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Educating engineering designers for a multidisciplinary future

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A changed situation for engineering designers

Contemporary companies on a global market are experiencing constantly changing business demands and increased competition. Increasing focus in product development is now put on issues like understanding users and their needs, the context where users' activities take place and creating sustainable solutions (McAloone, et.al., 2007). In manufacturing companies, engineering designers play a significant role in realising what is captured in these words.

Future engineering designers will hold wider responsibilities for such tasks (McAloone, et.al., 2007; Larsson, et.al., 2005), thus challenging current engineering design education. Educating engineering designers today significantly differs from traditional engineering education (McAloone, et.al., 2007). However, a broader view of design activities gains little attention.

The project course *Product/Service-Systems*, which is coupled to the lecture based course *Product life and Environmental issues* at the Technical University of Denmark (DTU) and the master programme *Product Development Processes* at the Luleå University of Technology (LTU), Sweden, are both curriculums with a broader view than traditional (mechanical) engineering design. Based on these two representatives of a Scandinavian approach, the purpose in this presentation is to describe two ways of educating engineering designers to enable them to develop these broader competencies of socio-technical aspects of engineering design.

Product Development Processes at LTU

A process, called Participatory Product Innovation (P²I) underpins the master programme Product Development Processes and originates from the Design for Wellbeing (DfW) framework (Larsson, et.al., 2005). This is an inclusive framework which seeks to bring together business, human issues and technology in a comprehensive approach to support the creation of tomorrow's innovations. A main principle is that many different disciplines should contribute to spur innovation by collaboration across disciplines (Larsson, et.al., 2007). The P²I process starting position is in Needfinding (Patnaik and Becker, 1999), where the students conduct observations and interviews to gain access to qualities in the users' context. An identified challenge here is to keep people in view and not jump into conclusions, i.e., to understand a situation perceived by its actors as problematic and to widen the design space.

Product/Service-Systems at DTU

Besides the teaching of traditional engineering skills, the curriculum for the project course aims to build up multidisciplinary competences such as understanding the socio technical aspects of product design and synthesis of products and delivery systems. The students are assigned to redesign an existing physical product, such as a washing machine, and turn it into a product/service-system. The main objective for the project is that the resulting solution should have a substantially lower environmental impact whilst maintaining a similar functional performance as the initial product.

The student teams are first guided through an analysis of the initial product's product life cycle, yielding insights into four aspects of product design:

1. identification of current environmental impacts,
2. life phase systems the product encounters,
3. activities that involve the human actor (i.e. customer) and the product,
4. actor-network that support and supply these activities throughout the product's life.

Based on the analysis, goals are set for the improved solution and concepts are developed for a new product/service-system. This way the students are lead through engineering and socio-technical analysis tasks and thereby laying the foundation for their synthesis work in the concept development phase of the project.

Concluding Remark

By emphasising socio technical aspects in a process model or in a project course, the students are more likely to consider users, their context and sustainable solutions. This we see as essential competencies in product/service-system design and functional product development.

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