The innovation element of the diploma (b.eng.) programs at DTU

In September 2014 the first version of the newly developed CDIO-based diploma (B.Eng) programs were launched at DTU (Nyborg et al., 2015). The programs are the result of a comprehensive merger process of former diploma programs, namely the programs at Engineering College of Copenhagen (now DTU Diploma) and the Technical University of Denmark.

The most significant new activity in the programs is the introduction of a common 10 ECTS compulsory course in innovation in the later part of the programs. The idea behind this course is to give students the opportunity to collaborate on interdisciplinary real-life projects.

This course strengthens not only innovation skills but personal and interpersonal skills as well. In this paper we will discuss the organization of the Innovation Pilot course. In particular we focus on:

- Structure of programmes
- Organization of the Innovation Pilot course
- The didactical considerations
- Scaling up the course from 50 to 500 students

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Design considerations regarding the development of an interdisciplinary engineering innovation course involving collaboration with small and micro-sized companies

This paper discusses some of the issues and dilemmas that have come up when designing courses aimed at teaching innovation competencies to engineering students through means of authentic industry collaboration with small and medium sized enterprises (SME).

The paper is focused around the phase of designing the course SME Innovation and Intrapreneurship where the aim has been to create a match between the company need for short, result oriented innovation projects and the structured
professional and interdisciplinary learning goals for a coming bachelor of engineering. The main dilemmas in the development have evolved around the concept of bridging real-life with a university learning context, the question of how to change teaching and exam structure to support new and different learning objectives, as well as the challenges of handling interdisciplinary teams.

The 13 week, 10 ECTS credit course is structured around a shorter project-period of challenging the problem proposed by the company and building the relations among the students necessary to generate innovation and a longer project-period dedicated solving the engineering challenge.

The CDIO (Conceive — Design — Implement — Operate) pedagogical framework has been used to design the project, and the paper will include considerations on design of the course and experiences with SME-collaboration as well as interdisciplinary collaboration between the students.

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**Design of an interdisciplinary engineering elective scoped around collaboration with Small Medium Sized enterprises (SME)**

To acquire the right competences as an engineer in the 21st century1 ((King, 2007), you need to be able to work inter-disciplinary and learn the necessary innovation methods and tools2.

This paper will strive to answer some of questions identified in the progress of developing and implementing a real life setting elective course, involving small and medium sized enterprises (SME) in engineering education. How do you engage with companies without compromising the learning outcome? How you manage the expectation from the companies and still maintaining the student responsibility for the problem solving? Do the interdisciplinary teams add value for the SME?

The elective SME Innovation and Intrapreneurship has been developed by DTU Diploma a department of the Technical University of Denmark. The department is mainly responsible for the education of the degree Bachelor of Engineering which is a 3.5 year long engineering education building on engineering industry practice as its core. All BEng educations build on the CDIO (Conceive-Design-Implement-Operate) as the overall teaching paradigm3. The development has been funded by the Danish Foundation for Entrepreneurship, and is seen as an experiment in the process of transforming the department into a hotspot for engineering innovation and entrepreneurship. Alongside this a much bolder step of introducing innovative competencies as a general intended Learning Outcome for the whole education4. The driver of this change will be the introduction of a compulsory 10 ECTS element with focus on interdisciplinary and industry collaboration for all Bachelors of Engineering at The Technical University of Denmark in 2016.

As collaboration partner the elective has chosen to work with small and medium sized enterprises (SME) as more than half of the value added to the European economy comes from the SME’s and around half of all employees work in micro or small businesses with less than 50 employees5. At the same time the barriers for university collaboration with SMEs are somewhat steeper than working with larger organizations6. The paper will focus on the SME cooperation and proceed with an introductory explanation of the current course, how the course has been scoped including the theory behind and how the company cooperation has been developed. Finally it will bring a discussion about preliminary results (as the course is ongoing) and recommendations for the future.

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Business oriented educational experiments enhance active learning by engineering students

It is generally agreed that one of the keys to recreating industrial growth after the financial crisis is to mobilize universities and engineering schools to be more actively involved in innovation and entrepreneurship activities in cooperation with industrial companies. This active learning exploration symposium on bridging the gap between engineering education and business is proposed on the basis of the Copenhagen University College of Engineering (IHK) being involved in a DKK 50m ongoing project “Business Oriented Educational Experiments” financed by the Capital Region of Denmark and the European Social Fund. The project is carried out with other major educational institutions in the Copenhagen area and organized in five themes: 1) world class competences, 2) new interactions between education and business, 3) the experimenting organization, 4) education on demand, and 5) new career paths. IHK is using this opportunity to developing the concept of a Center of Innovation and Entrepreneurship (CIE) building on a long tradition of close cooperation between industry and engineering students concerning internships, semester projects and bachelor projects. By further developing this tradition the CIE concept is put into shape as an innovation and information hub for SMEs and start-ups where students, professors and companies can meet, share information, and embark on innovative projects creating practical solutions that are immediately applied in business. Obviously, all parties should harvest benefits from the CIE activities: Businesses execute innovative solutions, students practice active learning and build a platform for their future professional career, and professors leave the classrooms and get an opportunity to reality check their theories. CIE is operating on a network platform made up of major regional players in the innovation and entrepreneurship value chain including close cooperation with major players in the area of technological research, development, and service. Thus, the scale, scope, and quality of the IHK study programs as well as the active learning part is significantly enhanced.