AC 2007-1759: ENGINEERING ETHICS EDUCATION AND ENGINEERING PRACTICE: A STUDY FROM A SMALL ISLAND WITH AN IMPRESSIVELY HIGH NUMBER OF ENGINEERING PROGRAMS

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She is on the board of directors of the Research Center for Water and Marine Sciences at EMU since November 2002, on the board of directors of the Advanced Technology Research and Development Institute since December 2004 and an Advisory Board member of the EMU Continuing Education Center since September 2004. She is also an active member of several committees including the Industrial Relations Committee, and the Library and Publications Committee in the Department of Industrial Engineering, and the Accreditation Board for Engineering and Technology Committee for the Faculty of Engineering.

Engineering Ethics Education and Engineering Practice: A Study from a Small Island with an Impressively Large Number of Engineering Programs

Abstract

This paper describes engineering ethics education in universities of Cyprus (both North and South) and the impact of engineering ethics education on engineering practice.

In the first phase of this study, we conducted a detailed review and analysis of curricula, elective courses and their course descriptions. Data was also collected from the national higher education accreditation bodies, the deans of faculty in the schools of engineering, and the program chairs of the respective universities targeted in this study.

In the second phase, we surveyed graduates of these engineering programs on engineering ethics education, code of ethics, awareness and knowledge of how to address ethical issues. We compared the responses of those who had received an engineering ethics course or seminar during their undergraduate engineering education to those who had not. The results were consistent with the assertion made by the Accreditation Board for Engineering and Technology (ABET) that engineering curricula should include courses in engineering ethics.

As a result of this study, an action has been suggested which targets provision of short courses or periodic seminars to increase awareness and to teach the skills on how to prevent and how to deal with ethical issues, especially for those who haven't previously received any training in engineering ethics. Another outcome of the study reflected that the difference in cultural norms and laws in Cyprus might be yet another reason necessitating professional ethics education.

Introduction

The Accreditation Board for Engineering and Technology (ABET) requires that all engineering programs they accredit or give substantial equivalency to must demonstrate that their graduates have an understanding of professional and ethical responsibility [1]. This can be achieved by offering an engineering ethics course or by incorporating ethics throughout the curriculum [2,3]. Cyprus, a beautiful Mediterranean country, has in recent years been referred to as "the island of universities" due to its impressively large number of universities despite its small size and population. Table 1 shows the universities with engineering programs in both the North and South side of Cyprus [4,5].

Aim

The aim of this study was to compare the ethical knowledge of practicing engineers who had graduated from the various engineering programs in Cyprus having received an ethics course during their training with those who had not.

Methods

The first part of the study involved collecting and analyzing engineering program curricula of universities in Cyprus. University web sites were reviewed in order to identify those with

Engineering programs. We confirmed the accuracy of this information by contacting the national higher education accreditation bodies of North and South, Faculty Deans and Program Chairs. We then conducted a survey of practicing engineers –as shown in the appendix- to find out whether they: (1) are aware of professional ethics and how it differs from personal ethics, (2) are aware of engineering code of ethics, (3) are aware of their professional responsibilities, (4) are able to recognize ethical issues, (4) know how to deal with ethical problems or considerations they face, (5) are aware of critical vs. non-critical loyalty, and (6) recognize or become part of conflict of interest issues.

Table 1 Engineering Programs in Cyprus

North Cyprus (population according to the 2006 census: 264,000 and Total Population of University Students Fall'2006: 38,912 [6])	
University	**Engineering Programs (4yr Bsc)**
Eastern Mediterranean University	Civil, Computer, Electrical and Electronic Industrial, Information Systems, Mechanical
Near East University	Civil, Computer, Electrical and Electronic, Mechanical
European University of Lefke	Civil, Computer, Electrical and Electronic
Girne American University	Computer, Electrical and Electronic, Industrial
Cyprus International University	Civil, Computer, Electrical and Electronic Industrial, Information Systems
Middle East Technical University TRNC	Civil, Chemical, Computer, Electrical and Electronic, Mechanical
South Cyprus (population: 775927, according to the 2004 census)	
University	**Engineering Programs(4yr Bsc)**
University of Cyprus	Civil and Environmental, Electrical and Computer, Mechanical and Manufacturing
Higher Technical Institute	Civil, Electrical, Mechanical, Marine
Intercollege	Broadcast, Computer, Electronics

The questionnaire was randomly administered to 10 engineers (Group A) who were known to have received an ethics course during their undergraduate education, and to 10 practicing engineers (Group B) who had not received any ethics training. This later group were known not to be Eastern Mediterranean University (EMU) or Intercollege graduates where engineering ethics training is routinely offered as part of the curriculum but likely graduates from universities abroad.

