Chapter 10
Engineering Ethics Education:
Issues and Student Attitudes

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ABSTRACT

In this chapter, the importance of engineering ethics education in engineering programmes is discussed, involving major elements that build ethics education. Definitions and concepts of engineering ethics are introduced, along with an engineering code of ethics. Ethical education in engineering programmes is analyzed, focusing on teaching approaches and the effect of science and technological development on engineering socio-ethical issues. Survey results are presented, which illustrate students' attitudes toward engineering ethics, where it is found that students' attitudes were poor. Some strategies are suggested to improve engineering ethical education in engineering programmes.

ENGINEERING ETHICS

The Oxford Dictionary (OED, 2014) defines ethics as "(1) moral principles that govern a person's behaviour or the conducting of an activity; and (2) a branch of knowledge that deals with moral principles." Professional ethics is often confused with morality, etiquette and religion, but none of these is identical to professional ethics. Ethics philosophies originated from cultural norms, but professional ethics of any disciplines is usually filtered through religious values and set of moral ideals that are shared by people of a society (Barakat, 2011). Religion is fundamental of all ethics that exist, whereby religion is the base for personal ethics. Social and professional ethics evolved from personal ethics. "God is supreme good, so the right path of every human being is always that which leads one to honor His percepts" (Basart & Serra, 2013, p.138). Professions were developed with the aspiration to protect the life beings from every activity that has been carried out by a professional, in which to protect every life being becomes the ultimate objective of every religion. Professional ethics is a set of principles that leads a person to make correct decisions without any interference from other moral and ethical elements.

Professional ethics, and especially engineering ethics, face challenges when personal and professional ethics overlap due to unclear boundaries between these two sets of ethics. According to

Harris *et al.* (2013), personal ethics are a set of rules or principles that covers personal commitments and how a person deals with others, whereas professional ethics are a set of rules about practicing a particular profession, including related legal issues. Practicing engineers must be able to distinguish between these two different ethics in order to make appropriate professional decisions.

According to Harris *et al.* (2013), ethics can be divided into three main sectors: (i) personal ethics, (ii) social ethics and (iii) professional ethics. Personal ethics is derived from religious belief, intuitions about right and wrong and self analysis (Laudon, 1995). For this type of ethics, the general rules are derived from religion. Social ethics arose due to the wide range of the influences and changes in the context of the society. Social ethics depends on human rights and law. Basart and Serra (2013) opined that social ethics is not found but it is developed from our interests as an individual in a society with the aspiration that every single should have equal rights and be protected by law whereas professional ethics goes beyond personal and social interest. It includes non-human being elements, sustainable development and systematic relations (Basart & Serra, 2013). Professional ethics is more common ethics as it involves the whole bio-sphere and the responsibility of a professional is extended out of the personal and societal contexts. "Professional ethics is a type of ethics that focuses on the relationship between individual professionals and their clients, colleagues and employers, or on collective social responsibility of the profession" (Herkert, 2005, p.374)

"Engineering ethics is a wide framework that brings most of non-technical aspects of the profession, including the professional, human and societal ones, into engineering practice" (Barakat, 2011, p.160). Lynch and Kline (2000) also state that "engineering ethics is a form of professional ethics, however, which requires reflection on the specific social role of engineers" (p.107). Engineering ethics covers the scope of engineering standards and how these standards should be applied. Engineering ethics also combines societal, economical and environmental factors in order to produce a set of rules that could lead an engineer to make decisions that protect the public interest, regardless of any pressure that they may encounter while serving a corporate organization. This ethics has been developed in a way that engineers will be more socially responsible in their decision-making; engineering ethics goes beyond legal and political correctness.

Engineering ethics covers a wide range of issues facing engineers. The issues are as following (Lynch & Kline, 2000):

1. Avoiding conflicts of interest.
2. Protecting secrets and confidentiality – trade secret and organization secret information.
3. Right to have different opinion.
4. Professional responsibility.
5. Obligation to protect public safety, health and welfare..

Engineering ethics combines the application of both professional standards and moral principles. Engineering ethics helps practicing engineers to recognize moral problems, and to understand what should be done when an engineer is in a dilemma. Many of these dilemmas involve making decisions to resolve conflicts between an organization and the public interest.

Unger (2000) reported a real case of a young software engineer who faced a problem with his employer. The engineer was setting up a computer interface in the intensive care unit (ICU) for a hospital in the US. The engineer found that his employer was trying hard to close the schedule gap by foregoing some important technical tests in order to meet the deadline and cut costs. The engineer argued with his employer regarding this

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