Ethics Education for the Third Millennium

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Abstract

A variety of technological disasters in the 1980s, including *Challenge*r, Bhopal, and Chernobyl, has prompted a renewed interest in teaching engineering ethics at the college level. This paper offers a discussion of need, subject matter, methodology, and resources to enable technical instructors to integrate ethical issues into their courses without sacrificing technical content.

Introduction

Higher education in America, notes Steven McNeel, "was originally a whole-person education with emphases. . .[on] four components of morality: moral sensitivity, moral judgment, moral motivation, and moral character."[6] But as knowledge became specialized and fragmented, due to technological development, the practice of teaching morality as the primary focus of education waned.

The destruction of the space shuttle *Challenger* in 1986, however, spawned a renewed interest in ethics education, particularly among the technical professions. Although other technological disasters, such as Bhopal, resulted in much higher loss of life, the large amount of publicity focused on *Challenger* brought to the forefront of public awareness a number of ethical issues previously unexplored in open forums: decision-making processes, management/technical staff confrontations, communication between organizational levels and between organizations, and basic engineering design. This paper explores ethics education for technical students, including need, appropriate subject matter, methodology, and resources.

Need

Competency in technical matters is, of course, essential for our engineering and technology graduates. Of increasing importance, however, are the "soft" skills, which include areas such as communications, interpersonal relations, and the social sciences. Indeed, some maintain that a firm grounding in these skills is as important in the workplace as technical facility. Former ASEE President Eleanor Baum, for example, has noted, "The area in which industry would like to see improvement is in the so-called soft skills. . .communication skills, team work, economic understanding, societal context, and global awareness." The "ultimate benefit," she explains, will be "engineers who will better satisfy the needs of the workplace and whose best humanitarian instincts will prevail."[1]

Boeing corporate manager of college and university relations, Al Hametner, similarly stated the need for more soft skill education at the 1997 ASEE Pacific Northwest Section meeting: industry is redefining what it means to be an engineer, and in addition to technical skills, engineers need to have a "basic understanding of the context in which engineering is practiced," be a "good communicator," and maintain "high ethical standards."[4]

While communications has long been recognized as an essential skill in engineering-related professions, a current movement is also occurring in the field of applied ethics and for a very important reason: engineering does not exist in a vacuum. Engineers make items which people use, and this social context results in an extra measure of responsibility for the engineer, to design and produce items which will not harm the users. Such responsibility places engineering squarely into the field of professional ethics, as Stephen Unger explains: "Those who are developing and applying technology must take responsibility for the consequences of their work and play an active role in directing it towards humane ends."[11]

Subject Matter

Professional ethics is a huge area for study, and instructors must make decisions about what comprises appropriate content matter within the realm of a technical course. The following is offered as a starting point and is appropriate for lower division courses.

Definition

It's difficult to discuss professional ethics without having a common definition to keep class discussions on track and to distinguish between personal and professional ethics. Brainstorming definitions is a useful in-class exercise, or an instructor may simply pluck one from a myriad versions.

I tell my students to think of professional ethics as "codified behavior," that is, acceptable practices and behavior within a clearly defined context. For more extensive definitions, instructors can consult engineering ethics texts. Martin and Schinzinger, for example, offer a twofold definition: "the study of moral issues and decisions confronting individuals and organizations engaged in engineering and. . .the study of related questions about the moral ideals, character, policies, and relationships of people and corporations involved in technology activity."[7]

Moral Development

We all change as we age. As our knowledge base grows, so too does our ability to analyze and synthesize; genuine insights occur as we gather information. But in addition to maturing intellectually, we also grow morally, and it's helpful for students to realize that they will become different people, ethically speaking, as they progress in their professions.

Instructors might find it useful to acquaint their students with the stages of cognitive moral development, as detailed by Lawrence Kohlberg or, later, Carol Gilligan.[10] As we progress through stages, our perceptions of what constitutes an ethical situation and how to cope with it change. The decisions we make in response to situations when we are 18 are quite different than those made in middle age.

