

4TU.

CENTRE FOR

ENGINEERING EDUCATION

4TU.Centre for Engineering Education

Strategic plan 2017-2019



Management summary

Engineering education is reinventing itself to prepare students for societal challenges in both traditional well-proven ways as well as in new technology driven ways integrating expertise from multiple disciplines. In our 2017-2019 strategic plan 4TU.CEE emphasizes a number of topics that we expect will be the ingredients in how our engineering education will evolve. We will continue with some topics, such as curriculum development and interdisciplinary engineering education. New topics for 2017-2019 have been identified too, such as virtual labs, future engineering skills, mathematics & engineering integration and challenges that come with growing numbers of students and increasing diversity among engineering students.

From a strategic perspective we see a role for 4TU.CEE in the growing importance of educational reputation enabled by the development of new ways to support staff and by new career opportunities, such as educational chairs. This requires modes of continuing professional development beyond the basic university teaching qualification (UTQ). We will support this development in ways that align with our own university teaching philosophies and HR strategies for rewarding teaching.

We will also establish modes of operating that are appropriate for gaining new expertise and for inspiring staff to further improve their professional skills with respect to teaching and learning in engineering education.

At organisational level we aim to further improve our international network of engineering education experts as well as solid in-house connections to all involved in making the best of the learning experience at our universities. In the writing of this strategic plan we have worked together with our new 4TU colleagues from Wageningen with whom we share our motivation for high quality engineering education.

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Introduction

The strategic plan first describes the topics that 4TU.CEE will be working on in the coming period. Thereafter we will address the vision we have for the organisation and working processes of 4TU.CEE for the upcoming years.

The engineer of the future has to play an important role in the grand challenges that face the world of tomorrow: climate change, limited energy resources, safety issues, mobility, health, et cetera. In order to be able to do so, apart from a strong scientific and technical basis in a domain, engineers need additional skills. Such as being able to collaborate in interdisciplinary teams, define and solve problems, use creativity, apply systems and entrepreneurial thinking and digital literacy; mostly attributes contained in the catch-all of 21st century skills. Engineering education needs to address these skills, but at the same time ensure that students have a strong working knowledge in a discipline and engineering as a whole. This requires a different perspective on education, where the emphasis is shifting from teaching to learning. This is not an easy task, given other developments that face the four Technical Universities in the Netherlands, such as a rapid growth and greater diversity in student populations, high workload of teaching staff, the implementation of new digital learning environments and limitations in the physical context of education, such as a shortage of rooms, laboratories or increasing cost of materials.

4TU.CEE topics for 2017-2019

The above goals, opportunities and constraints have directed 4TU.CEE to focus its activities on topics that are promising in realising engineering education of the future (see Figure 1). These topics concern (1) the manner in which *future engineering skills* are addressed in education, and what addressing these skills would mean for the potentially different roles that teachers need to play to achieve this; (2) the *(re)development of curricula* to integrate new skills and roles; (3) the development of *interdisciplinary education*, sometimes addressing the integration of typical engineering domains with for example maths and physics, and sometimes the integration of engineering domains with the medical domain, social sciences or economics; (4) the role of *emerging technologies in teaching and learning*, for example virtual labs or blended learning solutions, and (5) *sustainable engineering education*, making sure our education is both flexible as well as student centred, but also efficient in terms of materials, staff and other resources. Some of these topics have already been in focus during the past years, such as interdisciplinary education and emerging technologies or blended learning. 4TU.CEE will continue to conduct further research and develop these topics, yet start off new topics, such as future engineering skills and sustainable engineering education.

Thus 4TU.CEE will maintain its strengths, contributing actively to the professional development of staff, amongst others via senior qualification trajectories in education, but also via its workshops and study days, via study tours and other outreach activities, and via dissemination through publications and the Innovation Map. Its approach will be similar to the past years, namely working in an evidence-based manner and collaborating between different universities where possible and always engaging our staff in these endeavours.

