

Engineering and social responsibility: a case-based course

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Abstract

This paper describes a teaching experience. In spring 2006, a new optional course about engineering and responsibility was started at the Universitat Politècnica de Catalunya. Its methodology was mainly based on preparation and debate of cases of ethical conflict in the engineering practice, particularly those involving social responsibility. The enrolled students attended most of the classes and showed a noticeable degree of implication and participation. At the end of the course, the students wrote, discussed, and signed a manifesto trying to summarize what they have learned during the course. The whole experience was very positively evaluated by the participant students and will also be proposed in the forthcoming years.

1. Introduction

Since the complexity of the technology and its ability to transform nature and society is continuously increasing, the responsibility of the engineers becomes more and more apparent. This fact is stimulating in the last years the existence of many debates, committees of ethics, codes of ethics, etc., which are related in particular to environment and genetic engineering but also to other areas like information technologies. That growing interest in ethics of science and technology and, at the personal level, in the professional responsibility of engineers, is also arriving to classrooms at universities. So far the two first authors had been teaching an optional STS course at the Universitat Politècnica de Catalunya (UPC) which included a subject about professional ethics. Last year the course was split in two, and we are presenting here the first implementation of one of the halves, which is focused to professional responsibility and uses a case study methodology.

The name of the course is *Engineering and Social Responsibility: Study of Cases (ERSEC)*, in Catalan). ERSEC is an optional course which belongs to the curriculum of the Telecommunication Engineering degree (similar to the Electrical Engineering curricula from other countries), but up to 5 students from other engineering curricula can also enroll on it. It is one semester long (14 real weeks), with 2 hours per week of class attendance (3 credits). The classroom is a meeting room with a large table so that all the students and teachers can sit around it. There is also a screen for projection of movies and slides. An additional room is available to allow splitting the group in two subgroups when it is needed.

The course is offered in the spring semester. The first edition took place last spring. 13 students enrolled in it (up to 20 are allowed to enroll), 3 of them coming from another

engineering curriculum: environment industrial engineering. The students were grouped in teams of two, except one of three (the three only female students!). Thus, six teams prepared and chaired the debate of 6 different cases. Additionally, the team of three students was responsible of preparing a draft of the manifesto that was discussed, modified and signed by the whole class. During the last class a poll about the course was anonymously answered by the students.

2. Aim and contents of the course

The ERSEC course aims to help students to think about the ethical aspects of the engineer profession and, in particular, the social responsibility associated to it. During the course, students have the chance to practice and further develop skills of argumentation and discussion, and they can also lead a debate of their classmates around a case of ethical conflict in the professional practice.

The main specific concepts used in the course are just a few: profession, values, moral dilemmas, and codes of ethics. However, these basic concepts were not common background at the beginning of the course. In fact, in a poll carried out during the first class, the students showed that some of those concepts were less familiar to them than it was expected by the teachers. Concretely, the term *code of ethics* was largely unknown; a moral dilemma was more a conflict between the own conscience and a duty imposed by something external to oneself, than a conflict of values; and the *ethos* associated to a profession seemed to be almost missing in their awareness.

Short notions of those concepts were given during the first classes, in an interactive class format, just to set a common ground where to build the posterior debates. Along the course, they also developed a more concrete sense of several other facts like: the role of professional associations, the involvement of ethics in the daily engineering practice, the values that are predominant in our society, the contrast between values which are only (pro)claimed and values which are really rooting our lives, etc.

3. Course program and methodology

3.1 Introductory part

The ERSEC course was mainly divided in two parts. The first part, which was 6 weeks long, consisted of an introduction to some theoretical notions concerning values, profession, ethical conflicts and codes of ethics, as mentioned above. Those concepts were initially motivated with a case extracted from real-life and daily engineering practice. This case was kindly supplied to us a few years ago by a student of a former course about STS, who underwent it when she was in her first job while finishing the last credits of the engineering curriculum; therefore, the students feel the case is not far away from their current status.

The case is rich enough and well explained so, through it, the students can envisage how engineering practice works. In fact, the author explains, in first person and with a narrative style which looks for the complicity of the reader (the listener in our case, since the text is read aloud by a few students sequentially), how the realization of a technical project evolves when unpredicted situations and human factors arise, and how the ethical values of the engineer are involved in professional situations which are quite ordinary; additionally, the

author even describes the appearance and resolution of an ethical conflict between quality of service given to the users and privacy protection.

Working in teams of 2 or 3, the students discussed in class the various aspects of that case; then, the conclusions and arguments were brought to the whole group. The teacher acted as stimulator and moderator of the debate, and also introduced in it, when appropriate, concepts or short texts from books which could help to set up the aimed common ontology and terminology.

