

## CURRICULUM DEVELOPMENT FOR PROJECT-BASED ENGINEERING EDUCATION: HOW TO INCLUDE SOFT SKILLS

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### INTRODUCTION

The implementation of project-led engineering in a Production Engineering Course at the University of Minho, led to a number of questions on curriculum design for the inclusion of soft skills in the curriculum. Project-led engineering education is recognised as an important tool to improve quality of learning in engineering education. In this type of project-based learning, subjects are integrated and knowledge and skills are built up by students in interdisciplinary projects [1]. Project-led education avoids fragmentation of content into separate subjects that are not clearly connected and is recognised as a way to provide a coherent course programme. Students work in teams on the solution of an existing engineering problem that reflects their future professional practice and integrates technical competencies of different scientific areas. Not only they have to fulfil the requirements of the projects and show that they have found a feasible solution for the problem, they also have to show that they have obtained the competencies in the different subject areas that are related to the project. This kind of education asks for the development of skills that are less emphasised in traditional education, like team work and communication skills, and involves a much more integrated problem approach compared to a system in which subjects are taught in isolated parts.

### BOLOGNA AS A MOTIVE FOR PROJECT-BASED LEARNING

The Bologna Declaration is usually referred to as a document aimed at the demand for greater compatibility and comparability of systems of higher education within Europe. The European Higher Education Area should become more attractive and competitive and a more easily readable system of higher education throughout Europe is supposed to facilitate the harmonization of courses in higher education. Apart from the process of restructuring courses into a two tier structure and translating the student workload into ECTS credits, the Bologna Declaration was also the start of changes in the area of quality of education and the broad introduction of the concept of lifelong learning. The Prague Communiqué of 2001 highlights the importance of lifelong learning strategies, whereas the Berlin Communiqué of 2003 emphasises the importance of the knowledge based society (Furlong, 2005; Wächter, 2004). These fundamental changes of views of education in general and on higher education more specifically imply profound changes in teaching and learning. Higher education is no longer mainly teacher oriented, but focuses on the student as the one responsible for his own learning process. Being responsible for his own learning already during the engineering course, a

student develops competencies that enable him to steer his own learning throughout his life. In a curriculum aimed at lifelong learning, students do not only acquire 'technical competencies', but also skills needed for sustained participation in the knowledge society. Project-led engineering education is a response to the demands that are put forward by the Bologna Declaration, as the autonomy of the students is encouraged to solve multidisciplinary problems. Although the integration of different areas and the stimulation of effective study skills in early university education and more advanced professional skills in later university education are recognised by lecturers and professional bodies as valuable, the soft skills are regarded as difficult to teach and complicated to integrate in an engineering curriculum.

### SOFT SKILLS IN THE CURRICULUM

Lecturers agree on the importance of the inclusion of other than technical competencies in the engineering curriculum, but there are no general guidelines on what this means in practice and they are in general not prepared for instruction and assessment on soft skills. As a result of the lack of guidelines on the inclusion soft skills in project engineering curricula, a number of difficulties can be identified. In the first place, it is not clear for students what is expected from them with regard to other than technical competencies. There are no clear criteria for performance with regard to the soft skills. Therefore, it is complicated to assess students with regard to these competences. Having no clear assessment possibilities, the non-technical competencies of project work may remain undervalued, although they are an important aspect of the added value of project-led engineering education, compared to traditional education.

### A CASE STUDY: PRODUCTION ENGINEERING AT THE UNIVERSITY OF MINHO

The Production Engineering and Management course of the University of Minho in the north of Portugal is working on the 3<sup>rd</sup> edition of a project-led semester in which each subject contributes to a project. Because of the curriculum reforms due to the Bologna process, a number of first year teachers started to redesign the first year into project-led education three years ago. The full paper will discuss the difficulties of the inclusion of soft skills in a project-led engineering curriculum at the course and identify questions to be raised at curriculum design level.

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#### References

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## COMBINING EDUC.

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### INTRODUCTION

Learning to design can be on a student's own experience (teacher), and knowledge of others (the experience of others (the well as knowledge from. Design processes can be has to be made; for many be founded on (empirical by Schön, [1]) is a pe However, only learning b A starting student decide own experience to the st own experience, and on e However, design educat acquiring knowledge and curriculum. At Delft Facu education. In the full paper The essential elements of results will be outlined in

### DESIGNING: A COMP

According to many autl consisting of successive phase, the solution should solutions at a more detailed As other processes of pro as well, can be described objectives and constraints) against the requirements (c The cyclic character is ap against the requirements. During the process, the c experience by repeating solutions will extinguish.