Specifying learning outcomes for the specialisations of the Electrical Engineering master's programme

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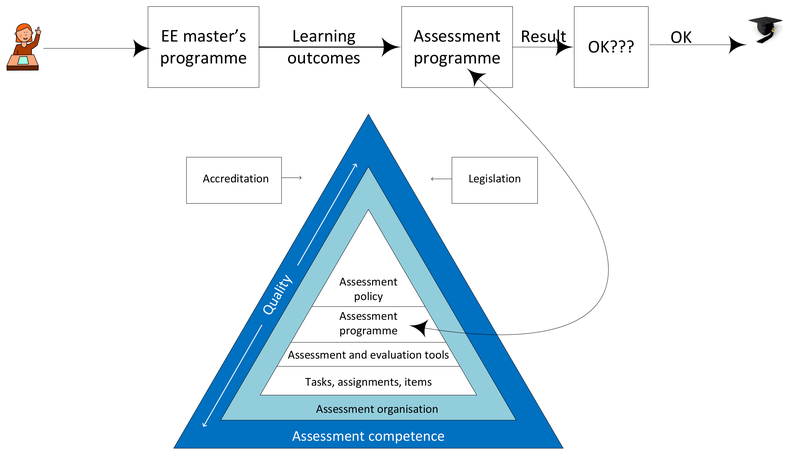
Problem definition

Educating and assessing students



Assessment programme requires well defined learning outcomes

- Learning outcomes of EE-specialisations have not been written down
  - "A master has specialized advanced knowledge in at least one of the specialisations of Electrical Engineering"
- The choice of compulsory specialisation courses therefore cannot be argued
- The examination board cannot check if a student satisfies the learning outcomes of the programme

Approach

Define new learning outcomes for the master's programme

- Merge the Meijers criteria and the requirements from the Domain Specific Frame of Reference.
  - Meijers criteria: general competences of an engineer
  - Domain Specific Frame of Reference: competences from the (EE-) discipline
- Identify the specialisation specific learning outcomes.
- Define specialisation specific learning outcomes for each specialization.
- Combine them with the common learning outcomes of the programme.

Example: the ICD specialisation

General competences	ICD
Meijers 1 **Is competent in one or more scientific disciplines** **DSFR 1-3: knowledge and understanding**	
have an in-depth knowledge in advanced fundamentals of mathematics and natural sciences	• calculus, linear algebra, differential equations • signals and systems • probability, random signals and noise • electromagnetic fields and waves • quantum and semiconductor physics
have in-depth knowledge in advanced subject-specific fundamentals of electrical engineering	• analogue and mixed signal processing • analysis and synthesis of (micro-) electronic circuits • semiconductor device operation and modeling • transduction and mechanical devices
have in-depth knowledge in one of the mentioned primary fields of application based on subject-specific fundamentals	• computer systems and computer architectures, including dedicated hardware • radio frequency applications • audio/video transmission • sensing and sensors • AD-conversion
DSFR 7: engineering practice and product development	
judge applicable methods and their limits	know how to realise electronic functions using IC-technologies
Meijers 2 **Is competent in doing research** **DSFR 4: engineering analysis**	
can evaluate new complex modelling, measuring, design and test methods concerning their relevance, effectiveness and efficiency and can develop independently new methods	Can analyse available techniques for the realisation of ICs for analogue and mixed signal processing, based on background knowledge about the available IC-technologies and the requirements obtained from the input and output signal properties and can develop independently new IC architectures.
Meijers 3 **Is competent in designing** **DSFR 5: engineering design**	
have specific skills for the design, development and operation of complex technical systems and services, thereby they are capable to assembly the best components of these systems optimally as well as to evaluate the interaction of the systems with their environment, (taking into account technical, social, economical and ecological aspects)	Have specific skills for the design of analogue and mixed signal processing circuits, based on appropriate design software packages. Optimisation of the design by using background knowledge about the available IC-technologies and the requirements obtained from the input and output signal properties. Specification of the input and output signal properties from sensor and actuator properties.

Remaining work to be done

ICD example

Creating a course programme that leads to the required learning outcomes

- Select the courses necessary to cover the learning outcomes to be obtained during the programme. This is a matter of comparing the learning outcomes of the courses with the learning outcomes of the programme.

Completing the project for all specialisations

- Obtaining final learning outcomes and assembling the course programme for the ICD specialisation
- Finalising and adopting the model for the description of the Electrical Engineering master's programme.
- Obtaining final learning outcomes and assembling the course programme for all specialisations
- Finalising and adopting the description of the Electrical Engineering master's programme including all specialisations
- Assemble an assessment programme for the EE master's programme

Conclusion

We have proposed a framework for obtaining learning outcomes for the specialisations of the Electrical Engineering master's programme. The example of the ICD-specialisation should give a look and feel of how this process may work out. Although much work remains to be done, we believe that the approach is feasible. Also we believe that carrying out this process will lead to a better structured programme and that finally it will enable us to check in a better way that the students indeed learn what they should learn according to well defined learning outcomes.