Instructors with a luxury of time and an eye for pre- and post-research data might want to administer the University of Minnesota's "Defining Issues Test" (DIT), which quantitatively examines moral development.[3] Students will then know how their moral perceptions compare to a large database.

Professional Codes

Students at the beginning stages of ethical inquiry should also understand that professional ethics is not something mysterious and esoteric, to be absorbed by osmosis on the job. At the very least, every student should have a copy of the professional code relating to his/her discipline. These are readily available from professional organizations, engineering ethics texts, on the World Wide Web, or from the Center for the Study of Ethics in the Professions at Illinois Institute of Technology.

After introducing the code, it's also important to discuss it in class. Make sure that students actually understand what "hold paramount the safety, health and welfare of the public" *means*. Some comments on corporate culture are also useful, to emphasize possible consequences of a clash between professional ethics and corporate values. The *Challenger* disaster serves as an excellent example.

Common Issues

Some understanding of ethical issues in engineering is also desirable. Common issues include the following:

- Conflict of interest
- Corporate moral and societal responsibility
- Gift-giving/bribes
- Information flow
- Loyalty and duty
- Relations between management and technical staff
- Risk-taking, profit, and public safety
- Trade secrets
- Whistleblowing

These can be introduced in class by using short cases or by soliciting narratives from students who have already had career-related employment. The latter can be especially illuminating.

It's also useful to balance disasters with positive examples, so students understand that engineers make beneficial contributions to society. In regards to whistleblowing, for example, a discussion about what happened to Roger Boisjoly after his Congressional testimony could be counter-balanced by the more uplifting cases of William LeMessurier and the Manhattan CitiCorp Tower,[8] or, for a truly heroic slant, Fred Cuny, a civil engineer who devoted (and sacrificed) his life to disaster relief work.[9]

An M.O.

While understanding of what constitutes professional ethics and an examination of troublesome issues is important, knowledge is useless without a plan for coping with these situations. Michael Davis, of the Center for the Study of Ethics in the Professions at Illinois Institute of Technology, offers the following as a *modus operandi* for dealing with ethical situations:[2]

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* (Include persons involved, laws, professional codes, other practical constraints.)

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

5. *Test options*, using the following:

   - Harm: Does this option do less harm than an alternative?
   - Publicity: Would I want my decision published in the newspaper?
   - Defensibility: Could I defend my decision before a Congressional committee or a committee of my peers?
   - Reversibility: Would I still think this decision 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 as my solution?
   - Professional: What might my profession's governing body or ethics committee say about this choice?
   - Organization: What does the company's ethics officer or legal counsel say about this?

Ethical Theory

Once students understand what constitutes professional ethics, what typical situations they may face, and how to cope with these situations, instructors might want to ground the practical side with a modicum of theory. Most appropriate to engineering ethics are *utilitarianism* and the *categorical imperative*.

While students do not need to memorize the terms, the concepts are important, especially in light of most ethical codes which have as a fundamental canon the protection of the public. Briefly stated, utilitarianism, first explained by Jeremy Bentham, refers to providing “the greatest good to the greatest number”; the good of society supersedes that of self. When deciding between alternative courses of action, an individual needs to consider the wider societal context. The categorical imperative, developed by Immanual Kant, states that any decision regarding an action should be applicable to all similar situations. In other words, moral decisions should be universally applicable to a given set of circumstances.

Generally speaking, lectures on ethical theory are less than satisfying for students. Instead of lecturing, a preferable method is to allow the concepts to arise out of discussion. With the *Challenger*, for example, it would be fruitful to discuss Kant, so students can realize the flawed logic behind the launch decision. In the case of Bhopal, utilitarian principles (or lack thereof) are evident.

Methodology

Faculty who integrate ethics into technical courses need not be philosophers nor intimately familiar with a variety of ethical theories. A modicum of training, however, is desirable, and participants can develop various methodologies during their training.

Training

Oregon Institute of Technology has developed a workable and relatively painless plan for orienting technical instructors in “ethics across the curriculum” (EAC). Similar to writing across the curriculum, EAC attempts to integrate ethics into technical classes without disrupting or displacing technical content.