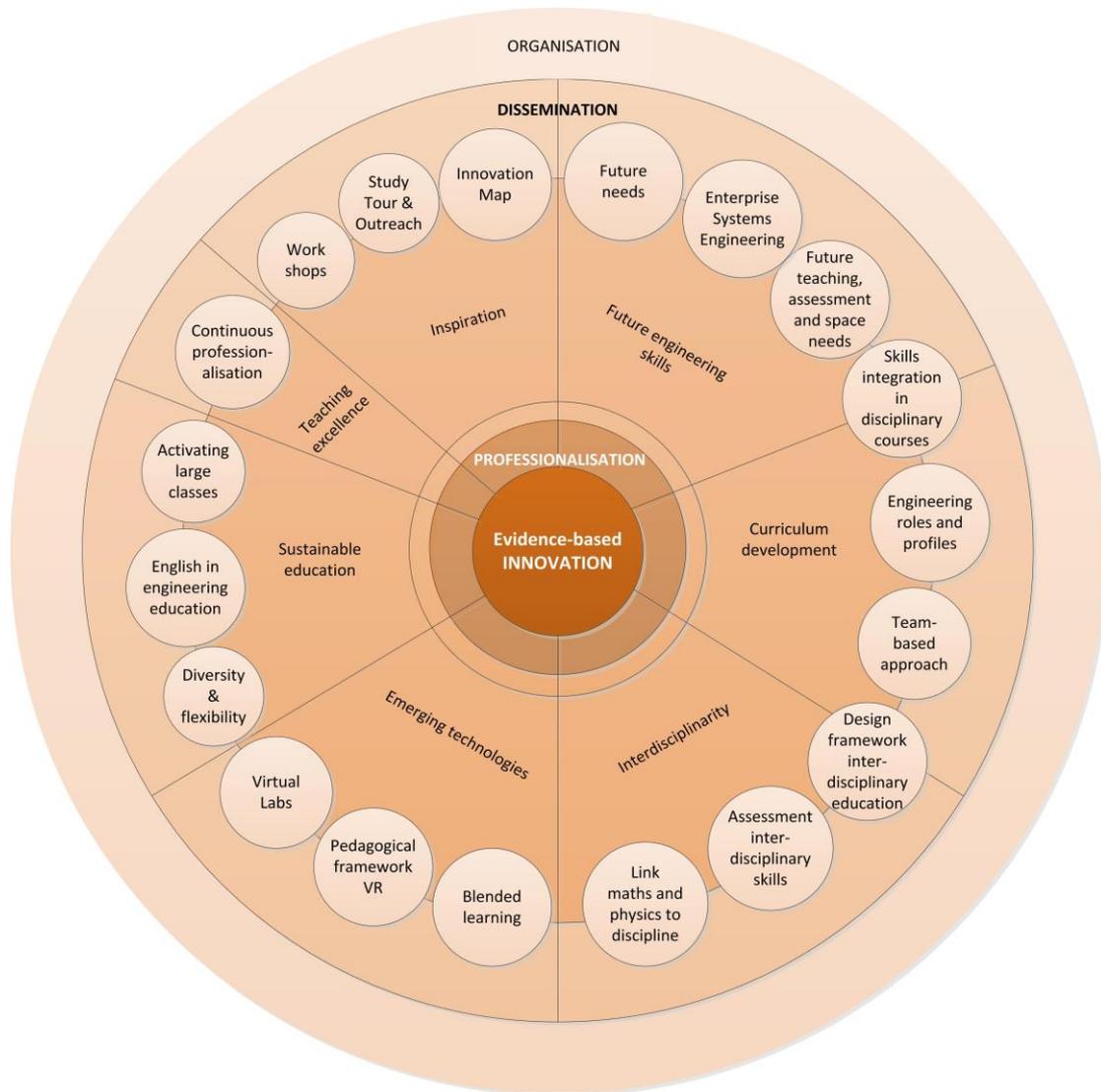


Figure 1: 4TU.CEE topics

1. Future engineering skills

4TU.CEE considers the implementation of future engineering skills in engineering education, and entrepreneurial behaviour in particular, to be an important topic of interest. On this topic we have identified three sub-projects.

