AC 2011-2906: ETHICS: WHY IT IS IMPORTANT AND HOW WE CAN TEACH IT FOR ENGINEERING AND CONSTRUCTION STUDENTS?

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Ethics: Why it is important and how we can teach it for Engineering and construction students?

Abstract

Ethics is becoming a serious problem in both academic and professional environment. This problem is particularly true in engineering and construction where undergraduates are most likely to cheat in colleges. Most professional organizations are trying to address the issues by including strict professional guidelines. Recently the American Association of Engineering Society (AAES), an umbrella organization of eleven engineering organizations summarized their professional codes and giving more importance on ethics. That is one of the reasons ethics is becoming an essential part of professional education because it helps students deal with issues they will face in professional practice. The best way to teach ethics is by using cases—not just the negative cases that make the news, but the kinds of cases that an engineer or contractor is most likely to encounter in their professional career. Methods for analyzing the cases are readily available. But the question is always for us how we can teach ethics better? Ethics can be taught in a free-standing course, but there are strong arguments for introducing it in several technical courses across the curriculum. If the subject of professional ethics is how members of a profession should, or should not, affect others in the course of practicing their profession, and education should be part of professional education in engineering and construction, just as it is in law and medicine. This paper will discuss the introduction of ethics into undergraduate education in terms of three questions: Why we should teach ethics in engineering and construction education? How should it be taught? When it should be taught?

Introduction

Lack of ethics or improper implementation of ethics is becoming widespread problems among all professions including engineering and construction. It can be due to widespread availability of materials through web and/or lack of understanding the importance of ethics as a professional responsibility. A historical comparison shows that in 1969, 33% of high school students cheated in their academic work compared to 67.8% in 1999 (Altschuler, 2001). In addition, other reports suggests that recent college students come to college to get a degree rather than coming for an education; and how these students get their degree is often not as important as the degree itself (McCabe, 1996)? Recent research among professional disciplines has revealed a correlation between an engagement in unethical behavior in college and engagement in unethical behavior in professional practice (Noinis et al., 2001 and Sims, R., L., 1993). This correlation can be due to the existence of a set of common personal and situational variables in both academic and professional settings that influence a particular individual's decision to engage in unethical behavior.

Most definition of ethics recognizes the moral element. Generally, it can be said that ethics is an individual's discovered and chosen moral code or self –standard which is used within the decision making process to resolve conflicts within his or her life or business (Carpenter et al, 2006) . Ethics is the moral element that deals with "what I can do versus what I should do."

To understand better about ethics, first we need to understand the real meaning of morality and then the distinction of morality with professional ethics. In addition, we need to understand how it can apply to everyone rather than only to members of a special group. Ideally, these standards are ones that every rational person wants every other person to follow, even if everyone else's following them would mean that he or she had to do the same (Harris et al 1996). When we were all quite young we learned such basic moral rules as: don't lie; don't cheat; keep your promises; don't steal; and so on. After a little while we learned that these rules have exceptions (for example, "except in self-defense" for "don't kill") (Davis, 1987). We may change our view depending on interpretation of a particular rule or exception.

Morality is different then professional ethics. "Professional ethics" we refer here to those special morally permissible standards of conduct that we want every member of a profession should follow. For example, medical ethics apply to people in medicine (and no one else); business ethics apply to people in business (and no one else); and engineering ethics applies to engineers (and no one else) (Davis, 1987 and 2001). Engineering ethics have been formulated in different codes of ethics, in the less formal way by which engineers pass to next generation of engineers how they do things. So, very few students can get an opportunity to learn ethics except at school or while practicing. Engineering ethics is as much a part of what engineers in particular know as factors of safety (fs), testing procedures, inspections, or ways to design or construct for reliability and durability with economy. Therefore teaching engineering ethics should be like as part of teaching engineering (Harris et al 1996).

Why it is important?

