Can Ethics Be Taught as a Core Competence of the Engineer?: Engineering Ethics across the Curriculum at the Kanazawa Institute of Technology

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ABSTRACT

It has been well recognized by the engineering communities around the world that the understanding of ethical and professional responsibilities is one of the key competencies (or attributes) of the engineer. For example, the International Engineering Alliance (IEA), which oversees international accreditation agreements including the Washington Accord, defined "ethics" as one of the core competencies of the engineer in their "Graduate Attributes and Professional Competency Profiles" in 2009. The other national and international engineering accreditation standards are in accordance with the IEA attributes and competency profiles. This paper describes how engineering ethics education is integrated into the engineering program with the so-called "ethics-across-the-curriculum" approach.

Kanazawa Institute of Technology (KIT), Kanazawa, Japan, is one of the largest technical universities in Japan. It is a private institution with no religious affiliation and currently has 14 undergraduate engineering departments in four colleges and three graduate schools with about 7,500 students and 350 faculty members in total. KIT was established in 1965 with three founding principles: 1) to create well-rounded citizens with good characters; 2) to be innovative; and 3) to promote industry-university collaboration. Since its foundation KIT has made special efforts on liberal education.

KIT has been recognized as a leader in engineering ethics education in Japan, incorporating engineering ethics into its formal curriculum as early as in the 1990s. The current curriculum with a number of ethics-across-the-curriculum (EAC) goals was first implemented in the 2004 academic year. It has been revised several times, but its basic structure remains the same.

As shown in Figure 1 below, KIT's EAC program consists of a number of elements which are designed and developed to achieve the institution-wide educational goal, that is, "to create engineers who can think for themselves, make well-balanced decisions, and act on them." Three required courses,

namely “Introduction to Engineering” for the first-year students, “Japan Studies” for sophomores, and “Science and Engineering Ethics” for juniors, are the core of engineering ethics education at KIT. In required engineering design courses as well as upper- division technical courses, students are exposed to ethical issues with the instructional method known as “micro-insertion,” which was proposed and developed by Dr. Michael Davis and his colleagues at the Illinois Institute of Technology.

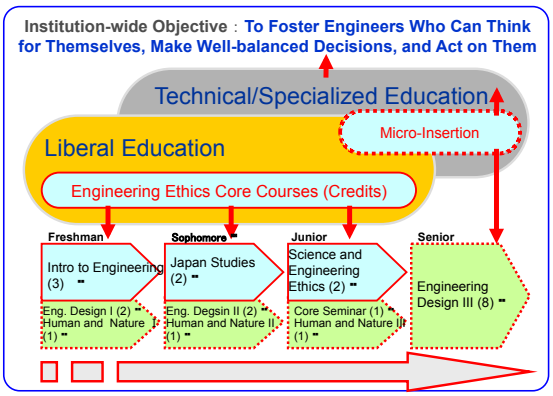

Figure 1 Engineering Ethics Education at KIT

In the junior-standing core course called “Science and Engineering ethics,” students explore various real-world ethical issues in science and engineering practices through group discussions on real-life cases. An e-learning system called “Agora,” which was developed by three technical universities in the Netherlands and adapted for the use in Japan by KIT, is implemented in a complementary style with group discussions so that every student can learn ethical reasoning in the active learning mode. (This is called “hybrid-style e-learning.”) It should be noted that about 1,500 students are enrolled in this course every year and six fulltime faculty members are responsible for this course using the same syllabus, educational materials, assignments, and exams with the same assessment and evaluation guidelines. To the best of the authors’ knowledge, in terms of the number of students enrolled and faculty engagement, it is the most extensive engineering ethics course in Japan.

In this presentation, the central elements of engineering ethics across the curriculum at KIT, including the educational objectives and contents of the three core required courses (especially the course for juniors), assessment methods, the e-learning tool “Agora,” and some other educational materials, will be described. It is intended that by sharing our experiences as well as the educational tools and materials developed at KIT, the merits and limits of teaching ethics to the future engineers with the EAC approach will be examined by our colleagues in Taiwan. It is also hoped that the paper provides the information, which might be of assistance for educators in Taiwan and Japan in creating a new model of general education for citizens in a globalized world.

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