Teaching sustainability in engineering solutions as a generic bachelor course

Engineers have the potential to significantly influence the sustainability of technological solutions. At DTU we aim to address sustainability to all engineering students at DTU. One of the means to address students throughout DTU is the establishment of a course aimed at bachelor students from all of the university’s study lines. The objectives of the course, which is named “Sustainability in engineering solutions”, is for the participants to acquire an understanding of the basic concept of sustainability and its three dimensions (people, profit, planet), as well as to get an overview of a number of tools for the analysis of problems and the synthesis of solutions that are sustainable throughout their life cycle. The course ensures that the participants acquire the skills to use the most central of the tools introduced. Furthermore, the participants should understand the engineer’s role and responsibility in the development of sustainable solutions. Examples of learning outcomes are:

• Describe the three dimensions of sustainability
• Explain that each dimension is multifactorial and discuss the trade-offs that exist within and between them
• Illustrate how companies can work towards the development of sustainable solutions
• Know and use various simplified tools for use in sustainability assessment
• Be able to relate critically to the results of various tools.

The course runs over a three week period, where the students work full time on the course. It employs project-based learning and is organised around a theme, within which there are several subprojects/-problems that the students work on in groups of 4-5 persons. The theme in 2011 was “everyday appliances”, in 2012 “the sustainable primary school”, and in 2013 “the sustainable campus”. In 2012 the students worked together with a primary school interested in improving their environmental performance and in which they could do some empirical work. Several sub-projects were suggested and 5 were chosen: heating, water use/supply, use of electronics, cleaning, and ventilation. Similarly in 2013 they worked with DTU Campus service who defined a number of projects. The general outline of the course (especially in the beginning) is that theory lectures and exercises are given in the morning and the afternoons are fully devoted to project work, applying the theory learned in the morning. As the course progresses and after the front-loading of large amounts of the course material, a number of the days are fully devoted to project work with supervision. Several milestones for the project are defined, where the students should present their work. The students are evaluated on their project presentations and final report, plus a multiple-choice examination, to test their theoretical understanding.

This paper takes an in-depth discussion of the considerations concerning how to teach such a complicated subject to students of widely differing backgrounds, and reflects both the teachers’ and the students’ experiences with the course.