For the past three years, OIT faculty have had the opportunity to participate in an eight-week series of EAC seminars aimed at increasing awareness of ethical issues in their fields of expertise and exploring techniques for integrating ethics in technical courses. The seminar facilitator is an instructor who has had EAC training through an intensive course at Illinois Institute of Technology and who has become active in an interdisciplinary professional organization which includes both theorists and practitioners.

Faculty are chosen for the seminar based on their interest in the field, their willingness to actively participate, and their openness about sharing seminar materials with their departmental faculty.

All participating faculty receive a resources notebook which includes the following:

- Copies of professional codes of ethics
- Information on current issues, ethical problems, the stages of moral development, and possible classroom approaches
- Course materials

- Ethics cases ("hands-on" computer exercises)
- A list of ethics centers in the U.S. and abroad, many of which offer free materials
- Internet and OIT library resources, including an annotated bibliography of library ethics holdings
- A list of film/video resources
- Selected readings for discussion

Faculty meet informally for eight weeks through winter quarter; meetings consist of discussions and small group exercises designed to bring faculty to agreement on what constitutes professional ethics and how they can integrate this information into their courses. The key to effectiveness is *seamless* integration; faculty want to avoid figuratively drawing a box around the ethical material and labeling it "ethics," thereby leading to students to the conclusion that this is "extra stuff" and hence not as important as technical content.

Seminar participants are also asked to implement at least one ethics exercise in a class they are currently teaching and report results to the seminar. Projects have been surprisingly varied, ranging from asking accounting students to number-crunch Ford Pinto gas tank redesign statistics to examining the Hyatt Regency walkways collapse in a civil engineering class to exploring, in a technical communications class, why a corporation persistently includes a deceased employee's resume in grant applications.

After the final meeting, participants complete a written evaluation of the series, and feedback has been excellent: all have been very satisfied with the seminar and are eager to include the material in their courses. One participant spoke of the weekly meeting as "an oasis," removed from daily pedantic concerns. Most importantly, though, this seminar series brings together faculty from a variety of academic areas and allows for free discussion of issues which will undoubtedly affect their students professionally. All gained important insights from this unique interdisciplinary cross-fertilization.

Techniques

Seminar participants also developed an impressive list of techniques for integrating ethics into their courses:

- Distribute professional codes
- Have students use codes to respond to situations (academic ones work well: cheating, plagiarism, etc.)
- Use personal experiences, narratives (discussion and written)
- Discuss whistleblowing (advantages and disadvantages)
- Hand out appropriate materials from the "Course Materials" section of the resources book
- Acquaint students with various approaches to ethical problems
- Take a "regular" problem and add an ethical dimension; i.e., turn waste disposal into *toxic* waste disposal
- Incorporate case studies (short or extended)
- Alert students to professional literature in the field

- Ask them to read some of the above and report back to class (a group activity)
- Have students interview engineering professionals for their thoughts on ethics; report back to class or write a short memo
- Use videos

Resources

There is no lack of information on engineering ethics. Quite the opposite: a brief sweep of the Web alone yields hundreds of thousands of listings, and library databases list an equal amount. In addition, many textbooks are available, both in professional ethics and, specifically, engineering ethics. Such an information glut, however, is more overwhelming than useful. The following list represents what I personally have found to be the most helpful in my decade-long research in this field:

Web Pages

- *Web Clearinghouse for Engineering and Computing Ethics*, developed by Joe Herkert at North Carolina State University, offers links to some of the best ethics pages on the Web. It decreases search time and includes international links; clicking on Chernobyl, for example, will take the user to the University of Kiev. URL: http://www4.ncsu.edu/unity/users/jherkert/ethicind.

- *Ethics Center for Engineering & Science*, developed by Carolyn Whitbeck at MIT and now located at Case Western Reserve University, also offers links to many sites and includes many useful student exercises, in addition to sections on problem solving, moral leaders, and cases. URL: http://www.cwru.edu/affil/wwwethics.

