Online Ethics Center
FOR ENGINEERING AND SCIENCE

Using Student-Authored Case Studies to Teach Bioengineering Ethics

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Description

This activity is considered an NAE Exemplar in Engineering Ethics Education and was included in a 2016 report with other exemplary activities. The activity described here instructs students in a 14-week required bioengineering ethics course to author a case study based on their research and analyze it using methods taught in the course.

Body

Exemplary features:

Has a reproducible approach; teaches how to frame an ethics issue; and involves class alumni.

Why it’s exemplary:

The use of case-based reasoning to teach professional ethics is currently recognized as a “best practice,” but there is still much to be understood regarding *how* professionals learn ethics using case-based reasoning. It is unclear what types of

cases should be used in teaching, and it is often difficult to assess what students actually learn when reasoning with cases.

The activity described here instructs students in a 14-week required bioengineering ethics course to author a case study based on their research and analyze it using methods taught in the course. Based on solid research from two consecutive NSF grants, this activity is exemplary because it recognizes the ill-defined nature of ethics and teaches students how to “frame” an ethics issue. This skill is needed to grapple with everyday practical ethics issues, which are not neatly packaged into teaching cases.

Program description:

The primary participants in the activity are graduate students pursuing a PhD or an MS in the Department of Bioengineering. The course has been taught for 19 years. Former students who are post-docs or who are employed locally have the opportunity to return to the class to teach their case study and to guide students thinking about ethics in practice. They serve as role models for the younger students and in turn deepen their own appreciation of the importance of ethics in their daily work. Two former students, now faculty, currently teach an undergraduate ethics course and a professional MS ethics course.

The educational goals of this 14-week required graduate bioengineering ethics course are designed to supplement students’ traditional bioengineering education in three specific ways:

- To teach the conceptual tools needed to identify, articulate, and resolve ethical dilemmas inherent in the practical, professional work that they take part in daily.
- To enable students to recognize that engineering and medicine each have unique demands related to professional practice, but each practice also reflects the general societal values in which the practice occurs.
- To provide a learning environment where practical ethics can best be understood. This includes group discussion of relevant ethics cases, field trips so students can observe professional ethics in action, and peer-reviewed, in-class group projects.

During the first few weeks of the course, students engage in small-group, case-based discussions. They learn to identify the ethical dilemma and the morally relevant facts and concepts in their assigned case, discuss alternative resolutions, and justify a resolution. Assigned readings and class discussions begin to introduce paradigm case studies. Key concepts such as ethics, professional ethics, personal ethics, role morality, ethical principles, and theories are defined. This steep start-up time provides a common language for students and sets the tone for the class.

The next portion of the course also employs small-group discussion while introducing students to a variety of methods of moral reasoning. Students begin a more formal practice by applying these methods as they discuss complex, technical bioengineering cases and classic paradigm cases in bioethics, tailored to their professional domains. Select students from previous years co-teach during this time and present their case studies. Students in the class are introduced to multiple knowledge domains in bioengineering, as well as a range of ethical dilemmas and methods of moral reasoning. (Issues covered typically match those identified in the 2009 NIH Guidelines for Responsible Conduct of Research.)

The final weeks of the class are devoted to presentations of student-authored cases. The capstone assignment is writing and analyzing a case study based on the student's research area and presenting it in class. Students are instructed to work in teams of two to four. They are coached on various ways to combine their knowledge domains, so that the final case represents a blend of real-life experiences, professional knowledge, and ability to use a method of moral reasoning. The case may be written using moral imagination. (That is, if a student is working on a device that is years from going to market, he or she can "fast-forward" it and anticipate dilemmas that might occur after it is in use.) If the case is based on an actual dilemma, such as an issue with one's mentor or a problem in the lab, the facts are changed to preserve confidentiality. Analysis of the case must use one or more moral problem-solving methods taught in class. The goal of this assignment is to give students the experience of applying methods of moral analysis to their own work. It also gives them practice in specifying facts and concepts of the case and framing the dilemma, effectively creating a professional ethics lens through which to view their research. The in-class case presentation provides students with the opportunity to engage fellow students in a discussion of their work, including identifying the ethics issues and suggesting resolutions to the case.

