stored medical information on individuals identified by name.
>
> Through no fault of the engineer, few controls had been placed on the system to limit easy access to it by unauthorized people. Upon learning of this the engineer first informed his supervisor and then higher management, all of whom refused to do anything about the situation because of the anticipated expense required to correct it.
>
> In violation of the rules for using the system, the programmer easily obtained a copy of his own medical records. He then sent them to a state legislator as evidence for his claims that the right of citizens to confidentiality regarding such information was threatened by the system. [7]

In small groups, students read the case and then answer these questions: Does the engineer's action constitute a breach of confidentiality? Is his behavior proper? What, if any, action against the engineer would be appropriate? Typically, students respond in favor of the engineer: it is not a breach of confidentiality, they suggest, because he has accessed only *his* records, and he should be commended for his efforts. In reality, however, this engineer was terminated. It doesn't make any difference whose records he accessed; his action violated confidentiality. As a whole, the class then generates alternative courses of action that the engineer might have taken.

Cases such as this allow students to exercise their problem solving and moral reasoning skills, as well as becoming acquainted with a very real situation. Discussion can also include issues of privacy, rights, and duties.

Providing Students with Decision-Making Processes for Ethical Situations

Awareness is only one piece of the puzzle. Workplace situations require solutions as well. Giving students a strategy for defining, analyzing, and resolving ethical conflict is essential. A process such as that below will help students understand that ethical decision-making requires deliberation and thought.

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

2. *Check facts* (many problems disappear upon closer examination of situation, while other change radically)

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

4. *Develop list of options* (be imaginative, try to avoid "dilemma"--not "yes " or "no" but who to go to, what to say)

5. *Test options*, using such tests as the following:

Harm: Does this option do less harm than alternatives?

Publicity: Would I want my choice of this option published in the newspaper?

Defensibility: Could I defend this choice of option before a Congressional committee or a committee of peers?

Reversibility: Would I still think choice of this option good if I were 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?

Any precautions can you take as individual (announce your policy on question, change job, etc.)?

Any way to have more support next time?

Any way to change organization (e.g., suggest policy change at next departmental meeting)? [2]

For optimal results, use a local situation related to class content and ask students to work through these seven steps. For example, a recent issue in my community is a Japanese firm attempting to establish a hog farm a few miles from town. The farm would raise 11,000 hogs for meat to send to Japan, and there is great concern regarding the resulting pollution, not to mention a potentially dramatic drop in adjoining property values. Besides these pragmatic concerns, the quality of life issue is significant for those adjacent to the hog farm. Students in an environmental class could investigate the case particulars, work through the seven-step process, and devise an appropriate solution that would benefit both the company and the local affected farmers.

Conclusions

Integrating ethics into technical classes is a very viable option to meet ABET criteria. Creative instructors can discover dozens of ways to take regular course content and imbue it with ethical dimensions, enriching the engineering experience. Students who learn ethics in this context, rather than stand-alone courses, may better understand the relevance of ethics to their professional lives. As Michael Davis notes, "To understand moral problems we must see them in context. To understand problems of engineering ethics, we must understand the engineering context." [8]

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