

HOW TO START ENGINEERING ETHICS EDUCATION IN JAPAN: FROM A NEW COMER'S POINT OF VIEW

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Abstract *¾ Important changes have taken place in engineering education in Japan. The Japan Accreditation Board for Engineering Education has presented a standard for engineering ethics, and that standard has resulted in active discussion regarding the nature of engineering ethics education. The purpose of this paper is to suggest how to start engineering ethics education in Japan. The first part of this paper will show the background of engineering ethics in Japan. Second, the paper will introduce a collaboration of engineers and philosophers that has occurred at Nagoya University and Nagoya Institute of Technology. This group has combined their expertise to discuss engineering education appropriate for Japan. Third, the details of their research will be presented. The group has determined that there are two differences between engineering ethics in Japan and the U.S. The group held a symposium to discuss appropriate ways to prepare a curriculum to teach engineering ethics in Japan to be most effective for Japanese engineering students. Finally, the paper will communicate findings from the symposium and present further suggestions on how to teach engineering ethics to Japanese students effectively.*

Index Terms *¾ accreditation of engineering education, business ethics, engineering education in Japan, engineering ethics, the study of the ethical impact of technology.*

INTRODUCTION

Important changes have taken place in Japanese engineering education. In 1999, the Japan Accreditation Board for Engineering Education (JABEE) was established to help to advance the globalization of engineering education in Japan. JABEE started administering accreditation testing on a trial basis in 2000 and was accepted as a provisional member of the Washington Accord in 2001. JABEE presented standards for accreditation that included engineering ethics like other signatories had, for example, the U.S. - based Accreditation Board for Engineering and Technology (ABET).

This acceptance of accreditation procedures implies that schools of engineering in Japan should teach their students about ethical issues in engineering. The purpose of this paper is to introduce specific methodology to start the expected engineering ethics education in Japan.

BACKGROUND

Let us discuss other pertinent reasons why engineering ethics is being built into engineering education in Japan. First, since the late 90's globalization of the engineering profession has required Japanese engineering societies to become professional societies that are similar to foreign engineering societies. Globalization accelerated the profession's adopting and revising of their codes of ethics. Second, due to domestic technological disasters in the 1990's, the Ministry of Education, Culture, Sports, Science, and Technology recommended that universities teach ethical issues of technology to students.

Together with the JABEE's standard of engineering ethics, these issues have resulted in active discussions over the future of engineering ethics education in Japan. We should note that engineers in Japan have had their own ethical standards. At the same time, globalization and domestic issues have forced both schools of engineering and engineering societies to take ethical issues in engineering much more seriously.

ENGINEERING ETHICS RESEARCH AND EDUCATION IN JAPAN

In the middle 1990's, U. S. engineering ethics was introduced into Japan and was referred to as one of the standards of ABET. A number of engineering societies wanted to be professional societies, and some faculties in the universities developed expanded interest in the ethical issues of engineering. Both groups began research on engineering ethics. Several articles on engineering ethics were written.

Since the late 90's, certain textbooks on engineering ethics in the U.S. have been translated into Japanese, and some domestic researchers have published textbooks and articles on engineering ethics. Examples of translated textbooks include *Engineering Ethics: Concepts and Cases Second Edition*[1] and *Ethics in Engineering Practice and Research*[2]. *Hajimete-no-kougakurinri (Engineering Ethics for Beginners)*[3] and *Kensetsugijyutsusha-no-rinri-to-jissen (Ethics and Practice of Civil Engineers)* [4] are examples of textbooks written by domestic researchers.

Recently, several engineering societies and some research groups studying engineering ethics have organized lectures and symposiums on engineering ethics. Examples of these events include: "On Relationships between

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Facing the global challenge

Technology and Society" (presented by the technology and society division of the Japan Society of Mechanical Engineers in November of 1999); the Symposium on Engineering Ethics, "Engineering Ethics and Business Ethics: Engineers as Employees" (held in October of 2001, and organized by the Language and Culture Department of Nagoya Institute of Technology and the Nagoya Engineering Ethics Forum with the support of the Japanese Society for Science and Technology Studies); the First International Symposium on Engineering and Science Ethics, "Perspectives on Engineering and Science Ethics in Higher Education" (given in November of 2001 and organized by the Applied Ethics Center for Engineering and Science of Kanazawa Institute of Technology and the United Center for Study of Technology with further support from the Japanese Society for Engineering Education and the Japanese Society for Science and Technology Studies).

