

# Professional Ethics in the STEM Disciplines

## Guest Editorial

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In the modern world in which scientists, technologists, engineers, and mathematicians operate, they have the ability to generate an impact (whether positive or negative) on society (locally, nationally, and global) in a manner and to a level never previously possible. In turn, society reasonably expects those individuals in science, technology, engineering, and mathematics (STEM) disciplines to make ethical decisions and to have the moral conviction to adhere to those decisions. STEM educators have the unique capacity and responsibility to role-model and, when called upon, to provide instruction in professional ethics. The intent of this editorial is to provide the STEM educator with information regarding resources available to assist in the instructional delivery of professional ethics education.

I must acknowledge that my perspective, and thus my writing, tends to be engineering-centric. However, it is my contention that the ethical issues faced in my field of engineering are, at their core, the same as those faced within science, technology, and mathematics. In addition, the classic case histories utilized in many engineering ethics discussions could easily be argued as fully applicable to science, technology, and mathematics.

A large number of well-written and widely used engineering ethics textbooks are currently used (for example, see Baura (2006), Gunn & Vesilind (2003), or Harris, Pritchard, & Rabins (2009)). However, beyond the traditional textbook resource, there is an extensive amount of digital-based (web and DVD) content that can be utilized in the preparation and delivery of ethics education. I provide herein a brief snapshot for three of the preeminent engineering ethics organizations that supply instructional material.

The Online Ethics Center (OEC) for Engineering and Research ([www.onlineethics.org](http://www.onlineethics.org)) was established with funding provided by the National Science Foundation (NSF) and is now maintained by the Center for Engineering, Ethics and Society of the National Academy of Engineering. The mission, as listed on the OEC website, is "to provide engineers and engineering students with resources for understanding

and addressing ethically significant problems that arise in their work, and to serve those who are promoting learning and advancing the understanding of responsible research and practice of engineering." Therefore, the OEC website contains an extensive number of cases and scenarios, as well as related discussion points, that are ideally suited to an active learning environment. Furthermore, guidelines and codes of ethics for both scientific and engineering societies from multiple countries are assembled in a single location and permit rapid access to instructional activities that compare and contrast multiple codes.

The University of Illinois is in the process of developing an NSF funded National Center for Professional and Research Ethics (NCPRE) ([www.nationalethicsresourcecenter.net](http://www.nationalethicsresourcecenter.net)). The stated mission of the NCPRE is to "develop, gather, preserve, and provide comprehensive access to resources related to ethics for teachers, students, researchers, administrators, and other audiences." In its early stages, the NCPRE website already contains a wealth of teaching resources including course lectures, course syllabi, role-playing scenarios, and various discussion scenarios. The further collection of educational resources by the NCPRE has the potential to make its website a primary resource for educators in search of instructional tools, ideas, and a common community of practice.

The final resource I offer for your consideration is the National Institute for Engineering Ethics (NIEE). It is the one I am most familiar with as a result of my position on the organization's Executive Board. NIEE is a not-for-profit educational corporation with the mission of promoting the study and application of ethics in engineering education and throughout the profession of engineering. NIEE was initially established by the National Society of Professional Engineers (NSPE), became independent of NSPE in 1998 and then, in 2001, was absorbed into the Murdough Center for Engineering Professionalism at Texas Tech University. NIEE continues to maintain its own identity and unique mission to "develop and foster education, training, and discourse in engineering ethics." NIEE facilitates professional ethics work-

shops, seminars, presentations, and distance learning opportunities. In addition, NIEE has obtained financing for, has produced, and markets a series of highly successful engineering ethics videos.

*Henry's Daughters* (© 2010)—The most recent educational DVD released by NIEE focuses on a retired but well-connected professional engineer and lobbyist, as well as his two daughters. One daughter is a professional engineer employed by a state-level Department of Transportation, while the second daughter is a recent college graduate and an intern with an automotive company. Henry and each of his daughters play specific—but in many cases conflicting—roles in the competition for establishment of a smart highway system. The many layers of the storyline introduce the audience to ethical considerations, including:

- ethical issues as an integral part of many engineering decisions;
- a licensed professional engineer's obligation to society, not just to fulfilling a contract with a client or customer;
- the fact that ethical dilemmas in engineering and technology have both technical and non-technical solutions; and
- ethical implications of workplace issues, such as gender discrimination.

*Henry's Daughters* has a running length of 32 minutes, making it well suited for a typical in-class viewing followed by discussion. An accompanying 24-page study guide includes a review of the storyline, a list of characters, and suggested assignments and is available on the NIEE website ([www.niee.org](http://www.niee.org)). The DVD is embedded with subtitles in 12 languages. NIEE has distributed complementary copies of *Henry's Daughters* to 350 colleges and universities in the United States and approximately 200 academic institutions beyond the United States.

*Incident at Morales* (© 2003)—*Incident at Morales* was the first DVD of its kind to focus on the unique aspects of professional ethics in an international context. The storyline, set in a fictitious town in Mexico, focuses on the ethical issues faced by a company that seeks to rapidly build a chemical production facility to gain a competitive edge over its competition. The plot provides viewers with opportunities to consider the following:

- ethical decision making,
- the role of a code of ethics in the decision making process,
- the applicability of a code of ethics in an international context, and
- the obligations of engineers beyond fulfillment of a contract with a client or customer.

Much like *Henry's Daughters*, *Incident at Morales* has a running length well suited for in-class viewing, has been subtitled in 12 languages, and can be used in concert with a study guide or other available educational content. Complimentary copies of this video were distributed to 341 U.S. academic institutions and 280 international academic institutions.

*Gilbane Gold* (© 1989)—The earliest video in this collection, *Gilbane Gold*, was produced in cooperation with the National Society of Professional Engineers, but is now distributed solely by NIEE. The storyline involves a computer component manufacturing company discharging lead and arsenic into a municipal sewer system. The environmental engineers for the company wrestle with the ethical implications of being pressured to increase discharge rates that meet the letter of the law but exceed limits intended by the spirit of the law. The video addresses the concepts of:

- protection of public health and the environment,
- quality of life and the welfare of individuals,
- free enterprise, and
- personal integrity.

The running length of *Gilbane Gold* is 24 minutes and it can be used along with a study guide that can be downloaded free from the Internet or with other educational content.

At the moment, NIEE is in the early stages of developing yet another storyline for the next DVD in this library of educational material. NIEE has also generated two editions of a widely used book titled *Engineering Ethics: Concepts, Viewpoints, Cases, and Codes* (2nd edition: Smith, Harper, & Burgess, © 2008). Finally, in addition to the educational DVDs, supporting materials, and book, the NIEE maintains a website ([www.niee.org](http://www.niee.org)) that contains a large number of ethical cases and related discussions. Numerous universities use these cases in ethics education courses.

Multiple reports and publications have identified a general hesitation or reluctance among

faculty in the STEM disciplines to teach classes in professional ethics. However, with the vast array of instructional material available to assist with the process of preparing and delivering a high-quality ethics educational experience, one need not feel disinclined. If you currently teach professional ethics in the STEM disciplines, I encourage you to consider how some of the resources identified herein could supplement and improve your instructional strategies. If you are new to the richly rewarding experience of teaching professional ethics, do not underestimate the role you have in developing the future generation of ethical and professional scientist, technologists, engineers, and mathematicians.

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