

## **Integrating Ethics into the Freshman Curriculum: An Interdisciplinary Approach**

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### Abstract

To ensure that undergraduate engineers have a deep and practical understanding of professional ethics, engineering colleges are developing ways to integrate ethics throughout their curriculum. The freshman engineering course is the logical and appropriate time to begin discussion of professional ethics, long before students are confronted with the tough decisions they may have to make later. The challenge is to find meaningful ways to engage freshman in analyzing ethical challenges.

This presentation explains a collaborative approach to integrating an ethics module into University 101-Engineering (UNIV 101-E), a freshman course for engineering students at the University of South Carolina patterned after USC's nationally recognized Freshman Year Experience course, University 101. Sections of the engineering course described here include a classroom instruction and discussion on the NSPE Code of Ethics and case studies which students gather from specified websites. To support the classroom instruction, the course instructor and the director of the College of Engineering's Professional Communications Center collaborated in developing a reflective writing assignment related to the NSPE Code. After completing the search, students write reflective papers analyzing the cases by provisions of the Code. Students then receive an introduction to Toulmin logic, a system of practical reasoning to aid their analysis. Following group discussion of the cases, students then write a team report in which they examine their understanding of the Fundamental Canons of Ethics.

This joint paper outlines the entire module: the website searches, materials used in the course, points to covered in the discussion of the Code and the reflective paper assignment. Rationales for the activities are described.

### I. Introduction

As even a brief literature and Internet search will reveal, integration of ethics instruction into freshman engineering courses is flourishing.<sup>1-5</sup> The NSPE WWW Ethics Center provides access to information about ethics modules used in a number of engineering colleges.<sup>2</sup> The objectives of these modules are to introduce students to ethical situations and questions similar to those they will encounter in professional lives and to help them examine alternative courses of action.

Typically, these ethics units focus on reading and discussing cases that highlight ethical questions or dilemmas. Some also incorporate team presentations on recommended courses of action and a few include essay questions for homework or a test at the end of the unit.

Few of the modules described on the web include either reflective writing or writing-to-learn. Likewise, few of the descriptions mention explicit instruction in analyzing ethical arguments.

In this paper, we describe an ethics module developed for use in the freshman year experience course for engineers at the University of South Carolina. The module incorporates the full range of language skills (reading, listening, writing, and speaking.) Although the prospect of reading and grading freshman papers often makes instructors reluctant to assign writing, the process of writing about applied ethics has unique benefits that warrant the investment of time.

First, a module that involves reading and writing about applied engineering ethics is particularly effective in helping freshmen learn the discourse and value systems of engineering. Second, writing about an ethical question in a real engineering situation gives students a believable context for writing. Third, writing about the ethics of a real situation requires students to link abstractions and concrete elements to communicate the significance of facts, a cognitive process that often must be taught explicitly to freshman writers, and especially freshman engineering writers who tend to focus on details. Finally, an assignment that involves reading, analyzing, and writing about ethical dilemmas in one's chosen profession can engage students in learning about the ethical argument, the form of public discourse that is necessary for any profession seeking to serve the public good.

## II. The Course

In an effort to increase the overall student success of first semester engineering freshmen, the University of South Carolina merged its traditional *Introduction to Engineering* course with the university's long-standing freshman seminar, *University 101*, to create *University 101 for Engineers* in the Fall of 1997. The objective of this merger was to provide first semester freshmen engineering students with the necessary academic, social and personal skills and knowledge to not only succeed in their engineering program but also to succeed in college and life as a whole.

One portion of the class focuses on traditional freshmen seminar topics such as creating awareness and involvement in campus resources and addressing key personal and social challenges that students face as they enter college. These include orientation to the library resources, career services, health awareness, and managing personal freedom and choices. These topics are discussed within the context of being a student in the engineering community.