Some schools of engineering have started to offer engineering ethics within their standard curriculum or as intensive courses. Engineering faculties, retired engineers, philosophers, and historians have participated in engineering ethics education. Examples of the subjects includes such lectures as: the lecture titled "Engineering Ethics" at Nagoya University; the lecture titled "Technology for Society" at University of Tokyo; and the lecture titled, "Society and Engineers" at Kanazawa Institute of Technology.

THE COLLABORATION OF ENGINEERS AND PHILOSOPHERS IN NAGOYA UNIVERSITY

In 2000, in order to discuss engineering ethics education that would be appropriate for Japan, engineers and philosophers at Nagoya University and Nagoya Institute of Technology (NIT) established the Nagoya Engineering Ethics Forum (NEEF) to include some graduate students and faculties of other universities. The purpose of NEEF is to clarify ethical issues of engineering and suggest engineering ethics education programs for schools of engineering. The members of NEEF have surveyed other research activities in Japan, reviewed engineering ethics textbooks in Japan and the U.S., and attended and held symposiums on engineering ethics.

What is engineering ethics?

Before presenting practical methods to start engineering ethics education in Japan, it is necessary to define engineering ethics. For example, in the U. S., the professional societies of engineering have emphasized certain social responsibilities for engineers. They have adopted codes of ethics. In the late 1970's engineers and philosophers collaborated to establish engineering ethics as a form of applied ethics. Since the 1980's, the standards of ABET have spread engineering ethics subject matter among schools of engineering in the U.S. In recent years, ABET's Engineering Criteria 2000 reinforced engineering ethics.

Engineering ethics is "defined quite narrowly as dealing with *judgments and decisions concerning the actions of engineers (individually or collectively) which involve moral principles of one sort or another* " (emphasis original) [5]. Note the following two points. First, engineering ethics is professional ethics. Second, engineering ethics is distinguished from the study of the ethical impact of technology. The latter study is concerned primarily with the study of the organized technological objects.

Differences between Japanese Engineering Ethics and the U.S. Engineering Ethics

The members of NEEF found that discussions about engineering ethics in Japan are different from those same discussions in the U.S. in two ways. It is essential to mention these differences in order to understand any examination of how to start engineering ethics education in Japan.

First, in Japan it is hoped that engineering ethics not only includes an understanding of professional and ethical responsibilities of engineers, but also a feeling or recognition of the ethical impact of technology. Only the former is included in discussions of engineering ethics in the U.S. Take the JABEE's standard of engineering ethics and compare it to the ABET's for example. The standard of JABEE supports, "an understanding of the impact of technology on nature and society, and of social responsibilities of engineers (engineering ethics)." On the other hand the standard of ABET describes engineering ethics as, "an understanding of professional and ethical responsibilities." It follows from what has been said here that we have a question to address: Is it possible to prepare students for a broader range of engineering ethics?

The second point to discuss is the fact that most engineers in Japan have a strong sense of belonging to their corporations. This sense of belonging is in rather strong contrast with the feeling of independent engineers in the U.S. Consider this statement from Hideo Ohashi (the President of the Japan Society of Engineering Societies (JSES))[6]. He notes, that Japan has been "Organization-based society," in which engineers have a strong sense of membership to their companies. In such a society, the responsibility for maintaining a reliable society is borne by the companies. JFES now proposes that society should become an "Individual-based society", in which engineers act as independent professionals. Fundamentally I agree with the proposal and the change, but society cannot evolve overnight. We should recognize from the current situation of engineers in Japan that we must devise pro-corporation engineering ethics, emphasizing the professional responsibility of engineers. The question we have to ask ourselves is what kind of relationship can we establish between a corporation and individual engineers with regard to engineering ethics?

THE SYMPOSIUM ON ENGINEERING ETHICS AND BUSINESS ETHICS

This section further considers how to start engineering education in Japan, and for that reason, I would like to introduce some answers to the questions raised in this paper. Let us examine the Symposium on Engineering Ethics and Business Ethics, "Engineering Ethics and Business Ethics: Engineers as Employees" which was held by the Language and Culture Department of NIT and NEEF in 2001.

