Ethics for engineers

From obscure subject to compulsory part of the curriculum

About ten years ago ethics became a compulsory subject for most of the students at Delft University of Technology. It was a paradigm shift. Until then, ethics had long been viewed as an obscure subject, one that scientists had better steer clear of. After all, ethics is all about subjective judgements.

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A wastewater treatment plant removes certain, statutorily defined, hazardous compounds from wastewater. Other hazardous compounds exist that are not mentioned in the applicable laws. Should these also be removed? And if so, who is responsible for doing so? Should you design medical equipment that can be used to keep vastly premature babies alive, who as a result will remain handicapped for life requiring constant specialist care? What conditions can be set if you’re asked to help develop aircraft, cars, or air-conditioning units that run on energy provided by fossil fuels, thus adding to the greenhouse effect? These are the kind of questions pondered by Delft master students attending the compulsory Ethics and Technology lectures. They are not required to come up with cut-and-dried answers. Nor are the lecturers. They are not there to impose their own set of moral standards. But matters of conscience and questions about what is and what is not morally acceptable are not shirked.

Recognising dilemmas

Engineers in the making have their own responsibility and they require a certain mindset, knowledge, insight, and skills to handle this properly. The ethics group of the Philosophy section at the Faculty of Technology, Policy, and Management provides these. “We think it’s important for future engineers to start considering any ethical issues and dilemmas they may encounter in their professional career while they are still at university,” is how the Board of the University justifies the focus on ethics. It is a view that until the early nineteen nineties was far from ubiquitous. The thinking in Delft at the time was that ethics is about subjective judgements, which had to be about neutral logic. Any connection with the regular engineering education was regarded with the utmost suspicion. Philosophy classes were attended only by a handful of enthusiasts, and then without any obligations, the way a professor might occasionally consider the ethical side of his profession. Up until the Second World War, the classics were only allowed to creep into the curriculum piecemeal. To counterbalance the one-sidedness of the technical curriculum, a professor from Leiden University, J. Huizinga gave cultural philosophy lectures between 1928 and 1932. A new impulse was given in 1946 with the establishment of the Studium Generale foundation, whose many talks on such themes as religion, philosophy, art, and psychology found great favour among the students. Its foundation had been stimulated by the horrors of the Second World War, which had become so grotesque mainly as a result of the advances in science and technology.

Chairs

The need for reflection at what was then the Delft Academy of Technology about the meaning and the possible effects of the developments in science and technology in 1952 resulted in the introduction of a chair of Philosophy ‘in particular in its relationship to technology’. The chair became permanent with the appointment – in true Dutch denominational fashion – of three associate professors, Dr Ir. H. van Riessen for Calvinistic philosophy, Dr L.G. van der Wal for humanistic philosophy, and Dr Ir. F.P.A. Tellegen for Thomistic (Catholic) philosophy. There was an ‘Introduction to philosophy’ for all students, and for the more advanced students there were such subjects as ‘Technology and culture’ and ‘From technology to philosophy’. Van Riessen gave lectures in ‘philosophy'...
of technology'. Starting in 1966 Professor Dr W. van Dooren lectured on humanistic philosophy in 'modern philosophical problems'. In 1968 Professor Dr W.A.M. Luijpen at the Roman Catholic St Radboud Foundation started with lectures on philosophy in which existentialism and phenomenology received ample attention. In 1972 Delft University instituted a normal Philosophy professorship, and Professor S.J. Doorman MSc became the first professor of philosophy. Following the student revolts in the late nineteen sixties, the social sciences became more popular than ever. During the seventies, one faculty after another introduced the compulsory subject of Technology and Society, which has remained part of the curricula ever since. Philosophy lecturers also spent time dealing with the ethical aspects of technology. For example, Van Dooren considered the ethical problems resulting from the development of science and technology, and he discussed current issues with his students. In 1974 Professor Dr Ir. E. Schuurman continued the cultural philosophy lectures started by Van Riessen, using one series to focus on philosophical observations on the development of computers and cybernetics, and the growing influence of the computer on the cultural and social aspects of life in general. This later became the Ethics of Technology subject. Dr L.C. Fretz also investigated the ethical aspects of technological developments during the nineteen seventies and eighties.

**Responsibility**

The subject of Ethics of Technology was approached in a theoretical and abstract manner, remote from the daily practice of the engineering profession. For a future engineer it had little to offer. During the early nineties, Parliament and Dr Ir. J.M.M. Ritzen, the Minister of Education, Culture, and Sciences, initiated the discussion about the ethical aspects of science and technology. Prompted by a parliamentary resolution, the minister in 1991 issued the memorandum, ‘Framework for discussions about ethical aspects of scientific research’, with contributions by seven other departments. One year later, a passage was included in the Higher Education and Scientific Research Act addressing the ethical aspects of scientific research. The Board of Delft University accepted its responsibility and in 1993 appointed an advisory committee for ethical guidelines, led by the philosopher Professor S.J. Doorman MSc, to provide recommendations on the purpose, nature, planning, and methodology for the new subject. The university adopted the recommendations, and in 1995 decided that the latter stages of all curricula, i.e. today’s master’s degree, should include compulsory subjects dealing with the ethical aspects of technology, the natural sciences, and the engineering profession. In this way Delft University of Technology could contribute to the education of engineers with a professional sense of morals. In the following year, the Philosophy section was given the task of developing and teaching these subjects. By then Professor Doorman had passed the supervision of the Philosophy section on to Professor Dr Ir. P.A. Kroes. This helped to change...
the subject from an abstract course into an application-focused philosophy of technology.