A second portion of the class introduces students to the engineering profession and the preparation necessary to become an engineer. Students are introduced to the engineering design process, team-based learning and basic computational tools. Students work in teams on an assigned design project and present it to the class accompanied by a written report. The team-based learning process serves as an excellent medium for teaching interpersonal communication

and critical thinking skills necessary for students to be able understand and apply ethical guidelines within the engineering profession to specific scenarios.

### III. Methodology

The instructional module on ethics for the freshman course includes distribution of the NSPE Code of Ethics and actual case studies taken from the NSPE web site for students to read in preparation for class.<sup>2</sup> In class, students write an informal response to the case, then work in groups to discuss their understanding of the issues. Following their group discussion, students then receive a brief introduction to Toulmin logic. This system of practical reasoning developed by British philosopher Stephen Toulmin gives students a useful tool for analyzing claims and support in an argument. For the final exercise in the ethics module, student teams apply the Toulmin model to their assigned case and write a collective brief.

**Rationale for reflective writing in teaching ethics:** The informal writing assignment in the ethics module is a required but ungraded response or reflective paper. Its purpose is to engage students in the case material, prepare them for class discussion of the issues, and encourage them to reflect on their response to the ethical situation. Reflective writing is a form of writing-to-learn that prompts students to examine their own thinking and to further their understanding of the active learning process. It is similar in purpose to forms of writing to learn used by educators in math, science, and professional disciplines to help students develop abilities to “imagine hypotheses and trace inferences,” organize facts, and use language to gain understanding of material.)<sup>6</sup>

More recently, scholars have realized an even larger purpose for writing to learn in the disciplines, that of inquiry. As Kirscht et al. point out, combining the approaches of writing-to-learn with those of teaching writing in the disciplines helps students reflect on the construction of knowledge in a discipline as they learn the forms of its discourse.<sup>7</sup> We maintain that reflective writing also helps students appreciate the significance of the Code of Ethics to their professional lives. As students read and reflect in writing on the Code of Ethics as applied to a real-life situation, they have an opportunity to examine their own responses to an ethical dilemma. This type of reflective inquiry into ethics is perhaps even more productive in the freshman year experience than in an upper level ethics course. Writing about students in college composition, and equally true of engineering students in freshman year experience courses, Jolliffe observes that most of these students in their late teens are “still working hard at developing their own positions on ethical issues vis-à-vis their parents’ and families’ ideas and attitudes. Writing essays about contemporary ethics could foster these students’ emerging self-awareness.”<sup>8</sup>

The need for reflection, however, is not confined to the very youngest members of the profession. Commenting on the distinguishing habits of engineers who “realize their ethical and truth-seeking potential,” Elizabeth D. Gee writes, “First, they talk honestly with themselves. They compose mental essays and then edit, critique, and revise them with bright red ink. They read, they think, and they ponder ideas.”<sup>9</sup> This composing of mental essays, Gee claims, is “a source of self-enablement.” We concur, but we would add that committing some of these mental

essays to paper or disk enables reflection over time and sharpens one's insight into ethical issues. The reflective writing assignment in the freshman engineering course allows students to experience writing as an aid to thinking about practical implications of ethical dilemmas.

**Rationale for using Toulmin logic to teach structure of ethical arguments:** Given the assignment to write a reflective ethics paper, many students will write their opinions or “feelings” about the issues in the case. However, to write the brief or report required in the final assignment, students need instruction in identifying and examining the grounds of their arguments or judgments. The structural model of argument developed by British philosopher Stephen Toulmin is a particularly useful tool for helping students analyze their positions on issues and apply external criteria in recommending solutions to complex ethical problems. Toulmin, as Caroline Whitbeck notes, was one of the main contributors to the advancement of practical ethics.<sup>10</sup> Dissatisfied with the shortcomings of syllogistic logic, Toulmin outlined a system of logic that represents the reasoning within an argument.

