Introduction

Most engineering programs tie laboratory experiences to specific lecture/content courses. A circuits or electronics course may have a one-unit laboratory component designed to expose students to experiments complementing the course content. At Loyola Marymount University (LMU) we put more emphasis on laboratory work and remove laboratory courses from pairings with lecture/content courses. Each semester the upper division electrical engineering students are enrolled in a three-unit laboratory course, not paired with a single lecture course, but designed to complement all the lecture courses that the students are taking in a given semester. These laboratory courses emphasize design, oral and written communications, and allow the instructors flexibility in what is accomplished during a given semester.

I chose to incorporate engineering ethics into the first-semester senior-laboratory course. This course afforded the flexibility I needed to devote the necessary time to meaningful discussions of engineering ethics. Also, I was not locked in by a rigid set of objectives. I incorporated engineering ethics in three lectures spread out over the semester. Each lecture was coupled with a writing assignment asking the students to reflect on the material covered in the lecture.

September 6, 2001

The first exposure I provided to the students was an introduction to engineering ethics presented by Dr. Mark Manion from Drexel University on September 6, 2001. Dr. Manion was being considered for an endowed chair position in engineering ethics at LMU, and he was required to present a lecture to students as part of the interview process. This lecture provided the perfect opportunity, not to mention a qualified person, to begin the discussion of engineering ethics. Dr. Manion discussed a few high profile cases involving engineering ethics and provided a brief introduction to the various codes of ethics. I required the students to attend the lecture and write a 350-500 word summary and critique of Dr. Manion's presentation. The students found the material very interesting and expressed a longing to hear and discuss more case studies.

October 30, 2001

The 1968 film **2001: A Space Odyssey** made valiant attempts to predict the future of technology. Who of us would attempt to describe the state of the world in 2035? HAL, the supercomputer and central character in the movie, is a very powerful machine capable of highly complex thought processes. In order to make astronauts more comfortable working with and relying on a machine, designers created HAL to possess many human characteristics and behaviors. This became a problem when the HAL discovers that the astronauts were plotting to turn off his power and thereby kill him. In a defensive strike HAL tries to kill the astronauts.

What responsibility do HAL's designers have in the death of these astronauts? Should they have foreseen this tragedy? This is an interesting ethical dilemma.

Dr. David Stork, an electrical engineering professor at Stanford University, wrote a book on the technology of **2001: A Space Odyssey** and was invited to LMU to speak on the subject. I required my students to attend the presentation and to write a 500 word response paper. For the paper, the students could choose one of three essay prompts. Although well written, the papers tended toward summarizing rather than tackle the more interesting link between ethics, responsibility and the development of technology. In retrospect, a post-lecture discussion would have helped the students better understand the focus of the paper.

November 8, 2001

My final foray into the world of engineering ethics was bolder and more direct. I attempted to summarize ethics and moral theory, provide a framework for analyzing and resolving ethical issues, and analyze several case studies. Small groups of 3-4 students were formed to analyze each case study. A representative from each group then presented a summary of the discussion to the rest of the class. Finally, I introduced the students to various professional codes of ethics for engineers.

Because I am not a philosopher, I expected this day to start out a bit rough. I was not surprised. In applying moral theories to resolve case studies, it was rather difficult to consider all of the possible outcomes and all parties involved. Perhaps this takes practice. Also, it was difficult to summarize ethics and moral theory in one lecture; partly because of time and partly because of my limited knowledge of the field. The students seemed to be very interested in the discussions, particularly the students who have taken an ethics course from the Philosophy Department.

The writing assignment for this lecture involved the professional codes of ethics. Each student was to choose one item in a code of ethics (IEEE or NSPE) and develop a dilemma which might arise in the field of electrical engineering. The dilemma should be constructed such that it can be resolved using the chosen part of the code. The students enjoyed this exercise, and it caused them to begin thinking about their professional responsibilities as engineers.

Course Impact Surveys

On November 8, 2001 the students completed the course impact surveys. Overall, the results were positive. One point that needs further explanation is question 7. The course material on ethics was significantly less rigorous than the other material in the course. Because of this, many students indicated that too little time was spent on ethics when completing the survey. I do not think (my opinion) the students felt that ethics was not covered adequately.