Work in Progress: Ethics and the Development of Professional Identities of Engineering Students

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Abstract - How do undergraduate students in engineering conceive of themselves as professionals? How does a course on engineering ethics affect the development of a student’s professional identity and potential for moral courage? In this project, students responded to questions about the characteristics and responsibilities of professional engineers. They identified people and experiences that shaped their understandings of these characteristics and responsibilities. They reflected on their own development of these characteristics and preparation for these responsibilities.

Index Terms – Engineering ethics, professional identity, moral courage

INTRODUCTION

What educational outcomes can we reasonably expect from instruction in engineering ethics? Students are definitely capable of reaching cognitive goals in knowledge and reasoning. Self and Ellison [7] demonstrated that in a full three-credit course on engineering ethics, the moral reasoning skills of students improve significantly.

While we may expect instruction in ethics to improve students’ cognitive skills, do ethics courses strengthen the student’s commitment to act morally? Should courses promote moral courage—not only the courage to blow the whistle, but more generally the volition to choose the right action even in everyday situations? Harris et al. [5] asserted that ethics instruction can increase the engineering student’s “ethical will-power.” Pritchard [6] hypothesized that stories of “good works” might help students develop moral commitment.

In their study of moral exemplars, Colby and Damon [1] concluded that when self identity and moral goals are aligned, people act on their moral judgments with certainty. It is logical, therefore, to precede an investigation of moral courage with a study of identity development. In this project, I studied the effect of instruction in engineering ethics on the development of an engineering student’s professional identity.

METHOD

I administered the following questionnaire to nine volunteers who had not taken a course on ethics, and to a total of 77 students in ECE 216, Engineering Ethics, an elective course for juniors and seniors, at the beginning of the Fall 2003 and Spring 2004 semesters. At the end of each semester, I asked the students how their answers had changed as a result of the taking the course.

Questionnaire (Final Version)

• What are the characteristics of the ideal professional engineer? What are the engineer’s most important professional responsibilities? Give specific examples. Explain your reasoning.
• What people and experiences have shaped your understanding of these characteristics and responsibilities? How have they done so? Describe specific incidents or actions you have taken. Possible sources could include relatives, friends, employment, courses, student organizations, etc.
• To what extent do you feel that you have these characteristics and are prepared for these responsibilities? Why or why not? How would you know that you are a professional engineer? Give specific criteria.

PRELIMINARY FINDINGS

Characteristics of ideal professional engineers

Students learned about the responsibilities and characteristics of professional engineers primarily from relatives, co-workers, and friends who are engineers. Few students cited courses as major influences. Although Downey and Lucena [3] warned that engineering education may socialize students in undesirable ways, it appears that regular engineering courses have much less influence on the development of the student’s identity than do people.

Students listed four kinds of characteristics of ideal professional engineers:
• Technical competence, including technical knowledge, problem solving skills, and creativity
• Communication skills for effective teamwork
• Conscientiousness, diligence, persistence, and a drive toward maximal performance
• High moral standards

Although the questionnaire did not mention ethics explicitly, students frequently identified honesty as an important characteristic. At the beginning of ECE 216, students who had had significant pre-professional experiences were more likely to mention moral standards and conscientiousness. Students without pre-professional
experiences were more likely to mention communication, teamwork, and accuracy.

Both groups of students stated that engineers should ensure the safety of the public. Davis [2] claimed that engineers, unlike managers, seem to be “hard-wired” with a code of ethics that emphasizes professional responsibility for safety. I believe that the origin of this attitude is not a mystery, but arises organically from the values of engineering courses and engineering practice. Engineering students understand clearly that engineers have the power to create and to control complex objects such as automobiles and aircraft, and large interconnected systems such as computer networks and electric power grids. For these objects and systems to function properly, engineers must solve technical problems correctly, as emphasized by engineering courses, because people’s lives depend on the proper functioning of objects and systems. Therefore, engineers are morally responsible for safety. A senior in computer engineering wrote,

The professional engineer ... must possess no tolerance for errors and mistakes. This is the most difficult of his responsibilities, because his work may affect the lives of other individuals or society in a ... beneficial or severely detrimental way. A glitch in his [computer] program might ... stop the artificial pumping mechanism of a heart patient, or even bring down a plane full of passengers.

Although Downey and Lucena [4] asserted that engineering students are taught to “make the self invisible in problem solving,” students—even students who have not studied ethics—are acutely aware that engineers are personally responsible for the social consequences of technical decisions.

Criteria for distinguishing professional engineers

Students used three different kinds of criteria determine whether they have become professional engineers.

- **Extrinsic markers:** has a B.S. degree, job title, P.E. license, or own cubicle; receives a paycheck
- **External approval from others:** receives a job assignment with major responsibility; enjoys recognition for technical expertise; is consulted for advice
- **Internal qualities:** understands the social implications of engineering decisions; thinks through moral problems clearly; has the courage to make good decisions

At the end of ECE 216, an electrical engineering junior wrote,

A professional engineer seeks to apply their sound moral reasoning, technical competency, communication ability, and ethical behavior to all situations they are faced with, both on and off the clock. I will know that I am a professional engineer when other people see me as someone who possesses the traits I listed above.

This student sought external validation (“other people see me”) of internal personal qualities. He would be a professional “both on and off the clock” because being a professional is integral to a person’s identity: an engineer is a professional all the time, not just at the office from 9 a.m. to 5 p.m.

**Outcomes of the course**

ECE 216 did not change students’ basic beliefs about the importance of honesty and integrity, but the course gave them concepts for moral analysis and tools for moral reasoning. By the end of the course, many students put moral reasoning on par with technical problem solving and communication skills as characteristics of ideal engineers. Several students mentioned that engineers need courage to make the right decision when confronted with an ethical problem.

Students said that ECE 216 helped them gain confidence in reasoning about moral problems. Students felt empowered when they understood that engineering work can have great impact on society. They also realized that because of their great power, they would have a commensurately great responsibility. A senior in computer engineering wrote,

I now realize that engineers have a larger social responsibility.... I now understand engineering as using technical knowledge to bring about a social change.

In conclusion, a full course in engineering ethics reinforces the students’ previous inclinations to act morally. Students expressed improved confidence in moral reasoning. I plan to explore further how students think about their professional identities and whether, in a difficult situation, that identity will give them the courage to choose the action that they have determined is right.

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**REFERENCES**