Results

The only universities offering an engineering ethics course in the North side of Cyprus was found to be the EMU and the Middle East Technical University North Cyprus campus (METU TRNC). Among the universities in South Cyprus, only Intercollege adopted an ethics course to their four year engineering program curriculum.

EMU Faculty of Engineering was highly motivated to revise their curricula when they started going through the ABET accreditation cycle. The evaluation of the two programs that applied for accreditation was successful and the Electrical-Electronic Engineering and Mechanical

Engineering programs received substantial equivalency in 2005 [5] . Ethics is a required course for these two programs and an optional course for the other 3 engineering programs preparing for ABET evaluation. Recently the civil engineering department has revised their curriculum and the new students enrolled will take the course "ethics in engineering" as part of their civil engineering education. The situation was different at the METU TRNC campus since they adopted the same curriculum as the Ankara campus.

There was a significant difference in responses between the two groups. Among the 10 participants of Group A only one failed to remember the professional code of ethics compared to 70% of Group B. The main outcome was that conflict of interest and uncritical loyalty was very common among engineers with no prior ethics training, while those with prior ethics training had difficulty knowing what to do when they recognized an ethical problem. Both groups were aware that health and safety issues should not be ignored and need to be addressed. From informal conversations with some practicing engineers outside these groups it was clear that most of the time they knew 'right' from 'wrong' ethical conduct but in practice would adapt to the so called 'existing system in the workplace'.

Conclusions

This study has shown that it is necessary to have engineering ethics as part of the curriculum for all engineering programs which is consistent with the recommendations made by ABET. We have also shown the need for ongoing post-graduate training in engineering ethics for practicing engineers. Cyprus is a small country where people know each other and the culture promotes favoring friends or doing business with people we know such as companies owned by our friends or relatives. As a result it is inevitable that "conflict of interest" and ethical issues will arise. In addition, finding a job is difficult therefore there is fear of losing one's job by mentioning an ethical issue in the workplace. Moreover the lack of laws protecting whistle blowers, even when it is obligatory to do so, is a serious impediment to taking this responsibility. It appears that even those engineers who are aware of professional ethics, after a certain period of work experience adopt themselves to what the society and their friends are expecting of them. When compared to populated and industrialized countries, because of our cultural differences, small population and the friendly environment, we propose that there be periodic ethics education for practicing engineers. This can take the form of a two to three hour seminar or one day workshop at least once a year. Future work will need to be done to identify the needs of engineers in Cyprus and to develop an ethics training program tailored to meet these specific needs. We plan to do this future work in collaboration with professional societies.

Appendix

Ethics Awareness Survey for Practicing Engineers

University and Program Graduated:
Year Graduated:
Number of years in practice:
Professional Society memberships:

1. Have you ever attended a course, seminar or workshop on engineering ethics?
   Yes □ No □ If yes which one: Seminar □ Course □ Workshop □
   Other ……..

2. Have you ever heard of the engineering code of ethics?
   Yes □ No □

3. Do you refer to or use the engineering code of ethics when making decisions in the workplace?
   Yes □ No □

4. Can a professional engineer refuse to participate in design she/he believes is against his/her religion?
   Yes □ No □

5. An engineer realizes that they are discharging waste including a chemical substance that is not regulated by the government and that it might pollute the underground water in that region. He is concerned and talks to his supervisor about it. The supervisor tells him that they are not doing anything against the law and that he should forget worrying about it. Would you do what your supervisor says if you were in place of this engineer?
   Yes □ No □

6. A Company is going to buy a large number of valves and John is given the duty to decide on the vendor. John's friend Tom is one of the vendors wishing to supply the valves. Since he likes and trusts Tom, without even looking at other proposals he immediately calls him and gives the order. Would you do the same if you were John?
   Yes □ No □

7. You are a design engineer in a company where you realize that the production department which is under your friend's responsibility has an unhealthy work environment where a couple of workers are getting ill and leaving job each year. You mention this to your friend and later to the manager but nothing changes. The manager tells you that he doesn't want to spend money on improvements. After a while you try to convince the manager again but this attempt is unsuccessful. Would you forget about the case believing that it's your friend's responsibility not yours and that you have done enough?
   Yes □ No □ If no, what would you do next?.....

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