a) Future needs

The future engineer needs, apart from a sound knowledge base in a specific engineering domain and related domains, personal and professional skills in order to engineer solutions for the grand challenges in society and bring engineering products to the public and politicians. These skills are diverse, but include creative thinking



and collaborating in multidisciplinary teams. Other skills are so-called entrepreneurial thinking and -acting skills, such as risk taking (dealing with uncertainty, ambiguity and risks), problem solving and leadership or team building. The EU has recently addressed the need for such skills as well as the development of teachers at all levels to teach and nurture such skills. Setting

these skills apart in separate courses or outside the curriculum does not seem to work; the question then is how to *integrate* such skills in disciplinary courses and educational design or research projects? What possibilities exist to achieve this, and what are advantages or disadvantages of such possibilities? 4TU.CEE aims to collect information on good educational practices integrating these new engineering skills in terms of course descriptions, materials, assessment practices and teaching methods and strategies, to compare and contrast these practices, and to make them available to the wider audience of engineering education.

b) Enterprise systems engineering

Engineering isn't just about making the perfect product at any cost. Keeping in mind the socio-economic aspects is absolutely crucial. Future engineers need to be aware that they are working in a competitive environment in which there is a fine balance between quality and price and often concessions must be made. 4TU.CEE will research what is necessary and how to integrate enterprise systems engineering aspects in the curriculum. We aim to bring this knowledge into practice in a

workshop, possibly in collaboration with a partner university who brings experience and expertise.

c) Future teaching, assessment and space needs

The need for ‘new’ teaching skills may involve new types of teaching and learning environments, for example innovation labs, innovation spaces or start-ups. These could also be environments where students work on real-world problems or assignments from clients, where they learn how to create physical prototypes, design and at the same time take user, market and ethical aspects into consideration. It is expected that courses that integrate such skills and content are often characterised by open-ended assignments with high complexity, uncertainty and ambiguous decisions. Assessing such assignments with an open-end is a challenge. We will investigate starting or ongoing experiments with courses using the innovation and design labs/spaces or using start-ups. We will be looking at the role of the teacher, characteristics of the learning environment, learning activities and the effects on learning processes of students. Via this, we aim to collect and distribute good practices that stimulate engineering skills using new teaching and learning methods.

2. Curriculum development

In the former activity plan, 4TU.CEE already identified curriculum development as a topic of interest and has compared the different bachelor innovations. In the coming years we will proceed to carry out projects on this particular topic.

a) Engineering roles and profiles

Engineering curriculum and course designs have been mapped at institutional, programme and course level. At programme level the Delft “Free Spirit” Think Tank outlook has been realised in the first 4TU.CEE phase. It will help frame a curriculum vision when planning for the education of future engineering professionals. Changes in engineering roles and profiles have been identified in the Think Tank. The results from the innovative curriculum work package from the previous work package of 4TU.CEE will be applicable in practical settings and disseminated via publications. A framework is being developed that can guide workshop sessions of multidisciplinary nature. This framework makes use of the engineering roles as a guiding principle for problem solving and teamwork. The evaluation results of multiple workshops are used to inform interested stakeholders on how to embed engineering profiles in the curriculum.

b) Skills integration in disciplines

An important question is how the roles and profiles, resulting from the Think Tank, and personal and professional skills that gain in importance in the future, can be integrated in our disciplinary education. In collaboration with academic and professional stakeholders we will explore future trends and define potential scenarios in society, engineering and technology. From there we will prioritise the expected changes in needs for professions in science, engineering and design respectively. Together with teachers and educational experts we aim to develop and run pilots in the context of science and engineering, integrating some of these skills in disciplinary courses, design or research projects.

c) Team-based approach

Many new courses are designed and implemented by teams of teachers. This team-based approach offers opportunities for new multidisciplinary approaches. 4TU.CEE research by Gast and Bron during the curriculum innovation at UT shows that this setting with peers is also an opportunity for further professional development of our teaching staff. Team approaches show a wide variety in the ways they operate aiming for both consistent design as well as efficiency. Overview of how teams could work, will help them choose their own way. These results will be disseminated both via our network as well as through scientific contributions in journals.



