Session T4F

Teaching Professionalism in an Engineering Degree

Phil Picton, Alan Casey and Douglas Mills
Engineering Division, The University of Northampton, Northampton,
United Kingdom, phil.picton@northampton.ac.uk

Abstract - Professionalism has become an increasingly important subject in Engineering, as seen by the number of Engineering Institutions who have produced guidelines and codes of practice. In the BSc Engineering at the University of Northampton, Professionalism is taught as part of the final year project. Students have to produce a Management Report in which they discuss the ways in which they have applied professionalism to their project. Students are taught in a series of workshops where they produce a “tick list” of topics that they agree should be covered. These include ethics, the environment, economics, the law and safety. When they write their Management Report they select the issues that they think are relevant to their project, but in the report they discuss all topics, justifying their selection.

Index Terms – Engineering Degree, Ethics, Professionalism.

INTRODUCTION

Professionalism has become a major theme in Engineering, and degrees reflect this by teaching Professionalism in the curriculum. The Engineering degree at The University of Northampton in the United Kingdom is no exception. The degree was initially created in 1996 and from the start it has been accredited by the Institution of Incorporated Engineers. It has always contained a taught component on Professionalism as this was felt to be an important aspect of a graduate engineer’s education. However, it was also a necessary inclusion in order to be accredited. Recently the Engineering Council in the United Kingdom has stressed this even more, and currently the degree is accredited under the UK-SPEC, the Guidelines issued by the Engineering Council for the Accreditation of degrees [1]. In this document they state under the heading of Economic, Social and Environmental Context specific learning outcomes should include:

- Knowledge and understanding of commercial and economic context of engineering process;
- Knowledge of management techniques which may be used to achieve engineering objectives within that context;
- Understanding of the requirement for engineering activities to promote sustainable development;
- Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety and risk (including environmental risk) issues;
- Understanding of the need for a high level of professional and ethical conducting engineering.

What is not explicitly stated is how this should be taught and how it should be assessed. A variety of approaches can be found, ranging from stand-alone modules to distributing the ideas throughout the course [2] and even role-playing [3].

At The University of Northampton, Professionalism is taught throughout the course. Each module teaches some aspect of Professionalism in the context of that module. However, it is in the final year of the degree that students are assessed in Professionalism. Like many degrees in the UK, students undertake a final year project. This is a double module in which the student undertakes a task, such as a design of some engineering system, build it and test it. They then produce a final report on the work as well as giving a presentation of their project. In addition, they have to produce a 1500 word Management Report half way through the project. In this Management Report they discuss professionalism as it applies to their project.

Although this module is taught by the module leader (Dr Douglas Mills), the practice throughout the time that the degree has been running is for the Head of Engineering to deliver the teaching on Professionalism, and to mark (together with the Module leader) the Management Reports. When Prof. Picton took over as Head of Engineering in January 2005, the lectures on Professionalism had already been given in the previous term. However, he found that he had to mark the reports. The problem was that although the students had been given lectures, they didn’t seem to have a clear view of a) what was required of them, and b) how to apply the ideas in Professionalism to their specific projects. As a result, the structure and standard of the reports was very variable. In addition, when the marked reports were returned to the students, they were not happy with the grades because many of them felt that they hadn’t been given clear guidance. One of the main problems was that they couldn’t see how issues such as ethical or environmental applied to their projects. The lectures had discussed these issues in general terms because there were such a wide range of projects. In order to teach Professionalism in the context of their specific projects would have meant essentially giving each student an individual lecture.

It is worth noting that the range of projects is so broad because the students decide themselves what they are going to do.
About half of the student are working full time, and attend classes on a day release basis. Of the other half, they would have been on industrial placements in the second year of the course, and the majority of them continue working for the companies where they were placed on a part-time basis. Consequently, the projects are industrially based, and largely determined by the type of industry and the facilities that they have. Also, the companies are happy for the students to carry out an industrially based project, particularly if it is relevant to that company. Therefore the projects are prepared by the student, set in a company and to some extent determined by the company. Hence the broad range.

Workshops

This year, Prof. Picton was given the task of teaching Professionalism, and in discussion with the Module Leader and the Course Leader (Mr Alan Casey), it was decided to try a different approach. The approach would be to hold a series of workshops. In these workshops the students would explore the issues involved in Professionalism, and in particular discuss how they apply to their project. At the end of the workshops the students themselves would have produced a specification for the Management Report, including the headings and sub-headings that would be used. This was achieved by getting the students to design a “check-list” in which they would itemize the topics that they felt were the most relevant to their project. As this was produced by consensus, their list should contain issues which would be applicable to the majority of students, which means that they should produce Management Reports with which they would feel comfortable. It also meant that marking would be easier, since they would all be writing to a standard template, and the specification would be used as the marking scheme.

Workshop I

In the first workshop the students were introduced to Professionalism – what it means and why it is in the course. They were then told to spend some time individually thinking up examples of engineers working professionally and non-professionally. This was then turned into a “snowballing” session in which they start off by working individually to produce examples of professional versus non-professional examples. Having written down some examples they were paired up and asked to discuss their examples with their partners. The aim was to get the partners to refine their lists into one list that they both agreed on. Next, they put into groups of four, and the same process carried out again. This continued until finally a plenary session was held in which each group read out their examples. This produced examples of good and bad practice, and led to some discussion over some of the issues. For example, one group said that how the engineer presents him or herself was an indication of professionalism. This led to some debate about dress code and whether this was generally an indication of professionalism. Having reached a consensus the students were then given examples of definitions of professionalism taken from a number of Institutions. For example, some of the ones shown were The National Society of Professional Engineers (NSPE) Code of Ethics for Engineers [4], the Institute of Electrical and Electronic Engineers (IEEE) Code of Ethics [5], and a consultation document produced by the Quality Assurance Agency (QAA) from the UK which had a revised benchmark statement for Engineering [6]. All of these contained guidelines on how engineers should conduct themselves, and the students were pleased to find that most of the examples that they had come up with fitted in well with these documents.