One of the first

After the two-year initial phase, other faculties also started to include Ethics and Technology in their curricula. During the 1998/1999 academic year, some seven hundred students from nine out of fifteen courses were attending Ethics and Technology. This made Delft one of the first European universities to make compulsory ethics education a major item on the curriculum. With the increase of ethics education and research, and with the development of the Philosophy of Technology foundation, the Philosophy section grew from an academic staff of two in 1995 to 25 today. The development of the Ethics and Technology course made good use of the experience the technical faculties had gained with the project-based Technology and Society curriculum, which is maintained and supervised by the technology staff themselves. The course uses a technology-based approach that appeals more to students than purely non-technical courses. The Ethics and Technology department’s own staff work in close collaboration with lecturers from the Philosophy section on real-life examples from the faculty’s field. Faculty staff ensure that the content has the required level, while philosophy lecturers provide knowledge about the theory of ethics. Knowledge of ethics is required as the course focuses on the responsibility of the engineer as an individual who can be held accountable for his actions. This so-called joint venture teaching model has proved successful.

Satisfied

The master’s programmes in Biochemical Technology and Life Science and Technology, Ethics and...
Technology combines theory with practice. The first section consists of a series of nine lectures followed by a series of nine group discussions about real-life examples. The theory offers analytical models and ethical ways of thought, based on normative ethical theories and professional ethics, providing a more secure basis for considering ethical issues and sharpening students’ personal powers of moral analysis and assessment. Student participation takes the form of discussion, providing answers to questions, carrying out assignments, and participating in role-plays during fictional decision-forming processes. The second section consists of writing a thesis.

For most other university courses this subject is more limited in scope, while the second section is not compulsory.

Students are very satisfied with the Ethics and Technology classes. According to a survey conducted in 2003, 90 percent of them could clearly see the relevance of the subject to their study, while 80 percent thought the classes were useful. The general setup and teaching methods also received praise from the majority of students. The subject managed to survive the transition to the bachelor-master system completely intact in most curricula, gaining a place of its own in the highly technology-focused master’s programme. This is indicative of the appreciation from the technical faculties involved. The Delft Ethics and Technology programme is now also being taken up outside Delft.

Over the past decades, Ethics and Technology has become increasingly practical, evolving into a subject that engineers can find a use for while, instilling specific skills required in the engineering practice. The development of the real-world focus of the Ethics and Technology programme has vindicated the old belief that philosophy needs a practical application in real life.

Sustainable energy in Delft

Ever since Al Gore’s movie ‘An Inconvenient Truth’ alerted the world to the catastrophic consequences of the greenhouse effect, sustainable energy has suddenly appeared high on the political agenda. Have we only now reached the point that we can make a start with the relevant research? Fortunately, things are not as bad as all that. Over the past decade, Delft University of Technology, together with other parties has put in a lot of work. However, state funding for sustainable energy has only decreased during the same period. Although the tide now appears to be turning.

In 1996 the University Board established the Delft Interfaculty Research Centres (DIRC), the brainchild of Board member Professor Dr Ir. Guus Berkhout, whose vision it was to use the DIRC system to create a 1 + 1 = 3 research condition with pan-faculty projects.

The Sustainable Energy DIRC received initial Board funding of 5.6 million guilders (€2.54 million euro) for a period of four years. The DIRC focused on the decentralised conversion and storage of sustainable energy and demonstrated that certain problems of a material-scientific nature had to be solved.

Great progress was achieved. For example, the 3-D nanostructured solar cell was conceived, based on materials that were more economical than the expensive silicon previously used, and functional materials were discovered for rechargeable lithium-ion batteries. The company ‘Advanced Photovoltaic Applications’ is currently constructing a pilot plant in Leeuwarden and intends to commercialise the 3-D nanostructured solar cell in 2008. The DIRC also studied wind power turbines and laid the foundations for the Delft Energy Laboratory of Professor Dr Ir. Lou van der Sluis, where silicon solar panels were connected to the national grid using special high-power electronics. In addition to lithium-ion batteries, hydrogen produced from water through electrolysis using green power could also be used to store energy. Safe and economical storage of hydrogen is a prerequisite before the hydrogen economy can be introduced, and so the DIRC also focused on this issue. During its existence, the Sustainable Energy DIRC has managed to secure funds worths 135 million from autonomous public institutes as well as project-related funding.

After the DIRC period, Delft University of Technology established the Delft Institute for Sustainable Energy (DISE). The University’s Board granted funding for research into the hydrogen economy, with again a strong focus on material sciences. On 1 January 2007 Professor Dr Ir. Tim van der Hagen succeeded me as scientific director of DISE. The institute has expanded to include DUVind and the Delft Energy Laboratory to become the Delft Research Centre for Sustainable Energy.

I have managed the DIRC and DISE for almost a decade with great pleasure and satisfaction. Together with excellent project leaders I am fortunate to have been able to shape the research into the decentralised conversion and storage of sustainable energy.

The financial support given to the Sustainable Energy Research in Delft is unique and it has given Delft University a leading position in the field of research into decentralised conversion and storage of sustainable energy. It should come as no surprise that the Laboratory for Inorganic Chemistry, together with ECN, two years ago managed to secure a part in a research project worth US$ 815,000 within Stanford University’s Global Climate and Energy Project (GCEP), which focuses on clean use of fossil fuels.

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