Ethics Centers

Ethics centers have burgeoned like mushrooms in the past decade; most focus on a particular area. The two listed below focus specifically on engineering ethics:

- *Center for the Study of Ethics in the Professions*, Illinois Institute of Technology, Stuart Building Room 102, 10 West 31st Street, Chicago, IL 60616-3793. Director: Vivian Weil. CSEP is a major source for professional codes. Currently, they are available for the cost of xeroxing; soon, however, they will be available on the Web.

- *Center for Applied Ethics*, Duke University, Durham, NC 27708-0287. Director: Aarne Vesilind. In 1996, the center developed a series of educational videos, appropriate for classroom usage and accompanied by instructor manuals, which focus on academic situations and their relationships to professional codes.

Textbooks

Although the number of available textbooks on engineering ethics does not nearly approach the number of Web pages, the following are useful both for the instructor's own education and for providing usable classroom material:

- Harris, Charles E., Jr., Michael S. Pritchard, and Michael J. Rabins. *Engineering Ethics: Concepts and Cases*. Belmont: Wadsworth, 1995. [Includes background information, specifically related to engineering, as well as many short cases for classroom usage.]

- Johnson, Deborah G. *Ethical Issues in Engineering*. Englewood Cliffs, NJ: Prentice Hall, 1991. [A thought-provoking anthology of readings on a variety of ethical issues, such as loyalty, client obligations, whistleblowing.]

- Martin, Mike W. and Roland Schinzinger. *Ethics in Engineering*. 3rd ed. New York: McGraw-Hill, 1996. [Provides interesting background information on engineering ethics and ethical theory; study questions; chapter summaries; and major ethical issues, including abbreviated cases.]

- Unger, Stephen H. *Controlling Technology: Ethics and the Responsible Engineer*. 2nd ed. New York: John Wiley and Sons, 1994. [Insightful consideration of professional behavior, with full-blown examination of major cases, such as *Titanic*, Bhopal, Chernobyl, *Challenger*.]

Computer Cases

Short cases, suitable for classes, are available from a number of sources. Diskette versions, some with commentaries and interactive components, can be obtained by writing

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319 Moore Hall
Kalamazoo, MI 49008-3899

Charles E. Harris, Jr.
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Some of these cases are also available on the Web, at Texas A & M University's "Engineering Ethics" site (URL: http://ethics.tamu.edu/). In addition, this site includes quantitatively-based ethics scenarios.

Professional Organizations

Joining a professional organization can increase instructors' ethical awareness. While many professional engineering organizations may have special interest groups or segments devoted to ethics, most ethics organizations tend to be philosophy-based. The Association for Practical and Professional Ethics, however, associated with Indiana University at Bloomington, tends to be more catholic and boasts members from a variety of professional interests, including engineering, medicine, law, communications, business, philosophy, and the social sciences. The society publishes a newsletter, *Ethically Speaking*, hosts an annual conference with a specialized mini-conference following (in 1997, the mini-conference focused on engineering and computing ethics, with William LeMessurier as the keynote speaker), and offers an intensive summer ethics experience at the University of Montana.

For more information, contact Brian Schrag, Executive Secretary, Association for Practical and Professional Ethics, 410 North Park Avenue, Bloomington, IN 47405.

Conclusion

"One of the values of studying engineering ethics," explain Harris, Pritchard, and Rabins, "is that it can help promote responsible engineering practice."[5] Knowing ethical obligations and responsibilities helps to make our students better professionals. If engineering and technology classes do not include content related to ethics, however, how will students know what might lie before them?

Part of our duty as faculty is not only to impart technical knowledge but to help mold our students into professional people. Knowing how to act and accepting the consequences of those actions is part of being a professional. I maintain that ethics is inherent to the engineering profession and studiously avoiding the issues--or shunting students into theoretical philosophy courses--is a disservice. Now, more than ever before, we are dependent upon sophisticated technology as a way of life. With that technology comes moral obligation and responsibility. As Stephen Unger explains in writing about Chernobyl, "people's lives are often greatly affected by decisions that they knew nothing about made by people in a far off place over whom they have no control at all."[11] If our students are the people who will be making those decisions, we need to ensure that they understand societal and global implications and make the right decisions.

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