Learning and Leadership

A combined mathematics teacher and engineering education

Introduction

Chalmers university of Technology, an highly regarded educator of engineers in Sweden, offers engineering students interested in mathematics education to simultaneously study for both an engineering degree and a teacher degree. The double degree enables the students to work in both sectors during their working life and hopefully transfer knowledge about learning and leadership between the two .

Objective

To educate ...

… upper secondary school teachers in mathematics and physics, chemistry or technology, having the knowledge and understanding of how mathematics is used in engineering applications.

… engineers well qualified in communication, leadership, and in organizing learning situations to develop skills, competencies and abilities of people in industry and business.

By recruiting ...

... dedicated students with a bachelor degree in engineering, that have a genuine interest for mathematics and applications.

... a group of students that that not necessarily knew that they wanted to become mathematics teachers when they started at university, but that have developed an interest for learning, maybe while helping friends or working as teaching assistants.

To offer

… the industry engineers with soft skills that is often asked for, communicative skills and knowledge about group dynamics.

… the Swedish schools capable teachers with a complementary profile. More on the craftsmanship and application.

… the students the freedom of choice giving them the possibility to work in school or industry, depending on preferences or conjunctional effects on the job market.

Method

Selection process

To identify engineering students that are likely to succeed in the class room and in other learning and leadership roles, and to ensure a good match between the students goals and the program goals, we use a selection process based not only on student achievements . The process is inspired by Teach for America and includes giving a short presentation and an interview.

Masterteachers

Excellent teachers from upper secondary school are contracted part-time to be involved in the program. They are involved in all courses in the program sharing experiences from class room reality, ensuring pratical value and coherency between courses. This is inspired by Uteach.

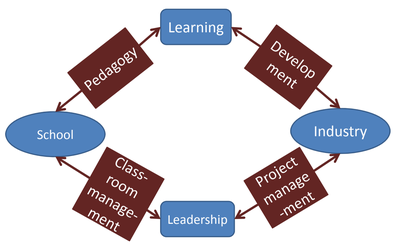
Involve industry and school

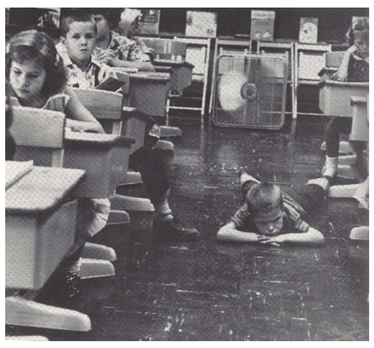
Representatives from both industry and school are associated to the program to ensure that the right competences are in focus and that the students will be winners on the job market.

Learning and leadership

Important in both school and industry

Both as a teacher and as an engineer knowledge and skills in the fields of learning and leadership are of great importance. In both sectors it is important to be able to help people, staff or students, to be motivated, to learn and to develop their knowledge.





The teacher is a leader

Leadership is not only for the principle, but also important for teachers in the class room. Among other things its about helping the students to see their own potential and to aim for high academic goals

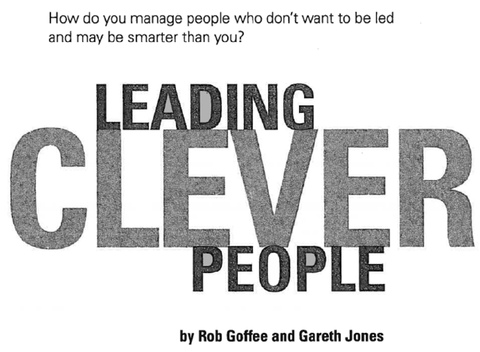
Learning in industry

To ensure a market place modern companies must resolve the learning dilemma.

"Every company faces a learning dilemma: the smartest people find it the hardest to learn."

Working with learning in high-tech and know-how companies requires expertise in how to create learning environment to develop the competences among the staff.

