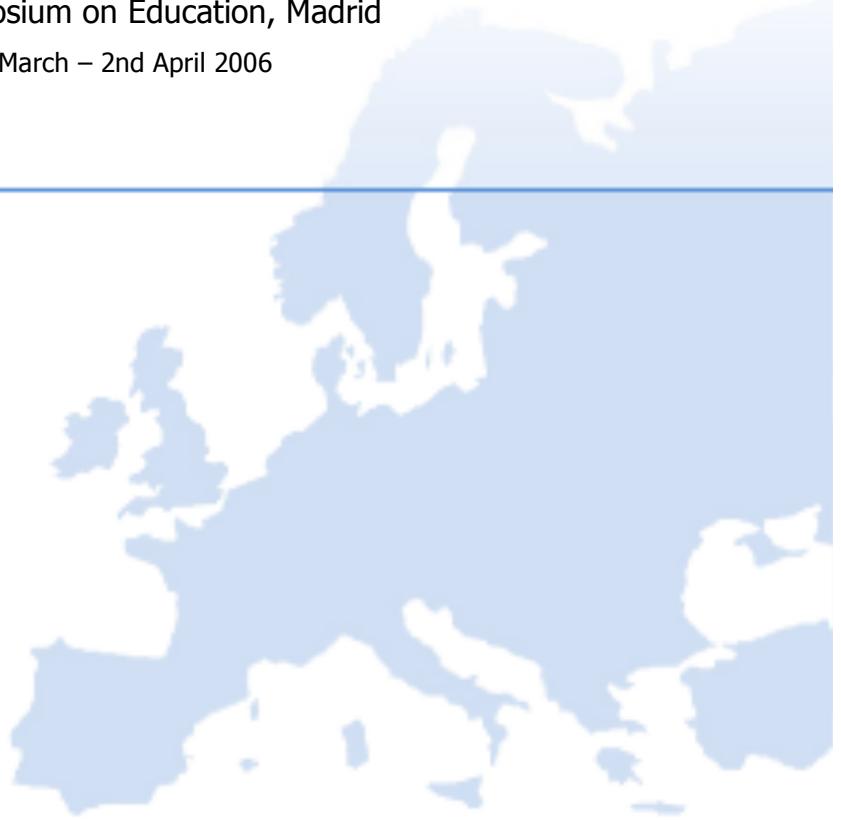

"Ethics and Sustainable Development issues in Engineering Education"

BEST Symposium on Education, Madrid

27th March – 2nd April 2006



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Abstract - Summary

A BEST Symposium on Education is a public event of the Board of European Students of Technology. This event creates a forum in which students from all over Europe can meet for one week, and state their opinions on hot topics of education during round-table discussions.

The topics vary among different educational issues: on this Symposium two main issues were discussed: ethics and sustainable development in engineering education. The Symposium was run by the Educational Committee of BEST (EduCo) and the hosting Local BEST Group Madrid. During the Symposium the discussions were held in three groups facilitated by EduCo members, and notes were taken by BEST members.

At this Symposium the participants consisted of 21 students from 14 different European countries, all in different stages of their studies from freshmen to PhDs. The participants were ensured to have sufficient background knowledge to participate actively in the discussions by reading the topic introductions provided by EduCo, by participating in the topic introductions session and the presentations where few professors and experts gave some information about ethics and sustainable development. Also, during the three discussion days of the event, case studies and talks were organised in order to provide the participants with different points of view on the two main topics.

The outcomes of the working groups will be brought to the decision-makers, so that they will have the possibility of listening to the students' point of view before changing the concept of education.

Introduction – Ethics

The importance of engineers in today's society is great and obvious. Therefore, the ethical issues they are dealing with and the decisions they make can influence the whole society and the discussion on ethics in engineering education is thus of big importance

Ethics is something everybody learns to a certain level while growing up, during his/her whole education, at home etc. So when a person enters the higher level of education he/she already has some knowledge about ethics. The discussions on this Symposium were whether that knowledge is enough for young engineers.

During the Symposium the participating students discussed about defining Ethics in general, presenting the current situation of courses on Ethics in their universities, talked about necessity of Ethics in Engineering education and the ways it should be implemented in educational system. During the discussions there have also been talks about cheating at school as an ethical issue.