3. Interdisciplinary engineering education

Interdisciplinary education is about solving problems that draw on multiple disciplines, either within the engineering domain or between the engineering domain and domains outside of engineering. It is about integrating information, data techniques, tools, perspectives, concepts and theories from two or more disciplines. Interdisciplinary learning is one of the central characteristics of both contemporary engineering education and design-based education.

a) Linking mathematics and physics to discipline

4TU.CEE will look for ways to strengthen the connection between mathematics and physics with engineering. International expertise from the SEFI working group on

mathematics and engineering and CDIO contacts will be used to help pioneer with integral approaches that help connect mathematics with engineering contexts. Examples from DTU (Copenhagen), Chalmers (Gothenburg) and other international partners will be compared with 4TU best practises. This will strengthen a sound didactics for mathematics & engineering. In Twente we will use the outcomes to support the fine tuning of the mathematics stream for all programmes.

In relation to physics and engineering mechanics, TU Delft has planned to investigate the feasibility and effectiveness of implementing an innovative 'lab-in-a-box', experimental physics set in which students can gain knowledge and insight in the physical phenomena by actually doing simple experiments at home or in the classroom. 4TU.CEE supports in the assessment to find out if such a box increases students' motivation and learning gain.

b) Design framework interdisciplinary education

As in research we expect to see a growing focus on boundary crossing programmes which will have to fulfil the interdisciplinary obligations that have been set out in the vision of their curriculum. For teachers in interdisciplinary modules and courses the



challenge will be achieving interdisciplinary goals with a team of disciplinary specialists. The first phase of this topic has led to a literature review and a framework that can help (re)design interdisciplinary education. Based on this phase, critical success factors have been identified. Also a checklist with assessment guidelines in interdisciplinary education can help implement interdisciplinary education

with congruent assessment methods. The checklist is now being used in a number of faculties at Eindhoven and Delft. The experiences will be compared and conclusions disseminated for the benefit of others. Both the review and the case studies will be reported on in articles and at conferences.

c) Assessment interdisciplinary skills

We will apply our lessons learned from the review study and from the overview that we gained from six case studies across the technical universities from research carried out in the previous activity plan. Expertise from Wageningen colleagues Spelt and Oonk on aspects of interdisciplinary engineering education will be embedded in our efforts and can help us further in designing and evaluating new interdisciplinary settings.

4. Emerging technologies

Virtual labs and virtual reality systems offer the opportunity to acquire ‘hands on’ engineering skills as such or they can help prepare for realistic settings. While many of these applications are mainly used in industry and research, there are indications that such settings can provide significant benefits in education. We give priority to explore this educational potential as we see fast developments taking place with new virtual reality systems such as headsets and other tools that can help support information sharing in new ways while increasing our knowledge, exploring new places and improving consumer experience. We will explore which new method works best in creating hands-on, problem solving activities, field trips, internships, project and lab-work at the tip of our virtual fingers. 4TU.CEE wants to investigate, test and support the use of such technologies and verify what the enhanced learning gain and other educational benefits might be. We believe that this endeavour should be organised with the help of interested teachers and other stakeholders to stay as close to daily practice as possible.

a) Pedagogical Framework for VR in education

A literature review/interviews/site visits will be carried out to create a pedagogical framework for the implementation of any tool that supports the learning process.

b) Virtual labs

(I) A TU Delft experiment with VR systems in which Google glass or similar tools in combination with physical visits are used to familiarise students with wastewater treatment plants. We will test and evaluate whether this suits the learning process and provides added value to students (tangible understanding) of practical engineering know how in this particular setting and other engineering fields.