Apart from that case, two movies were also used in this first part of the course. First, *Gattaca* was chosen to incite further discussion about values and conflicts. And, second, a documental entitled *Visions of Heaven and Hell* was used to broaden the perspective of the students bringing to the class the subject of ethics in technology development. Each debate took a two-hours class and the teachers acted in them just as moderators. Often in those classes, the teacher asked the students to play in the debate the role of defending one of two opposite positions.

3.2 Cases: preparation and debates

The second part of the course consisted of debates about cases which had been prepared by the students themselves. In fact, the whole class group was split at the beginning of the course in small teams of two or three students, and each team prepared a case, using the bibliography given to them and/or searching in the web, and also following the guidelines given by the teachers. In those guidelines, the students were requested to either look for or invent a case of ethical conflict in professional practice involving several actors, and analyze the case according to the following indications:

- Describe who are the involved actors and which are their positions and attitudes
- Determine the norms or laws which apply or can be applied to the case
- Look for the underlying values (especially those related to science and technology)
- Find the possible moral dilemmas
- Confront the case with relevant articles from codes of ethics of engineering societies
- Analyze the consequences of each position or decision
- If the case is open, look for a decision creatively and argumentatively. If the decision is already given, look for arguments.

Before starting the period of case debates, each team had to deliver to the teachers an essay about the case with a succinct and clear description of it, the analysis that had been carried out, and the preparation of the debate session, explaining in detail its format, i.e. presentation of the case, dynamics of the discussion, roles to be played by the students, decisions to be taken, etc. Four out of the six cases were fiction, though they closely followed real-life situations. Once a week, one of the teams presented its own case to the whole group and chaired the debate, acting the members of the team as both stimulators and moderators. The teachers acted as spectators of the debate, and at the end of it they gave to the students a

criticism of the development of the debate both in terms of content and dynamics. Also, at the end of each debate, all the teams other than the chair team answered a questionnaire to evaluate the task of the chair team in terms of case preparation and performance in the debate.

3.3 Evaluation

In their evaluation of the students, three aspects were taken into account by the teachers: case preparation and debate (60%), active participation in class (20%) and class attendance (20%). The peer evaluations made by the students at the end of each debate were taken as a strong basis for the evaluation of the case preparation and debate. Additionally, in the last class, the teachers requested from each student a self-evaluation that was also taken into account in the final evaluation.

4. Students manifesto

In the last class, and as a conclusion of the course, the whole class group discussed a proposal of manifesto drafted by one team. The draft proposal had been written as a very long list of duties. After discussion and voting, many articles were removed, other were merged, and other were rewritten to include all the modifications agreed by the big group; at last, only nine articles were kept. The approved manifesto, translated to English, can be found in the Annex, at the end of this paper.

5. Conclusions

The students enrolled in the ERSEC course attended most of the classes and showed from the very beginning a noticeable degree of implication and participation. At the end of the course, a poll was carried out by the teachers. In summary, the experience was very positively evaluated by the participant students. They considered the practice of argumentation and dialog as very important for their learning process. Some debates chaired by students were felt as too long, but others as too short. They also valued very much the fact of leading the debates, although they felt that six debates in a row were a little tiring. Additionally, they made some suggestions for improvement: even less time should be spent by teachers with theory, and the corresponding classes should be more practically oriented; more time spent on practicing different group dynamics before starting the case debates lead by students, etc.

In forthcoming years we will take into account those recommendations, we probably will have a more flexible course structure, and we plan to include in the first part of it the case *Incident at Morales*, using the audiovisual material produced by the National Institute for Engineering Ethics (see references).

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7. Main references (given to students)

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- National Institute for Engineering Ethics: <http://www.niee.org>

Annex. Manifesto

We, students from several engineering areas of the Universitat Politècnica de Catalunya, manifest that we will adapt our future professional practice to the following ethical principles:

1. We will carefully analyze each situation in which third-parties are affected, the possible solutions and their consequences.
2. We will inform about every effect, either positive or negative, of deployment of a product or service related to technology.
3. We will adequately respect and apply all laws, regulations, technical rules, and codes of good practice related to our profession and specialty.
4. We will consider all professions respectfully.
5. We will respect the personal and professional dignity of our colleagues and all those professionals with which we have technical relations. We will facilitate their access to training and information that can be helpful in order to do a good job.
6. We will respect dignity, culture, religion and customs of the people and communities from the region where we work that could be affected by our job.
7. We will consider gender equity as a fundamental issue and we will not tolerate any kind of discrimination. In case of gender segregation, we will take measures against it.
8. We will not perform any kind of racial, religious or origin discrimination.
9. We will acknowledge our duty with the society and the environment. If the task to be performed shows opposite to the public welfare or to the environment, we will let the company and the client know it, and we will make every effort to persuade them and achieve the appropriate modifications are made.

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