The Discussion

General Knowledge on Ethics

In today's life, people learn about ethics all the time, being aware of it or not. The society, the religion, the family, the culture, the media, the traditions, everything has its influence. The awareness of ethics is on a very high level, but the level of knowledge of every person and every society is not the same. Also, common ethics are learned because of the factors mentioned above, but professional ethics are not.

It's needed to take into account the distinction between morals and ethics, ethics being the practical reflection of some morals. Morals are unconsciously learnt during childhood, but ethics are learnt at the time of confrontation with problems in life. Ethics as a field of study is universal, but the perception of ethical correctness differs in different cultures. Ethics are changing during the years because society is changing. Distinctions between personal and professional ethics also exist.

Ethics in Current Engineering Education

Talking about the ethics in current university education there are different situations:

- Complete specific course on ethics.
- Integrated in some other courses – based on the will of the teachers or part of the program of the course.
- The students are not taught ethics at all.

Even if ethics is taught in some universities, like in the first two cases, it can be problematic in some situations:

- The course is elective and not all the students are taking part because of the big number of courses they can choose.
- The material is extensively theoretical.
- Professors have no proper approach and make the course not attractive and tedious
- The methods that are used are inappropriate

Ethics in Engineering Education: is it necessary and why?

The necessity of ethics in the engineering education was corroborated by the problems faced by engineers. They will be critical about all the information they will receive. Also they will be more confident when standing up for their own opinion, resisting outer pressure if needed. The critical thinking will be raised with a background on ethics that the engineers will have with this kind of courses. Thus, in every day situations, the dilemmas will be solved in a better way and the long-term consequences of engineering discoveries will be more carefully evaluated.

Ethics also have an important role on the gaps that there are inevitably in laws and involve the responsibility of communicating with the society, of presenting, objectively, one person's own work.

Implementation of Ethics in Engineering Education

The idea of having a course on ethics was supported by all the participants, mainly not as a mandatory course but more as compulsory. More ideas on how the course should look like were presented:

- The course should give a direction of thinking that would make people more aware of their actions. By introducing a certain level of criticism, automatic behaviour would be excluded from decision making.
- Students generally would like to have interaction among all the students that enrolled the course and the teacher. It is a way through which more ideas could come up and more sharing could exist.
- The course should include: case studies, examples from real life, problem-solving methods.
- Although theory and definitions are not so attractive to students, they should exist.
- Optionally: the first contact with ethics should be before university, and it should be about general ethics and latter on professional ethics should be given at university.
- Dynamic course: as the time is changing the material should also change. The technologies are changing, so the courses should take it into account.
- The course should represent a lot of examples from real life.
- About the person(s) who will give the course there were more ideas:
 - The person should have not just theoretical knowledge but also a practical background, the person should have experience as working as an engineer or as an option, special training on ethics.
 - Cooperation among two persons: engineer who will be practical and philosopher who will be theoretical.
- Having and not having grading:
 - The grading will be a reason for bigger interest and motivation during the course. The grade should not be based on classical exam, but on the activities during the time the course is rolling and a final project.
- There was not agreement if the course should be in the beginning or in the end of the studies:
 - In the beginning: The students will learn to act even in the beginning of their studies.
 - In the end: the course would be based on the final preparation of the engineer for his/her professional work.

Miscellany

While talking about ethics, the topic of cheating on exams was brought up and generated a debate. It was agreed that unethical behaviour during studies affect future behaviour. To avoid it, a reform in the educational systems should be carried, in order to make it not worth.

Conclusions

There is a distinction between moral and ethics, as moral is something learned unconsciously and ethics is something learned by reflecting moral stands in a real world.

Big need exist for engineers to understand ethical issues that will occur during their carrier, especially as engineers are the ones making the discoveries and they need to stimulate the consequences of those. Engineers have to stand up for their positions in ethically questionable cases.

In different universities the way ethics is taught varies from specific ethical courses, ethics being part in some technical courses to not having any ethics taught to the students. In cases where ethics is taught there are some problems concerning competitiveness of teachers, and lack of practical examples. The goal of Ethical courses should be to promote critical thinking. They should be compulsory, dynamic and interactive (real cases, case studies and so on).

The teachers should have theoretical knowledge but also practical and technical experience as engineers. During the discussions there was no conclusion reached concerning when the ethical courses should be implemented (at the beginning of studies or at their end)

There was also a discussion about cheating. Unethical behaviour during studies can effect future behaviour. How ever in many universities system of exams seems to promote or at least doesn't try to stop that kind of behaviour. So the system should change in order to make it unworthy to even try.

