Ethics 101

Marilyn A. Dyurud
Oregon Institute of Technology

Introduction

Ethics training, now somewhat formalized as ABET EAC criterion 3f and TAC criterion 2i, is by necessity becoming a more integral part of engineering and technology curricula, whether via stand-alone ethics courses or inclusion in technical courses and programs.

Instructors new to the field, however, may find themselves in a quandary as to course content and methodology; ethics is an enormous and ancient field of study, and tailoring philosophical content to fit a technical class poses a challenge. Pedagogy in philosophy, too, varies a great deal and tends to be more discussion-oriented than in engineering and technology.

This paper gives instructors new to ethics tips on content and pedagogy: what do students need to know about ethics in order to assist them in their careers, and how do instructors impart that information? Specifically, this paper examines definitions, codes of ethics, major issues in engineering ethics, and pedagogical techniques.

While ABET provides a pragmatic reason for including ethics in engineering and technical curricula, Michael Davis, who has widely published on the topic of applied ethics and is senior researcher at the Center for the Study of the Ethics in the Professions at Illinois Institute of Technology, suggests more compelling reasons:

- increased ethical sensitivity
- increased knowledge of relevant standards of conduct
- improved ethical judgment
- improved ethical will power

In short, the goal of including an ethics component in engineering and technology education is more than simply addressing ABET criteria: it is to make students aware of the pervasiveness of ethics in their chosen profession and expectations regarding their conduct as representatives of that profession.

Before embarking on ethics instructions, instructors themselves should develop a modicum of expertise in the field. Reading is, of course, essential, but instructors should also consider enrolling in an ethics workshop, such as the NSF-sponsored summer ethics across the curriculum seminars at Illinois Institute of Technology or the summer ethics program at the University of Montana’s Practical Ethics Center.
Definitions

Philosophers depend upon definition for both substance and common ground. To make ethics-oriented discussion more fruitful and relevant to students’ education and future careers, beginning a course ethics component with an examination of terminology is essential, for it provides the foundation for subsequent discussions. In my professional ethics course, for example, we start first by defining “ethics” and then by examining the term “professional”; both of these terms are used rather carelessly in our culture but have distinct meanings in philosophy. Most students are unaware that ethics is performance-based, that is, ethics is something that we do, not just think about. Being a professional, students discover, is more than having a job: it means performing at a level as defined in professional codes of conduct, which involves such duties as scholarly contribution to the field, the pursuit of life-long learning, and exhibiting a passion for the particular field of study. Indeed, students learn that being a member of a profession is a “calling,” not just a way to put food on the table.

Once armed with this knowledge, we proceed to defining two key approaches to ethical situations: deontology and teleology (also called consequentialism). A statement such as “the ends justify the means” is a teleological statement, focusing on desired outcome rather than the method used to attain that outcome, whereas a deontological approach will examine means rather than ends. The distinction is critical, for it determines decision-making, and may be illustrated by a brief glance at the Challenger space shuttle disaster, which occurred on January 28, 1986. The loss of seven astronauts and $1.2 billion of equipment was primarily attributed, according to the investigatory commission, to the effect of cold temperatures on the solid rocket booster field joints: the o-rings, which were critical for sealing the joints, failed on the right aft joint, allowing hot gasses to ignite the external fuel tank. Challenger provides a classic example of the difference between deontology and teleology: engineers were looking at means (feasibility and safety), and management was primarily concerned with ends (finances and reputation).

Codes of Ethics

Definitions help to provide a context for an examination of professional codes. Typically, about 25% of students in my class, most of whom are graduating seniors, have never read their code, and many are unaware of its existence: some have even stated in class that ethics is intuitive and does not need to be written down; it is a matter of common sense. Ideally, codes should be introduced as early as possible, during freshman orientation, to provide a moral framework for technical courses.

The fundamental principles and canons of all engineering codes are similar, for they derive from a common source, the 1947 Engineers’ Council for Professional Development code, although several areas have formal codes that date back to the mid-
19th and early 20th centuries. It was the 1947 code, however, that introduced language extending beyond the interplay of employer and engineer and involving larger societal concerns; some suggest that comments regarding engineering societal responsibility were included due to professional engineers’ complicity in the Holocaust and other World War II atrocities.