Why we should teach ethics? One answer may be to assure that personal actions do not harm anyone (including self) or that personal actions contribute to the betterment of common good. Harris provided an answer that ethics should be taught to avoid the long and familiar list of tragedies, disasters, and scandals in which engineers have been major players (Harris et al. 1996). Something should be done to avoid all these disasters. Ethics teaching can't be done only to discuss all the exciting big news/bad news which usually comes in the media. Although these incidents should be a matter of concern for all of us as human beings and as engineers. We always need to consider that these are exceptional rather than ordinary occurrences in engineering. Most engineers will usually not be involved in such circumstances.

Media coverage is important but not everything about ethics. Whenever a question is asked about ethical failure (or disaster) issues in engineering and construction, most students think of a familiar list of disasters: the collapse of the NY crane killing eight peoples in 2009, Hyatt-Regency walkway in Kansas City, the Challenger disaster, the Bhopal disaster in 1984 (killing about 15000 people), Atlanta Parking Garage Collapse in 2010 and so on. These tragedies definitely encourage engineering students to think of ethics although they may not be part of tragedies.

So to answer the questions "Why teach engineering ethics?" we need to look elsewhere rather than disasters. Several years ago the Hastings Center, an ethics think tank in New York, brought together educators from a broad range of disciplines to talk about what should be the common goals of ethics education in colleges and universities (Calhoun, 1980). One goal they identified

was to stimulate the ethical imagination of students. Too often young professionals get caught by surprise when they faced with an ethical problem in their professional practice. If they did not think about such an ethical problem, usually it becomes difficult for them to handle it properly.

Another topic is how to help students recognize ethical issues. For example, what counts as a conflict of interest in engineering practice—as well as precisely why it is an ethical problem—may not be obvious. So, another Hastings Center goal comes into play: to help students analyze key ethical concepts and principles that are relevant to the particular profession or practice. Other concepts come to mind—public health and safety, quality, usefulness, efficiency, cost/risk/ benefit analysis, environmental harm, truthfulness, trustworthiness, loyalty and so on which are common in all engineering professional ethics.

Many of these concepts are sometimes confusing and conflicting. Engineering math cannot be used to solve these problems to get the right answer. So, how we can help students to deal with ethical disagreement, ambiguity, and vagueness? It is always part of real life that some disagreement and uncertainty can be expected and should be tolerated, but majority's view is the acceptable one although in many cases it may not be true (Harris et al 1996).

There are additional goals of teaching ethics as well. Teaching ethics can increase student sensitivity to ethical issues simply by making students aware that they, as engineers (professionals), may have to resolve certain ethical and or conflicting problems in their professional career. If they are exposed in the curriculum, they will be more likely make a better decision under a conflicting environment.

Research found that teaching engineering ethics can increase student knowledge of relevant standards and codes, and the ethical judgment. A student who reads a code of engineering ethics is more likely to know what is in it than a student who does not read it. Ethical judgment, like technical judgment, tends to improve with repetitive use and experience. If we, as a faculty member, gives students a chance to make ethical judgments, explain them, and compare them with those other students view, the student is more likely to judge well compare to others who does not have such experience.

The main goal of the engineering ethics component is to provide the knowledge and intellectual understandings to become professionally and socially responsible engineer" (Lynch T, 1997/98). Lynch explained the following components of professional and social responsibility which are:
- being aware of the complex relationships between technological development and social well being;
- understanding the professional responsibilities of engineers and the norms for exercising these responsibilities; and
- having the capacity to make mature decisions about professional responsibility and to deal with ethical dilemmas when they arise"

How are we going to teach?

There is widespread agreement and discussion that the best way to teach professional ethics is by using cases. There are several modes of ethical analysis that can be useful in treating cases. The author like the idea of methods of instruction (Harris et al., 1996) that are explained in Harris:

One of these expressions is “drawing the line” between acceptable and unacceptable actions. Let us consider a case that illustrates this first mode of ethical analysis, which we shall refer to as resolving a line-drawing problem.