In addition to in-class instruction, students are required to attend two out-of-class assignments. This may include observing at an ethics committee meeting of the University of Pittsburgh Medical Center (UPMC) or UPMC Children's Hospital; attending the University of Pittsburgh's Center for Bioethics and Health Law's bioethics grand rounds; or taking advantage of other offerings in the ethics programs at the University of Pittsburgh or Carnegie Mellon University. An option also exists for students to attend a U.S. Food and Drug Administration (FDA) panel meeting in Washington, D.C. to observe firsthand the process by which a device is evaluated for market approval. That activity is funded by the Bioengineering Department at the University of Pittsburgh. Former Pitt students who work at the FDA host students and informally discuss workings of the FDA and answer questions about the panel meeting proceedings.

The activities described above contribute to the creation of a "moral community" in the class, where difficult issues can be discussed openly. This explicit and tacit overall goal of the class is perhaps the most important aspect of this exemplary activity.

Assessment information:

A student's final grade is based on:

- Attending and participating in class (15%).
- Completing one critique/analysis of an out-of-class activity (10%). Students are instructed to observe the activity and note what the ethics issues were, if they were resolved, and how.
- Analyzing at midterm one complex technical case (10%). Students use the Teletronics Pacemaker Case Study (Pinkus and Bates, unpublished casebook, University of Pittsburgh, 2005).
- Writing and analyzing a case study based on the student's research area (40%) and presenting the case in class (25%). This is the capstone assignment.

A web-based peer-review system (Chris Schunn's program, Scaffolded Writing and Reviewing in the Discipline, or SWoRD; https://sites.google.com/site/swordlrdc/directory, accessed January 29, 2015) is used during the in-class student case presentations to provide each student/group with constructive comments and to impress upon students that there is an objective way

to evaluate a student-authored ethics case study. To that end, the SWoRD program was adapted to the task of writing, reviewing, and rewriting an ethics case study and problem analyses. The adaptation guides student reviewers in assessing a peer's quality and flow of the presentation, significance of ethical dilemma; choice and application of method of moral reasoning and problem analysis. Both a Likert scale and written comments are available to the reviewers. This peer review form compliments the assessment grid used to evaluate the final paper.

The final paper is evaluated using an innovative assessment grid developed during work on the NSF grant referred to earlier. It focuses on the use of five measures of moral reasoning:

1. Employs professional/technical knowledge to frame the issue.
2. Views the problem from multiple perspectives.
3. Flexibly moves among multiple perspectives.
4. Identifies analogous cases and articulates ways the cases were analogous.
5. Employs a method of moral reasoning in conducting the analysis.

These five measures are not stand-alone criteria. Taken together, they allow students various ways to frame, analyze, and resolve an ethics dilemma. The fifth criterion has been objectified and broken down to three parts: labeling, defining, and applying a concept used in the course. The concepts are specific (e.g., "risk assessment," "cost-benefit analysis") and general (e.g., "case-based reasoning," "utilitarianism"). An ethics concept is said to be "labeled" if the term for the concept is mentioned; "defined" if a dictionary-like definition of the concept is presented; and "applied" if the concept is brought to bear appropriately using facts of the particular case. Each of these could be done correctly or incorrectly. All concepts used in the course are listed on the grid, and a grader can review the paper and note which individual concepts students use. This grid attends to the ill-defined nature of applied ethics and enables objective assessment of individual framing of student-authored cases.

Beyond the formal grading is the "deliverable" of the final student-authored cases. In addition to being used to teach in the graduate course described here, these cases have been used in the undergraduate ethics courses, the professional MS course, and an MD/PhD 4-week ethics workshop at the University of Pittsburgh Medical School. They are uniquely creative and speak to frontline issues that graduate students face. That some students generously donate their time to teach in

the ethics courses in the Bioengineering Department and in the Medical School, with their case as the focus of the presentation, attests to how much they value the student-authored case activity and reflect on the content. The fact that two graduates of the bioengineering program (one an assistant professor and another an employee of a device testing company) now teach ethics courses in the department also speaks to the impact of both the course and the student-authored case exercise.

Additional resources:

1. Goldin I, Pinkus RL, Ashley KD. 2015. Validity and reliability of an instrument for assessing case analysis in bioengineering ethics education. Science and Engineering Ethics. doi: 10.1007/s11948-0159644-2; http://link.springer.com/article/10.1007/s11948-015-9644-2
2. Pinkus RL, Gloeckner C, Fortunato A. 2015. The role of professional knowledge in case-based reasoning. Science and Engineering Ethics. doi: 10.1007/s11948-015-9645-1; http://link.springer.com/article/10.1007/s11948-015-9645-1

Rights

Resource Type

Educational Activity Description

Parent Collection

NAE Exemplars in Engineering Ethics Education

Discipline(s)

Biomedical Engineering and Bioengineering
Engineering
Research Ethics
Teaching Ethics in STEM