The Toulmin model can be used to diagram the elements and thinking within a given argument, thus helping students see the structure of proof. The model shows both the dynamic of an argument, the movement from data or evidence to a claim, and the grounds, or warrant, for making a particular claim based on the data. Warrants in Toulmin's schema, as Brockreiede and Ehninger explain, reflect “an assumption concerning the way in which things are related in the world about us.”<sup>11</sup> (An outline of the terms of Toulmin logic and a diagram illustrating one possible application of the Toulmin model to an ethics case is attached as Appendix A.)

Guiding students in applying the Toulmin model to an argument or position in an ethics case is an excellent way to help students identify opposing claims and warrants that may arise from an set of identical facts. It also provides a visual heuristic for analyzing the warrants, grounds, or reasoning upon which opposing claims are based. Further, the structural scheme is a helpful analytic tool which students can use for analyzing writing throughout their education, as it is easily applied to proposals, lab reports, and other technical documents.

**Rationale for collaborative writing assignment:** The final assignment, a collaborative paper, engages students in exploring the ethical discourse of their profession as a group. As the first writing assignment, the reflective paper, is a way to “talk honestly with one's self” about ethics, the collaborative paper is a forum for talking honestly with one's peers and future colleagues about the ethics of the profession they share. According to Whitbeck, contemporary ethicists such as Alasdair MacIntyre have “argued that ethics is an aspect of the life of particular communities rather than a body of abstractions.”<sup>10</sup>

Since ethics is a community or cultural construct, it makes excellent sense to require freshman engineers to come to terms with the complexity of ethical questions as a group. In this final stage, the students negotiate a text and create an oral presentation summarizing their position on one incident in the life of the engineering community. This composition requires students to use abstract thought and concrete examples to create meanings in context for readers and listeners, a writing task that involves considerable skill and sophistication.

In their team paper and presentation, students will articulate values of the society they will soon represent. Accomplishing the assignment will require them to discuss professional ethics from a perspective that extends beyond personal opinion. In linking a case situation to moral standards, students will learn to use more advanced and compelling structures of argument and the language of responsible persuasion in matters affecting the public at large. Because this introduction into the discourse of engineering ethics explores the responsible use of language as well as responsible professional behavior, we believe it enables students to become better writers and better prepared to fulfill their ethical obligations as engineers.

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Elisabeth Alford, Director of the Professional Communications Center for the College of Engineering at the University of South Carolina, coordinates the College's programs of writing instruction and consultation. She received her Ph.D. in English, with a specialization in Composition and Rhetoric from the University of South Carolina in 1993. She served as Assistant Director of Freshman Composition at USC from 1991-1992, and has taught freshman composition, technical writing, and professional writing. Prior to returning to USC, she was an executive in a health care association.

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Tom Ward is the Director of Institutional Services for the College of Engineering at the University of South Carolina where he manages undergraduate recruitment, retention and assessment. He received his B.S. from the University of Oregon in 1981 and a Master of Public Administration from the University of South Carolina in 1987. He has been an instructor for the USC's Freshmen Year Experience Program for the past 12 years. He has taught special sections designed for engineering freshmen and was a team instructor for pilot courses taught for high school seniors.

Analysis of Applied Ethics Case of the Month (Case1010/Jan-Feb. 1999)<sup>12</sup> Using Toulmin Logic  
 (Diagram Adapted from Brockreide and Ehninger)

The Toulmin model shows the movement of an argument from data to a claim, as justified by a warrant. The basic elements of the main line of proof in Toulmin model include Data (D), the facts, opinions or evidence; the Claim (C), a conclusion or main position of the argument, and the Warrant (W), the part of the argument that justifies reaching the particular conclusion or claim from the given data. The Warrant, the most difficult concept in the model, is a general form of reasoning that is best explained to students by listing and illustrating the use of some of the common warrants: cause and effect, analogy, generalization, classification, authority, and motive. Other option elements of the model include Backing (B), if necessary to support the Warrant; a Rebuttal (R), which recognizes the conditions under which a Claim will not be true or justified; and a Qualifier (Q), which expresses the degree of certainty of the Claim.<sup>10</sup>