Engineers often face the problem of accepting gifts from vendors or subs. On one hand, most engineers probably believe that eating a fast food (cheap lunch) from a vendor is permissible. On the other hand, all engineers believe it is not permissible to accept a $100,000 check from a vendor or sub to specify a product that is both inferior and more expensive-sometimes unsafe. But where do we draw the line between these two extremes? Suppose a vendor offers to take us to the local country club for golf for a weekend, or to sponsor us for membership in the country club for a year? Suppose the vendor or sub invites us to a professional seminar in London, where his company and ours split the expenses. Suppose he invites us to a seminar in Hawaii, all expenses paid? Where do we draw the line?

In the line-drawing method, we compare the controversial case to noncontroversial cases, i.e. to the cases where there would be little doubt that the action is right (accepting the free lunch) or wrong (accepting the $100,000 bribe). By isolating the similarities and differences between the controversial case and the noncontroversial cases, it becomes easier to decide whether a controversial action is morally acceptable.

Now let us discuss the second mode of ethical analysis-‘conflict’. We say that we are in a conflict over an issue, meaning that we feel we are not agreeing for competing considerations. Here is one classic conflict problem. A young inspector discovers faulty construction equipment and applies a violation tag preventing its continued use. The inspector’s supervisor, a construction manager, views the case as a minor infraction of safety regulations and orders the tag removed so the project will not be delayed. The inspector job requires him to sign documents certifying that equipment meets the city regulations, when he suspects that it does not. To make matters worse, the emission from the equipments are mostly carbon-mono-oxide and can be inhaled by the workers who are working in a small confined place. The young inspector believes that he could lose his job if he presses the issue because supervisor does not want to spend any extra money or time.

The inspector experiences a major conflict between his obligation to be a loyal employee and his obligation to protect the health and safety of the workers. Both obligations are legitimate. What should he do? He should first think of what we call creative middle ways, i.e. actions that will enable him to meet all of his apparently conflicting obligations. For example, he might try to find a technical solution to the problem. This would enable him both the workers’ health and to protect the company, which may not cost any extra time and money.

Unfortunately, creative-middle-way solutions are not always possible in real world problems. Then more difficult choices must be made, in which some obligations must be given priority over others. He might have to tell his superiors that he will not conceal anything or have to refuse to sign any more documents that certify that equipments are within city regulations.

A Question of Ethics - a case study (ASCE News)

An engineering firm has been overcharging its client, a local public agency, for the design work it was performing. Although none of the firm's principal officers are members of ASCE, an ASCE member working for the firm as an engineer also is indicted for lying to the grand jury during its investigation. This indictment is dropped in exchange for the member's testimony against the firm's officers, and the member is named as an unindicted coconspirator in the suit against the firm's president.

In his testimony at trial, the ASCE member admits to inflating the hours reported on his time sheets at the direction of his supervisor, who himself claimed to be acting on the orders of the firm's president. The firm and its president are convicted of falsifying records in order to overcharge the client, and a state court imposes fines and a suspended jail sentence on the guilty parties. After the trial and sentencing, the CPC advises the ASCE member of the ethics complaint filed against him and invites the engineer to discuss his involvement in the case before members of the CPC.

QUESTION: Did the engineer's actions in inflating the amounts reported on his time sheets as time spent on a public project violate ASCE's Code of Ethics?

DECISION: While this case was considered under a previous version of the ASCE Code of Ethics, the canons involved are substantially the same as in the current code. Therefore, for the purposes of this article the numbering and language of the current version will be used.

Although the ASCE member's original indictment alleged false testimony before a grand jury, suggesting a violation of canon 3's mandate to "issue public statements only in an objective and truthful manner," the CPC felt that the swift dismissal of the indictment and the member's subsequent assistance to the grand jury made it difficult to support a violation of that canon. Instead, the committee focused on the member's confession that, at his supervisor's direction, he had falsified his time sheets to inflate the hours reported as time spent on the public project.