The Department and NEEF organized the symposium to discuss engineering ethics education and explore following questions: Is it possible to prepare students for a broader range of engineering ethics? ; What kind of relationship can we establish between a corporation and individual engineers with regard to engineering ethics? A Vice College Head of NIT, two ethics officers of the private companies Matsushita Electric and Texas Instruments Japan, and a philosopher who participates in NEEF were invited to be contributing panelists. In the following part of this paper, I will summarize papers presented by the panelists at the symposium.

The answer to the first question can be found in a paper by Vice College Head, Tetsumi Horikoshi, who is a Professor in the Department of Environmental Technology and Urban Planning. Is it possible to prepare students for a broader range of engineering ethics? In his paper, "On Introduction of Ethical View Points to Engineering Education," he states that he understands engineering ethics as being a broad field and then introduces environmental education as the engineering ethics at NIT [7]. He points out that a purposeful engineering ethics is having students be aware of relationships between engineering, society, and nature. He goes on to say that NIT has a course in "Environmental Control Design in Houses and Towns" and another course in "Urban Climate and Environmental Planning." The former has students think about the current status of environment pollution, and the latter expects students to consider how to recognize and improve environmental pollution.

The following suggestion by the philosopher, Kazuhisa Todayama (Associate Professor in the School of Informatics and Sciences, at Nagoya University) could be the answer to the second question. What kind of relationship can we establish between a corporation and individual engineers with regard to engineering ethics? In his paper, "How Can Philosophers Contribute to Business Ethics and Engineering Ethics?", Professor Todayama suggests that given the present situation of Japanese engineers, engineering ethics should be integrated with business ethics in Japan[8]. If we apply the U.S.-based engineering ethics that put stress upon each engineer's individual decision directly to the Japanese engineers, it will result in laying too heavy a responsibility on an engineer. Therefore, we had better question the collective responsibility of a corporation first and then hold the individual engineer to account. He argues that the highly

theoretical question of integrating engineering ethics and business ethics is to inquire the following: "How could we justify that corporations as a legal entity have moral responsibility?" and "How should we distribute the responsibility we place on the corporation as a whole among its individual employees including engineers?"

We found that the following papers by ethics officers of the two companies at the symposium Matsushita Electric and Texas Instruments Japan revealed two points. First, corporations in Japan have approached business ethics; thus, integration of engineering ethics and business ethics is linked to success. Second, we can introduce the business ethics programs of corporations to students by providing engineering ethics education.

The ethics officer of Matsushita Electric, Kouichi Ikeda, in his paper, "Why Corporations Should Practice Business Ethics," says that business ethics has been essential to corporations in Japan, noting current social circumstance [9]. The global business climate has led to social change in values and social expectations for corporations. These days, people hope corporations give top priority to business ethics. Ikeda suggests that corporations must embrace compliance management.

Furthermore, the ethics officer of Texas Instruments Japan, Kazuhiko Ueda, in his paper, "Practice and Development of Business Ethics: in the Case of Texas Instruments Japan," presents the concrete business ethics of the company [10]. The company has an ethics office in which he works. The office conducts an ethics program consisting of adopting a code of ethics and establishing a consultation system. The code of ethics emphasizes Integrity, Innovation, and Commitment. Every employee can consult with the Ethics Office on any ethical problem. The Ethics Office investigates ethical problems, taking care to maintain confidentiality to protect the employee from possible retaliation.

CONCLUSION

Before suggesting how to start engineering education in Japan, let us summarize the differences between engineering ethics in Japan and in the U.S. First, the issue of the ethical impact of technology is seen as part of engineering education in Japan. This circumstance is in some contrast with the engineering ethics education in the U.S. where the ethical impact of technology is regarded as a separate subject from engineering ethics. Secondly, engineering ethics education is integrated with business ethics in Japan. This situation also appears to contrast with the engineering ethics education in the U.S. where engineering ethics and business ethics are separated.

How can we start engineering education in Japan? First, we can use material in conventional engineering education for teaching issues regarding the ethical impact of technology to engineering students. At the same time we should explore new fields of study and research about the

ethical impact of technology. Second, we can introduce current business ethics programs of various corporations to students in engineering ethics education. I also argue that researchers of engineering ethics in Japan should study and work to develop a better relationship between engineering ethics and business ethics.

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