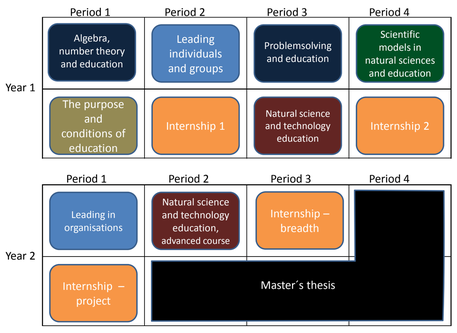
Pedagogical dimensions of leadership



Smart people, that are great assets to their company, know their value and are ready to move on if they are not engaged intellectually. Hence, they require leadership that, like the a good teacher, manages to guide the energy and efforts in a direction that is meaningful and beneficial for all.

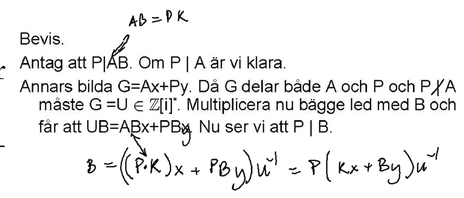
Mathematics and learning

Mathematics education and mathematics are integrated. The student's own learning of mathematics is the base for their studies in mathematics education, guided by mathematicians, mathematics educators and master teachers in collaboration.



Algebra, number theory and education

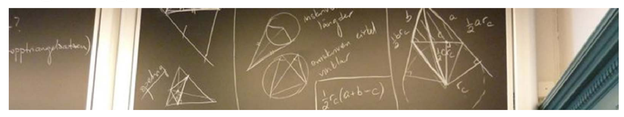
The mathematical theme of this course is algebraic structures and basic number theory. The mathematics is used as a vehicle for practicing teaching and feed back skills.



This is the first course in the program and starts from practical aspects of teaching, as case-based studies, using the work of Merseth, and by arranging many opportunities for the students to present mathematics, not only for each other, but also for the general public, and to practice on how to get and give feed-back on each others teaching.

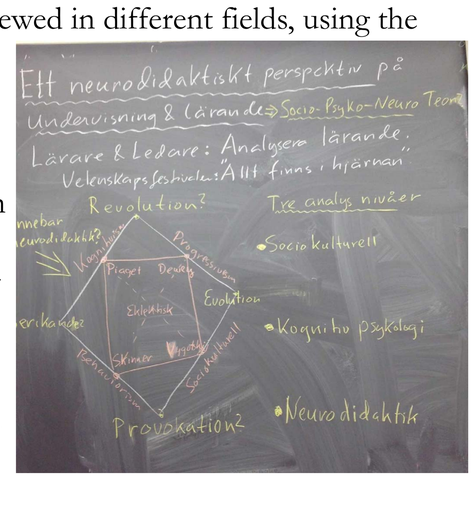
Problem solving and education

This is a course about problem solving. Practical problem solving is taught while studying geometry, mainly classical but also spherical geometry. This is integrated with studies of strategies for problem solving using the work of Polya, Shoenfeldt, Posamentier and Krulik.



Scientific models in science and education

In this course the concept of scientific models are discussed, how models are used and viewed in different fields, using the work of Lundh and Gerlee. Mathematical models are studied and the students do a project where they model a phenomenon of their own choice. A number of different models of human learning are studied on three different levels of analysis: socio-cultural level, cognitive psychology level and neuroscience/brain level.



Conclusions

The masterprogram Learning and Leadership, offered as part of the 5-year engineering program, leads to both an engineering and a teachers degree in mathematics and chemistry, physics or technology for upper secondary school. Courses integrates mathematics education and mathematics. There is a progression starting from ideas on how to teach and react, followed by models and theories on learning and leadership, and completed by the students own developmental work Whether the students will start to work in industry or in school, and their argument for doing so, and whether if they will move between the sectors during their working life, will be monitored as part of the evaluation of this effort.

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