Codes vary in length and specificity, depending on whether or not the organization has added interpretive comments. The ASME code, for example, is “bare bones,” with just the principles and canons. For interpretive comments, members need to consult the Board of Professional Practice & Ethics, which details policies and interpretations. The ASCE, however, has developed a fairly detailed pamphlet, “Standards of Professional Conduct,” which includes interpretive remarks as well as definitions of key terms.

While there is philosophical disagreement involving the need for professional codes, most textbook authors agree that codes help to provide a moral compass. Charles Fledderman, for example, states that codes provide “a framework for ethical judgment,” Harris, Pritchard, and Rabins suggest that codes actually constitute agreements with the public that “articulate shared standards of professional ethics.”

Regardless of the philosophical schism, code work can help students understand the necessity of common norms for behavior. A useful class exercise is to take a short case and have students examine it for code violations. Reliable sources for these types of cases include the National Society of Professional Engineers’ Board of Ethical Review and state engineering examining boards. OSBEELS, the Oregon state examining board, regularly publishes ethics cases in its newsletter. These cases have the virtue of including discussion sections that pinpoint specific sections of the code that have been violated.

Major Issues

Issues in engineering ethics are of two types: micro, those involving individual engineers, and macro, those involving the profession itself. An examination of both types is necessary for they are intertwined: individual engineering decisions may affect the reputation of the profession and have far-reaching consequences.

Micro issues include such items as autonomy, truth-telling, loyalty and duty, integrity, responsibility, accountability, and whistleblowing. Examining micro issues and individual engineers allows students to see the gamut of professional behavior.

William LeMessurier offers students a glimpse of how “doing the right thing” by reporting a potentially disastrous design oversight results in the problem being repaired. LeMessurier was the structural engineer for the Citicorp Tower, which was universally hailed for its innovative design. An inquiry from a student led LeMessurier to ponder the effects of diagonal winds on the structure, which were previously unexamined due to New York City’s building code. To his horror, LeMessurier discovered that the steel wind braces had been bolted, not welded as called for in the original design, and...
calculated that hurricane-strength winds would cause the structure to fail, sending 35 stories of concrete and steel cascading down on city streets. LeMessurier considered several courses of action, including suicide, and decided to contact Citicorp. The bolts were replaced with welds, and LeMessurier’s liability insurance rates actually decreased as a result.\textsuperscript{18}

Examining the engineers involved in the Kansas City Hyatt Regency walkways structural failure, Jack Gillum and Daniel Duncan, aptly illustrates the catastrophic effects of rubber-stamping changes. A design change, which would suspend the walkways extending across the Hyatt’s atrium space from the ceiling, rather than from each other, was initiated by the contractor as a cost-cutting procedure. The G.C.E. International engineering firm approved the change with virtually no examination, and, as a result, 114 people were crushed under tons of concrete when the walkways failed.\textsuperscript{21}

The micro issue that most interests my students is whistleblowing, specifically the case of Roger Boisjoly and the Challenge space shuttle disaster. Students learn that while whistleblowing is generally a good and even noble action, it has major consequences on the professional and personal life of the bearer of bad tidings. Studying whistleblowing also encourages students to look at larger issues, such as the values of a society that punishes those who act ethically.

Macro issues, those involving the status of the engineering profession, include such items as product liability, public safety, social contract considerations, and sustainable development. They are also a fruitful area for examination and discussion, as they often have ripple effects, described as unintended consequences. For example, the introduction of computers has changed our lifestyle, but the average life of a PC is only about two years. The US annually discards about 30 million computers, with a meager 14\% being recycled.\textsuperscript{23} Consequently, e-trash has become a major problem: what happens to old computers? Currently, many end up in third world nations, primarily Mexico and China, where villagers are paid a daily pittance to root through the wreckage for traces of precious elements. However, computer components also include toxic substances, such as lead in the cathode ray tube, which are contaminating ground water in countries receiving the waste and are wreaking a toll on human health.\textsuperscript{19}

