

Development Dialogue
Mechanical Engineering
Utrecht, 1 July 2019

Introduction

After a week of visitations from 10 to 14 December 2018 in Twente, Eindhoven and Delft, the visitation committee for the Mechanical Engineering programmes consisting of

- Prof. K.G.S. Östlund, KTH Royal Institute of Technology (chair)
- Prof. H.J. Rice, Trinity College
- Dr. M. Velonà, ETH Zürich
- Drs. J.J. Steen, Wageningen University & Research

and in Delft:

- Prof. R.W. Birmingham, Newcastle University
- Ir. J. Leideman, DEMCON Advanced Mechatronics
- A.J. Knijnenburg, BSc, MSc student Mechanical Engineering at the University of Twente

in Eindhoven:

- Ir. M. Muijens, ASML
- Ir. L. Kusters, Automotive NL
- C. Bakker, BSc, MSc student Mechanical Engineering at the University of Delft

in Twente:

- Ir. S. Spijksma, DEMCON Advanced Mechatronics
- M. Borst, BSc, MSc student Mechanical Engineering at the University of Eindhoven

had a good view of the programmes. During the development dialogue on July 1st, 2019, the committee, represented by Prof. Östlund gave suggestions for improvements of the programmes and for the cooperation between the three institutions.

How to deal with growing student numbers without losing the personal approach and integrated project education that is so characteristic to the Dutch ME programmes

The committee appreciates the integrated project education approach of the Dutch technical universities. Everywhere (not only in the Netherlands) the inflow of students is increasing and universities have to deal with large numbers of students. In order to cope with these growing numbers, the committee recommends to improve the matching of new students in such a way that their individual possibilities, development and expectations have full play in the programmes. There are good initiatives in various universities, varying from a one-week matching program to thoroughly select large groups of students to in depth assessments.

The committee also advises to consider allocation methods for distributing graduates over the available supervisors. Students should apply for tracks and specialisations and write motivation letters. Both teachers and students play an important role when it comes to finding the right

placement. The committee also advises to find a way to involve new faculty staff in education as soon as possible, so that they quickly adjust to the education values and to the student-supervision approach of the department.

The committee further advises to give more attention to tutoring systems and involve more students in teaching. At the TU Eindhoven Dutch MSc students tutor bachelor students in a compulsory 2.5EC course. International students and students from a Dutch university of applied sciences need to take a research skills course in parallel.

Limit the study duration in the master (and in particular that of the internship and the master thesis projects)

The committee states that study delay is a cultural topic, it is a matter of principles and values. Dutch students use their study time to develop themselves in other areas, which is often endorsed by industry and university staff. Students therefore experience no pressure to study faster. The committee advises to change this culture; students must be made responsible for their progress and the universities should clearly express their expectations to students. The committee regards it important that the faculty formulates a clear vision on study progress and that this vision is widely disseminated. Students must understand that times have changed, that government, companies and taxpayers expect faster progress and a more optimal balance of study and personal development.

In addition, the committee identified two elements in the master programme that tend to take longer than they should: internships and MSc thesis projects. The committee advises that a time limit for both is set, as unnecessary delays must be kept to a minimum. In this context the evaluation of the thesis work should include time management as a criterion. In case the graduation thesis project is done in industry the committee advises to consider abandoning a separate internship, internship experience can take place in the graduation project. It is underlined that international students often complete their programme within the designated time, Dutch students should be motivated to follow them. The committee advises that students draw up a plan for the graduation year that is monitored by the supervisors.

How much knowledge of computer science and automation do our ME students need? Embedded software in particular is becoming increasingly important.

The committee indicates that it is important that the foundation of IT is laid early in the BSc programmes. This does not have to go very deep, students should be trained to translate a problem into a computer programme and learn to systematically build a software system. Topics such as Deep Learning are not required in the BSc but can be a part of MSc programmes.

The committee points at the possibility to shape interdisciplinary teams of students from different MSc programmes so that students learn to cooperate with other disciplines and to appreciate knowledge and skills in other scientific areas.

How does the ideal mechanical engineering programme look after the committee's visit to 11 programmes? Which elements from various programmes should be combined to obtain the ideal program in 2020 and 2030?

Over the last thirty years, education has changed considerably but the core of the mechanical engineering discipline has remained more or less unchanged; the assumption of the committee is that it will remain so in the future. Changes come with small improvements and adjustments. The differences between the European ME programmes are in view of the committee rather small. Mechanical engineering used to be quite theoretical, but CDIO has become the dominating trend, stimulating to combine theory and application. Basic issues are combined with applications and design, and soft skills have become more prominent. The committee therefore advises to provide students with a firm scientific foundation combined with knowledge and skills to apply their knowledge in the future.

The world is globalizing, the students are born in the internet age, and there are more students. The committee advises to apply modern education methods which on the one hand are accessible to large groups of students and fit to the expectations and needs of those students, and on the other hand are interesting and challenging. The committee suggests to work on a didactical renewal of the programmes, it points at opportunities in the digitization of assessments. In general the committee advises to look into more flexible learning paths, as it is important that universities stimulate their students in self-development, Bildung, sustainability, and ethics, and that students take more responsibility for their own programme and study progress.

The committee warns for the threat to overload the curriculum: mechanical engineering is broad; the study load can become too high. In the future, the basis of mechanical engineering will not change much, but there will be new accents, e.g., in sustainability and ethics. The committee advises not to put more courses in the programme, but to integrate new accents in existing courses or projects.

The committee states that too narrow defined programmes will have no future. Some programmes like Materials Science Engineering (metals) and Offshore and Dredging Engineering (oil and gas) should watch out for a too narrow scope. Those and other programmes should broaden up and consider the demands of the future engineer.