Introduction – Sustainable Development

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It is often referred as a way to ensure survival of the mankind taking into account, economy, environment and society.

Sustainable Development is already very much part of curricula in some fields of engineering education (environmental engineering) but the question is concerning all other fields which are not directly connected to the concept of sustainable development.

Questions discussed on this symposium were on sustainable development in engineering, importance of it in engineering education, current situation and ways to improve it in future.

The Discussion

Sustainable Development in general

The awareness in our society about Sustainable Development is increasing and if we won't take it into account, we cannot ensure the survival of Humanity. The first steps have been taken, but Sustainable Development is still more discussed than applied because it often interferes with the rules of the market.

Sustainable Development is based on three pillars (economics, environment and society) and the art is to find a balance between them. Albeit nowadays the rules of the market stress more the economic aspect, those pillars are not necessarily in conflict.

Sustainable Development and Engineers

Because of the role of engineers in our society, there is a great importance of them be concerned with Sustainable Development. Engineers should not only inform the society about the impact of the technologies and make companies aware about Sustainable Development issues, but also cooperate with all kinds of stakeholders (e.g. Non-Governmental Organisations) to improve the quality of our future.

Sustainable Development in Engineering Education: how is the current situation in Europe?

Nowadays, the situation of Sustainable Development in Engineering Education is rather diverse in different fields of studies and in different countries: some people learn it already in secondary schools, while others cannot even choose it at university. When at university Sustainable Development is a part of the curriculum, then it is mostly integrated into various courses and mainly related to the environment.

In some countries one can study *Environmental Engineering*, a study programme that also takes the economical and social pillar of Sustainable Development into account.

Sustainable Development in Engineering Education: is it necessary and why?

Sustainable Development is a crucial aspect in Engineering Education to understand the impact of an engineer's professional activity on economy, environment and society. Obviously, not every pillar has got the same relevance according to a field of study¹. There was also mentioned during the discussions that

¹ E.g. the impact of the work of computer engineering on society is more important than on the environment.

engineers should be able to understand other professionals, such as lawyers, social scientist, other kinds of engineers and so on.

Sustainable Development in Engineering Education: if it is necessary, how should we implement it?

The answer on this question is not evident and the opinions of the participants were not always the same. In this section we would like to list several general accepted ideas that came up during the discussions together with the questions that are still open or there was no agreement for.

- At the beginning of studies there should be an introductory course about Sustainable Development. The participants of the discussions did not agree whether that course should be theoretical or practical. At the end of the studies, applied courses are necessary and they should be different depending of the field of study.
- Sustainable Development should be a part of the technical courses that already exist in the curricula of engineering students. There was no agreement between the participants whether professors or lecturers should get some extra training for that.
- The most appropriate learning methods are discussions, examples, case studies, projects, internships etc.
- The professional world should be involved in the teaching of Sustainable Development. They can give realistic examples, provide guest lecturers etc.
- Creativity and critical thinking should be promoted.
- When the participants were asked if teachers of Sustainable Development courses should be engineers, there was no concord. Some students were convinced that only engineers could give valuable lessons to engineering students, as other participants believed that social scientist or environment specialist could give a surplus value to the Engineering Education.
- Teachers of Sustainable Development need to have an up-to-date knowledge about the available technologies.

Miscellany

During those discussions, some other off-topic aspects were discussed. One group had got a discussion about migration and sustainability, while another one was thinking about an eco-consumption tax.

Conclusions

The awareness of Sustainable development in our society exist but more as discussion not as practical achievements. It is based on three pillars (economy, society and environment) but still today economy issues are to a certain level more important than others.

Engineers should be concerned about sustainable development by informing society and cooperating through NGOs or similar organisations.

Currently in engineering education in Europe there is a diversity of levels of implementation of sustainable development from secondary schools to not having even a choice of learning about it. There is a study environmental engineering that talks a lot about social and even more environmental aspects of engineering.

There is an agreement that sustainable development is crucial for engineering education but not all pillars should be taken to account equally, but depending on a field of study.

Implementation of sustainable development left some discussions opened. But what was agreed was:

- Introductory course at the beginning of the study

- Should be part of some technical courses
- Courses should be interactive (discussions, case studies...)
- Teachers should be up-to-date about new technologies

Not strictly related to topic there was an idea of eco-consumption tax which would partly substitute different classical taxes.

Credits

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