Workshop II

In the next workshop they were given another snowballing task. This time the idea was that they would produce a checklist of issues under four main headings. The headings were:

- Economic
- Environmental
- Legal
- Ethical

Initially they were given the task of coming up with subheadings for each of those four categories. By the end of the snowballing session, they had produced a number of sub-headings. In the plenary session they were asked to refine the sub-headings so that there were three in each category. This led to a great deal of discussion as they prioritized the sub-headings. Again they were asked to consider these sub-headings in the context of their own projects. In other words, if they had to write something about their project under each of these sub-headings, would they be able to do it. This exercise resulted in a refinement of the sub-headings. It was time to reveal the purpose of the checklist.

When the students come to write their report, they would first of all go through the checklist, and indicate which of the subheadings applied to their project. After the Workshop II they would then use the sub-headings and write a few paragraphs under each one. At this stage they were still happy with the sub-headings that they had come up with so far. However, they were then told that they would also have to justify in their report why the other sub-headings that they hadn’t selected were not relevant to their project. They realized that they would have to write about all of the subheadings, even if they didn’t think that they applied to their project. Once they realized this they wanted to make a few changes to the checklist.

A fifth category was also added to the checklist which was Safety. Many of the students felt that this was an important aspect that couldn’t be ignored. In addition, it was decided that a fourth sub-heading would be included under each category which just said “other”, for projects where there were specific issues that weren’t covered by the sub-headings.

Workshop III

For the final workshop the students were each given a copy of the agreed checklist, together with a project dissertation from previous year. They again carried out a snowballing activity in which they decided which sub-headings were relevant to that
project. Thus it gave them the opportunity to see how the checklist could be used to focus in on the professional issues. The debate at the plenary was quite animated as students discussed why certain sub-headings should be included while other students disagreed. It gave the students an indication of how difficult this task can sometimes be – there is no right answer.

Appendix 1 shows the final checklist that was produced by the students.

**THE MANAGEMENT REPORT**

When the students came to write the Management Report they used the checklist first, and then used the headings and sub-headings to structure the document. This meant that rather putting effort into structuring the document, they could concentrate on the content. Most of the students checked all of the items on the checklist. When asked, their argument was that they thought that all of the issues were relevant, and it was easier to write about how an issue is relevant to their project than it was to write about how it wasn’t relevant. So in some cases these issues were discussed even though there was not much that they could say.

As usual there was a range of quality, but the task of grading was much easier than previous years. The poorer reports tended to fall down because the students hadn’t followed the structure of the sub-headings. Consequently the discussions in the reports tended to be unfocussed and often fudged the issues.

The marks (in percent) of the student ranged from the lowest of 48% to the highest of 82%. The average grade was 58%. Last year the highest score was 72% and the lowest was 43% with an average of 56%. The grades were therefore not much different, with a slight improvement this year. However, there was a much greater satisfaction from the students as they had a much clearer understanding of how those grades had been calculated.

**CONCLUSIONS**

Overall the approach to teaching Professionalism by a series of workshops helped to engage the students in the discussion, and in particular gave the students a feeling of ownership of the problem. By getting the students to design the checklist the students felt that the issues relating to their own projects were being addressed, rather than some general ideas of Professionalism. In a follow up questionnaire the students rated the module highly, and made specific reference to how much they liked the Management Report. So overall the students were happy with the process.

As for the staff involved in marking the Reports, they were happier with the standard of the reports and said that the common structure made it much easier to grade the work. The range of grades was slightly higher than the previous year, but at least the students appreciated how the grade had been arrived at, and this year there were no complaints from the students.

The same approach will be taken next year, so it will be interesting to see what checklist the students produce in the Workshops and how it compares to the one produced this year.

**REFERENCES**

[1] UK-SPEC, 2004  

<http://engr.calvin.edu/ces/ceee/schimmel.htm>


<http://www.me.ttu.edu/Home/Class%20Websites/M E%201315%20Intro%20to%20Mech%20Engr/NSPE%20C ode%20of%20Ethics.php>

<http://www.ieee.org/portal/pages/about/whatis/code.html>

### BSc Engineering
Management Report for the Final Year Project

#### Appendix 1 Checklist

Tick all of the boxes that are relevant to your project.

**Economic**
- [ ] Quality versus price
- [ ] Cost of ownership e.g. cost of building, running or disposal of system
- [ ] Is it economically viable
- [ ] Others

**Environmental**
- [ ] Disposal of waste material at end of life or during manufacture
- [ ] Recyclability
- [ ] Energy efficiency
- [ ] Others

**Legal**
- [ ] Regulations and standards
- [ ] Patents and copyrights
- [ ] Contractual obligations and confidentiality
- [ ] Others

**Ethical**
- [ ] Impact on surrounding (including people)
- [ ] Does it actually do what was intended
- [ ] Plagiarism
- [ ] Others

**Safety**
All reports should discuss safety.

Attach this checklist to your management report. In your report you should discuss all of these points, indicating why you think they are relevant to your project or why they are not relevant.