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## Teaching sustainable product design

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## Teaching Sustainable Product Design

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Tutors in Study: Allen Clegg, and Shahin Rahimifard, Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University

Subject Area: Sustainable Design

Study Completed: May 2005

This case study has been developed from data gathered through a demonstration of the teaching and learning materials available, interviews with the tutors and a student focus group.

### Background

Sustainable Product Design is a final year module on the MEng Product Design and Manufacture degree at Loughborough University. The module comprises of 11, 2 hour lecture periods (of which only 7 are used for formal lectures and, where possible, week 7 is given by a guest speaker as a link to the project), a group coursework project and an end of module exam. The lecture series covers Life Cycle Assessment (LCA) and introduces students to the various aspects of Life Cycle Analysis as well as tools and software that can be used to assess the environmental impact of the materials, manufacturing processes and disposal of the artefact after use. At the end of each lecture a short exercise is posted on a Discussion Board and students are asked to submit their views and encouraged to debate points with their peers. A website was produced to provide video clips and PowerPoint presentations from industrial collaborators, along with access to library resources, tutorial questions and answers, past exam questions and answers and lecture PowerPoint presentations.

Students are set a coursework project to “apply Sustainable Product Design principles and Design for the Environment practices to the re-design of an artefact.” Industrial customers provide the artefacts and this year’s groups are, for example, looking at the manufacture and assembly of light units from JCB and Jaguar. Students are expected to propose design modifications that reduce the environmental impact of the artefact throughout its life cycle, to give an oral presentation of these ideas to their industrial customers, staff and peers in week 12, and to produce a technical report.

The module was originally developed and taught by Allen Clegg with the knowledge that once it was established the materials and teaching would be taken over by Shahin Rahimifard.

### Reasons for introducing this teaching method

The Royal Academy of Engineering Visiting Professors’ scheme was designed to develop teaching materials, based on case studies, which would enhance both the understanding and the practice of teaching sustainable development. Through the tutors’ engagement with the Visiting Professor at Loughborough University, the department wanted to increase the exposure of undergraduate students to sustainability issues and identified the MEng course as one vehicle for this. Through the engagement of a number of academics as project supervisors it was hoped that the dissemination of the principles across the department would also be improved.

### **Lecturer's perspective**

The tutor wanted to “mix formal lectures with practical work, and started with the concept of an industrial project which was put into practice through the knowledge gained in the lectures”. A single company supplied the projects for the first year that the module was run, but as the class sizes increased other industrial contacts have been used to bring in additional project artefacts.

From the outset the tutor's approach was prompted by the relative maturity of the small final year groups of MEng students, the majority of whom had undertaken industrial placements. Handouts are provided with the formal material that needs to be covered, not all of which is covered in the lectures, along with questions based on case studies for them to discuss in their project groups. “It gets them talking between themselves and arguing their cases within the peer group” and the tutor feels that this is “more beneficial than just listening to me lecture”.

### **Students' perspective**

The students thought that overall the content of the lectures was good and that the tutor was very thorough, talking about “how to apply it, rather than just the theory”. They welcomed the use of case study examples in the teaching but would have liked to use these further to increase their understanding of how to apply the tools and techniques covered in the lectures. Having previously completed a module on manufacturing for the environment, the students felt that they had been provided with a background to the material presented in this module and the pace of the lecture series could have been increased. This would have allowed them more time to work on the case studies and to go into more depth in their coursework assignments, which the students saw as key to their understanding of the principles presented in the lectures.

The students had learnt that “designing for the environment does change your approach to things” and saw it as teaching them about responsible design. They felt that an awareness of sustainable design was a valuable tool to have, “If every engineer has to start to think about design for the environment then why do only the masters students do it?” They also found it frustrating when conducting projects in other modules with mechanical engineering students who had not studied the module as these students thought that considering design for the environment was a “load of rubbish!” Students also suggested that all of their tutors would benefit from completing the module!

### **Issues**

As it was envisaged that the module would be delivered to small groups of relatively mature students, the format was based on that used to deliver short courses to mature industrial delegates, i.e. one that encouraged ‘delegate’ input. Each group is assigned a project supervisor within the department who has expertise in sustainable design. This year there were 4 groups of 3 students and each completed a project on a different topic. However, it might not be practical to find a sufficient number of different projects and supervisors for larger class sizes.

### **Benefits**

The use of real projects meant that the students engaged with the material presented in the lectures and saw the topic as “interesting rather than boring”, and the industrial case studies provided a link between the lecture course and the group projects. Students had developed an appreciation for the growing emphasis on sustainable and environmental design and, with recent changes in legislation, felt that it would be beneficial if the module was covered earlier

in their course so that they could apply the principles and knowledge throughout their degree.

## Reflections

One student commented that it was “really interesting to be learning something that’s so new”. The tutors were seen as being “genuinely interested in the subject” and students valued the “real effort” that was put into the module.

The assessment results for the last 2 years have given an average final module mark for each student of over 70% and the tutors see this as reflecting the high commitment the students place on the module and the value placed on the interaction with industry. The students felt that they learnt a lot from completing the coursework and were unsure what more they would gain from completing an examination in the subject “because everything we have been taught relates to the coursework for the module”.

Following this year’s delivery of the module three modifications are planned for next year. The first is the introduction of more user-friendly LCA software to accelerate the students’ learning curve. The second is the introduction of the group project topics in week 4 rather than week 7 to focus their commitment at an earlier stage. Finally, the tutor will introduce tutorial sessions in response to the students’ desire for more time to be spent on consideration and discussion of the case studies.

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