Canon 4 of the code says that "engineers shall act in professional matters for each employer or client as faithful agents or trustees," and canon 6 holds that "engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero tolerance for bribery, fraud, and corruption." The CPC believed that an engineer's obligation to serve his or her client faithfully and to be vigilant in eschewing fraud and dishonesty created a clear ethical obligation for the engineer in this case to report with strict accuracy the time spent on his client's project.

The engineer claimed that he had initially questioned the order to falsify his time sheets but said that his supervisor had given what, at the time, appeared to be plausible explanations of why the overbilling was neither dishonest nor unethical. The engineer said that he respected his employers and had high regard for their integrity, but he expressed remorse that he had failed to place greater reliance on his initial qualms.

While the CPC believed the engineer's claim that he had trusted his supervisor's explanation for the suspicious practice, its members nevertheless felt that his actions had violated the Code of Ethics. At the same time, the CPC took into consideration the member's youth and inexperience and felt that he had already been punished by the loss of his job and the substantial legal fees he incurred during the investigation. The CPC believed that in light of these mitigating factors and

the ASCE member's apparent remorse for his action, the member deserved a less severe penalty than the committee might otherwise have recommended.

The CPC found that the ASCE member had violated canons 4 and 6 of the code and recommended that he receive a letter of admonition, but it also recommended that no publication of the case appear in an ASCE publication. The Board of Direction agreed with the CPC's findings, and a letter of admonition was issued to the member.

Because overbilling of public agencies for services is fraud not only against the government but also against the taxpayers whose contributions are being misused, penalties for persons found to have engaged in such conduct are harsh. The federal False Claims Act, enacted in 1863, imposes civil penalties of up to triple the amount fraudulently billed and criminal sentences of up to five years for any person found to have knowingly submitted a false claim to a federal agency.

This kind of dilemma questions can be brought in the class and get the students' opinion. Then take a vote what they are going to do under this conditions and why? Faculty needs to moderate every opinion, explain it plus and minus of each point and then explain the ASCE's decision. Every month ASCE News publishes ethical dilemma which can be discussed in the class.

There is a considerable body of cases in engineering ethics for case analysis. Texas A&M University developed a set of eleven cases taken mostly from real-world situations which can be a good resource to teach ethics as a new instructor. The National Society of Professional Engineers has case material available under the title, "Professional Engineers in Education (NSPE-PEE)." An electronic disc containing eight cases with guidelines is available from the Murdough Center for Engineering Professionalism and Ethics at Texas Tech University, directed by Dr. Jimmie Smith. Dr. Michael S. Pritchard and others.

The emphasis of the course will be on promoting thoughtful reflection and problem solving rather than on role behavior or instilling specific norms. The course can provide the practical source of support for engineers in a real world setting providing more guidance than traditional exercises emphasizing a choice between external whistle blowing and keeping one's job (Lynch. T, 1997/98).

When are we going to teach ethics?

Ethics should be introduced or taught wherever appropriate inside and outside the curriculum such as guest lectures, presentations to student chapters of professional societies, discussing scenario from professional magazine and others. Another possibility is to have a single, free-standing, non- technical elective course which can be taught by a regular faculty or an experience industry professional. It is always a good idea to introduce ethics several times in the student curriculum rather than in a single course. In addition, ethics can be taught in a professional seminar class.

Another approach is to introduce engineering ethics into required engineering courses. This approach has the advantage of teaching engineering ethics in a way that brings out how integral engineering ethics are to engineering practice. In the Construction Management of Southern Polytechnic State University ethics is taught across the curriculum through several courses such as safety, seminar, project management and orientation rather than through a single course.

Another easy way is to pass out a code of ethics at the beginning of the semester and refer to it often enough during the term so that students get the idea that it is important for them to read. An instructor can repeat the importance of that part throughout whole semester.

Conclusions

Teaching ethics sometimes becomes very difficult depending on the composition of students and their background. There is not a single pedagogy to teach ethics. It can be taught many ways depending on instructor, and availability of resources of the department.

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