

Vital Skills in Engineering: Ethics

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Through the course of a four year NSF project, we interviewed over 140 engineers and conducted case studies of six engineering firms from varying industries. Over 2000 engineers or engineering graduates also responded to surveys. All of this data enabled us to draw conclusions about the ways of thinking, skills, values and identities of practicing engineers. This report on communication ethics is one of a series of brief reports on ideas for further enhancing the connection between engineering courses and engineering practice.

Ethical Engineering as a Standard

Engineers have codes of ethics intended to guide decision making in much the same way that doctors and other professions have a specific code of ethics which that guides them. Engineers look to the National Society of Professional Engineers or IEEE and other organizations for codes of ethics.

Where doctors are called to “never do harm,” the NSPE Code of Ethics calls upon engineers to “hold paramount the safety, health, and welfare of the public.” Ideals like these are not only worth celebrating, but worth instilling into the fabric of the culture of engineering professionals. While knowledge of the NSPE Code of Ethics is ostensibly necessary to obtain the qualification of PE, our study found that engineers thought of “ethics” in different ways than expected. They used the words “quality” and “integrity” when thinking of ethics.

52%
of practicing engineers we surveyed said ethics was essential to the job

Quality and Integrity

Our data show that many engineers are startlingly unaware of engineering ethics codes but nonetheless bring a keen sense of right and wrong to their everyday work. Practicing engineers’ views on ethics in their own work lives held an interesting contradiction: while the majority of respondents felt that maintaining ethical standards was essential, a majority *also* said that they had never seen a challenging ethical question come up in their work.

“The NSPE Code of Ethics? What’s that?”
-- *Masters Student in Electrical Engineering*

Nevertheless, we know that ethical questions arise often for engineers, as they balance the requirements to work cheaply, work efficiently, and address the “safety, health, and welfare of the public.” Engineers regularly face ethical dilemmas, but we found that they often frame them in terms of *integrity* or *quality*, not as an “ethical” problem. Thus, it is important as instructors and practitioners to keep this intersection of vocabulary in mind when teaching and working within the engineering community. Student projects should include trade-offs and opportunities to reflect on integrity and quality in a project, with explicit connections between these ideas and ethics.

“There are times when I’m inspecting and the contractor is not properly shoring the trench. As the construction review technician, you can only advise them to shore up their trench....There is a fine line where your personal ethical factors come into it. If the trench is falling in or is shifting on somebody, you have to tell the person in the hole to get out of the hole, but technically you shouldn’t say anything. So there is always that time where there are compromises, where you have to make a moral decision whether or not you professionally want to not say anything, but morally and personally you want to say something.”
--*Engineer, working as an on-site inspector*

A Pedagogy Toward Ethical Engineering

Students must learn to pull apart any professional code of ethics, such as those from the [NPSE](#) or [IEEE](#), and apply that code towards broader decision-making. While some decision-making might seem obvious to most engineers, understanding the formal qualities of ethics can be of great help for those engineers dealing with an unclear ethical situation. Particularly as codes of ethics often contain more than one set of standards; they house professional standards (“this is how professional engineers behave”) and organizational standards (“this is how we do business here”).

An understanding of ethics is a critical part of a future engineer’s training. Instructors need to impart the principle that every engineer’s ability to act with credibility and integrity is necessary to the reputation of the engineering community. Emphasizing this point and providing students with training on core ethical principles prepares students for their lives in a professional world where ethical questions arise regularly.

Possible Exercises

Focused discussion: In this exercise, a specific ethical case in engineering is brought up to the class for discussion. Cases can be brainstormed in class or found in a resource set, [such as those at the NSPE site](#). Think of cost/benefit situations, safety issues, obsolescence, outsourcing of labor, questionable business practices, managers taking credit for work not theirs, and so forth. Cases should include multiple people or groups who have various interests at stake in the decision, and these interests should be in conflict. Brainstorm various potential decisions that an engineer could make to resolve the situation and what these decisions could mean for all of the stakeholders involved. These situations shouldn’t be overly dramatic; in fact, students often feel distanced from the great catastrophes. Instead, use everyday examples that speak to common experience. The goal of the exercise is to show that ethical questions are involved in even mundane, everyday decisions—even those that would not result in catastrophes.

Integrated discussion: During the discussion of any applied engineering problem, push students to think of potential ethical problems that might arise and then discuss them. Ask students what factors must be balanced when making decisions in such a project. Provide to the class a code of ethics as a touchstone.

Resources

[In-Situ Ethics: The Ethical Sensibility That Engineers Bring to Their Work](#)

This paper from the 2010 ASEE proceedings is a look at the findings from NSF-funded research in the AWAKEN project, reported in this handout.

[National Society of Professional Engineers: Code of Ethics](#)

This code of ethics is considered a cornerstone for engineering ethics study and application. Individual cases are housed at this site that can be used in the classroom or on site.

[IEEE and ASCE Codes of Ethics](#)

The codes of ethics from these two professional organizations can provide general considerations for designing projects and discussions.

[IIT Center for the Study of Ethics in the Professions: Code of Ethics Collection](#)

This extensive collection of codes of ethics from many different professions can provide a real-world lens for interpreting and discussing professional ethics. There are also resources for authoring, interpreting, and applying codes of ethics.

[National Academy of Engineering Online Ethics Center](#)

This NAE resource provides links to cases, ethics codes, teaching tools, bibliographies of related articles and other educational resources.

In case you are viewing a paper copy of this report, an online version with live links can be found at: <http://hplengr.engr.wisc.edu/resources.htm>