On a more inspirational note, instructors can introduce Engineers without Borders (EWB), an international philanthropic group that travels to economically disadvantaged areas and uses basic technology to solve typical problems, such as designing a simple pumping system to bring water from a river to a village in Mali or providing electricity to a rural school in Haiti or working on Native American reservations in South Dakota and Colorado. Bernard Amadei, professor of earth systems engineering at the University of Colorado at Boulder and founder of the US arm of EWB, is adamant about the responsibility of engineering to improve the lot of the world’s destitute: “Improving the lives of the 5 billion people whose main concern is to stay alive at the end of each day on our planet is no longer an option for engineers: it is an obligation.”\textsuperscript{1}
Pedagogical Techniques

In addition to self-education, instructors including an ethics component in technical classes need to reconsider teaching methodology. Ethics education is perfect for active learning, by enfranchising students in class discussions and case research. For the instructor accustomed to the lecture-test technique, however, this means giving up a degree of control over the classroom and allowing students to take the lead.

Having taught ethics classes for over a decade and integrated ethics into my communications classes for even longer, I have learned some valuable lessons. The main one is that ethics need to be discussed. While lecture is certainly a possibility, this style has a distancing effect since students are not actively engaged. To make ethics relevant, vigorous discussion and moral deliberation is desirable; students quickly discover that they can apply their engineering problem-solving skills to ethical situations, for the process is similar.

Generating discussion about ethics is a relatively easy matter, since students tend to display great interest in the field. Using small groups is, I have discovered, usually more fruitful than whole class discussions and has the effect of enfranchising everyone. Students who may be reluctant to comment in front of the entire class usually contribute in smaller groups, and the more intellectually involved students are, the more they tend to retain the material.

Cases illustrating micro and/or macro issues tend to engage students immediately. Cases are very versatile teaching platforms and are readily available from Internet engineering ethics sites or in engineering ethics textbooks and vary in complexity. Cases have the added appeal of being narratives, which we, as story-telling creatures, find naturally attractive. For the best results, use real cases rather than hypotheticals. Confected cases can oversimplify and have virtually no consequences, whereas real ethical situations tend to be rather messy and may have complex ramifications. It is also helpful to introduce, preferably early in the course, an ethical decision-making path.

Videos can also be helpful in generating classroom discussion. The NSPE’s Gilbane Gold or the recent Incident at Morales, produced by the National Institute for Engineering Ethics, are both realistic portrayals of engineering ethics problems that students can relate to. I have found success in using popular films for discussion of specific topics. For example, a discussion of Kohlberg’s hierarchy of cognitive moral development makes more sense to students when presented in the context of Groundhog Day or A Civil Action, rather than as abstract moral theory. Popular films also have the virtue of student recognition, since most of my students are avid movie-goers.

Conclusions

Our engineering and technology students are charged with the task of creating a better world for the planet’s population. This is an onerous responsibility, one that is fraught
with ethical implications. We can best serve our students by making them aware of ethical obligations and situations that they will undoubtedly face in their careers.

While most of them will not be involved with situations of such magnitude as Challenger, they will face, on a daily basis, ethical decisions in the workplace, ranging from minor infractions to potentially harmful actions. They need to develop moral problem-solving skills as well as a firm grounding in the engineering method, for the relationship of ethics and engineering is symbiotic. As Samuel Florman has suggested, “The conscientious, effective engineer is a virtuous engineer.”

References


**Biographical Information**

Marilyn A. Dyrud is a full professor in the Communications Department at Oregon Institute of Technology and has been active in ASEE for over 20 years. She has compiled the annual “Engineering Technology Education Bibliography” for 18 years, has been her campus rep for 15 years, and was recently elected as chair of the Pacific Northwest Section. She has given over 100 conference presentations and workshops and has published more than 80 papers in refereed journals and proceedings. In addition to ASEE, she is also active in the Association for Business Communication and the Association for Practical and Professional Ethics.