Successful Techniques to Introduce Engineers to Ethics;

And considerations as to why this is needed

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ABSTRACT

During the ABET review of our MfgET program in 2012, a concern was raised about the lack of explicit ethics training in the program. The visitor agreed that there was some implicit training, but, being hidden inside other topics, the effect was not being measured. This finding lead to a review of degree requirements, mindful that both engineering programs would be reviewed in 2014.

As reported at the 2005 IL/IN conference, Bradley did have an "honors seminar" on engineering ethics in place offered on an occasional basis. This was entirely voluntary and not part of any degree program in the college. Hence, a new method of teaching ethics was needed.

This paper reviews the history of the seminar model (still viable) and a module model developed after the 2012 ABET/TAC visit for our MFEgT program.

INTRODUCTION

For a complete review see Kroll [8]; what follows is a summary of that work. During a faculty exercise Kroll and Anglin developed a professional ethics course for engineers and nurses. [2] This course was never offered due to administrative problems; yet a portion was used in a different setting. This author then modified the course to be offered under a different system at Bradley.

A standard honors seminar met once per week and discussed various topics in a concentrated area; but when offered some problems arose. This author found that many of the students did not partake in the discussions due to the limited time available. The course was then moved to an on-line, asynchronous format allowing the students more time to become involved in the topic at whatever time they had available. This proved very successful for the students involved. Yet, only 12-16 students took the course which was only offered at most once a year. A different method needed to be developed; such a program needed to meet our department's needs across all undergraduate programs.

There are only a few courses which all three majors of our department (BSIE, BSMfE, BSMfgT) must enroll in and transfer students from 2-year schools only are required 2 of those.

A small module was added to the senior design project, more as a refresher to an earlier planned exposure. A similar small module was added to the Introduction to Graphics course, as an introduction. A 4th or 5th (given transfer students) semester course with all 3 majors was modified to have an extensive content on ethics.

THE CHANGE

The chosen course dealt with the overall view of how engineers actually work in the real workplace, not a staged lab. The ambiguity of actual issues (a key issue) and the teaming of various expertise are emphasized. Teams have 5 joint laboratories; these are developed as scenarios vs. set situations. The team needs to develop metrics and then devise actions to improve those particular metric(s). Each team also chose a job on or near campus and developed ADA compliant job descriptions and provided some reasonable accommodations for various common disabilities. These helped in students developing an ability to understand conundrums.

A module on ethics with a team semester long analysis of a real situation was developed and replaced a QFD lab (placed in a different course.) A number of cases were taken from various sources and modified to fit the needed situation. A short chapter was compiled and added to the course notes with an extensive bibliography. (This included a significant collection at the Bradley Cullom-Davis library obtained via a CGS grant for research ethics.) A single lecture introduced the chapter and the case studies. The cases always held a conundrum which would not normally be considered in everyday life.

The lecture brought out the basis for the problems occurring in any of the cases. Loyalty of a professional, who is still a person, employee, citizen, etc., becomes a key component. (See below.)

RESULTS

The results were measured by student anonymous surveys each May. After only one semester of using this new model, the students' appreciation of ethics soared. Seniors and juniors did not think anyone had considered the topic. Sophomores, who had taken the team based problem, ranked ethics coverage 4 vs. the 1 of graduating seniors. These results continued to be measured and the 2014 EAC visit for our two engineering programs had no mention of lack of ethics training. However, the 19-20 year olds taking the course, while learning to appreciate ethics situations, complained that the process was "nasty" to say the least. Hence, the need to focus the one lecture on WHY is important.

WHY ETHICS AT ALL

The teaching of ethics is only a beginning. Why have ethics at all? One reason is the ABET requirement, but deeper we need to delve into history at a number of levels. During the classic periods of Western culture (Greek, Helenistic, and Roman [1]) a good life was considered

to be one of ethical conduct for the city-state. Also Weaver and Tate and various founding fathers of this country felt that ethics, formed by religion, were necessary to our existence as a country. This author believes we need a melding of Eliot's political philosophy with our shared, cold, heartless engineering (and sciences and mathematics.) Jordan [4] delves into such a melding of the past into a modern form of social ethics.

Livio [9] asks if God is a Mathematician. The argument echoes back to Plato and has been debated/discussed ever since. If mathematics shows there is a God; then ethics should also be found in the same manner we find/build math. Elshtain [3] asks if loyalty is involved, as this author believes it is. The problem is then who do you owe loyalty to. Any instructor trying to inculcate the idea of professional ethics to undergraduate students needs to have some idea of these underlying questions; the alternative is to be caught by some student who destroys all of the course. As mentioned in her article, Bonhoeffer [10] offers a drastic, if obvious, example of loyalty being tested by lack of ethics – A child being asked by a teacher in class if it is true that his/her father often comes home drunk. She also brings to the fore Jane Adams and her lifelong work of melding of family claims and social claims of loyalty.

As engineering educators, we need to understand how to inculcate young people with very adult ideas. This requires a gentle, yet focused approach. Given each university's situation and each program's limitations, one of these methods may be applied to meet the ABET requirements – which are based on so many of our professional societies' codes explanations.

References

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ApendixA - Partial example of chapter on professional ethics

CHAPTER 1

PROFESSIONAL AND ENGINEERING ETHICS

Why consider ethics as an engineer and a professional? Everyone reading this set of notes considers themselves reasonably, if not totally, ethical (I hope.) As a student of an important profession, the difference of personal and professional ethics covers very different areas to be considered. As a practicing engineer, to whom do you owe ethical behavior and on which areas of human interaction? Unless you own your own company, you have an employer to whom you owe some level of ethical and honest behavior. Many of the products of your engineering ingenuity affect a small or large group of the public - workers, customers, or even more; what do you owe them? Many of you have or will soon have a family to support; you will have significant income compared to the average person. Does this family obligation come first or somewhere in the middle or...well where? What does your education (while paid for dearly, think of the history of engineering and the work your instructors did to help you learn) create a duty to the world?

Besides the obligations to people, consider the topics engineers deal with in their daily work. Engineering Economics leads to a number of assumptions and educated guesses. Without funding, very little gets done in a company. Do you assume high or low so as to make your project look good - at least on paper?

While many students of engineering enjoy the control of the world such a profession provides, they often forget people are always involved. This text is aimed especially at Industrial and Manufacturing engineers and technologists. These professions cover the interface of people and things - both the worker and the work place as well as the customer and the product or service.

Why Study Ethics?

- Isn't everyone already ethical – mostly?
- But there are often conflicts among various people or groups of people.
  - Yourself
  - Family
  - Employer
  - Public
  - Customers
  - Fellow workers/employees
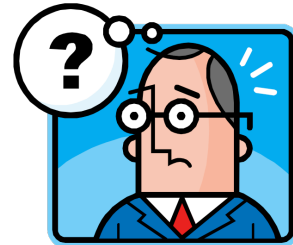
Ethical Inhibitors

- Self-deception
- Groupthink
- Uncritical acceptance of authority
- Ignorance
- Egoism

- Unsure of own ability
- Unsure of data quality
- Need to fit in
- Unwilling to seek legal advice – too confusing
- Unwilling to perform research for new/better methods