(II) A 4TU experiment in which [GO-lab](#) is explored as a platform for different simulations in design and other engineering settings. The GO-lab tool is supposed to wrap existing virtual labs with a dedicated educational layer. This can speed up the process of transferring professional R&D virtual labs into the educational domain. We will collaborate with the international GO-lab team led by UT researchers.

(III) A TU Delft experiment exploring the possibilities for a virtual coach to support and optimise the learning processes of students through immediate feedback in the educational situation. Outcomes can be combined with review outcomes and lead to next steps in this area of virtual coaching, for instance in oral presentation trainings.

(c) Blended Learning

In close collaboration with 4TU.AMI we will further engage in efforts to implement blended learning concepts in the way mathematics education for engineers is being

organised. This will range from connecting with international examples, supporting the design of educational scenarios, piloting, evaluating and disseminating. It will be



important to find scenarios with optimal balance between face-to-face and online course components. Only then will it be possible to both harvest gains at the flexibility and efficiency side of mathematics education as well as sustain student motivation and good study success rates. We will also help in finding and applying the right evaluation instruments that help analyse and optimise learning gains.

At TU/e, for example, a 2-year investigation will be conducted with first year bachelor students in different courses, to see how they use various platforms and digital or other resources and how this affects their learning. This will be compared with similar data from other contexts in for example the UK, France and Norway. Outcomes will help improve designs of blended learning and in preparing students for learning mathematics at the university.

5. Sustainable engineering education

Since student activity is key to learning effectiveness, the question of activating audiences is very relevant for education. Research shows that this can be enhanced by combining a variety of teaching methods. However, this can become a challenge in large-scale lectures, which will become increasingly common with the growing student population. Engineering classes are subject to specific challenges as engineering students need to gain hands-on experience in labs that are not suited for large groups. How can you offer an engaging education programme when there is a shortage of facilities and only limited availability of the costly materials needed in class? Special attention is paid to maintaining sustainable engineering classes in three projects.

a) Sustainable engineering education with increasing student numbers

Our universities are all facing a growing student population and with this growth, a more diverse student population enters our programmes. This raises issues with respect to flexibility within programmes and the ways students can best be prepared for their programmes and courses. Teachers require up-to-date insights with respect to expertise and knowledge of their students in order to be able to deal with large

groups of students in the lectures, lab work, as well as in the graduation projects. Several projects within our universities try to solve these challenges. An example is a [wiki](#) on how to provide activating education for large and diverse groups of students at TU/e. Other projects focus on testing prerequisite



knowledge and offering a flexible programme in relation to the differences in knowledge and competences of students. By conducting a systematic literature review and collecting (good) examples from our four universities and elsewhere, we strive to disseminate the knowledge and experience on these topics. The results will be dispersed via the Innovation Map and in a conference on this theme.

b) English-medium Instruction

In the nineties it was already clear that internationalisation was of growing interest to technical universities, with Delft and Wageningen having the largest numbers of international students. English-medium instruction would lower the threshold for international participants interested in our universities. As a result all master programmes are taught in English at most universities since the past decades. Teacher training, assessment of English Language proficiency of both staff and students and student surveys have been a part of the built up expertise in English-medium instruction at our institutions. Presently, a second round of changing the language of instruction at the bachelor level has announced itself. Many the same emotional outbursts and arguments have been discussed in the papers and by stakeholders. We can learn more from our mutual prior experience across different engineering fields:

- What is needed to support our staff and students in the best possible way with the implementation of English-medium instruction at bachelor and master level?
- Benchmark with European partners such as the Karolinska Institute, University of Vienna, Oslo University, Linköping University, Denmark Technical University and others. Through inspirational workshops we aim for a framework of best practices.

c) Diversity in engineering students

Changing the instruction language to English in the bachelor and master programmes leads to a more diverse student population with growing numbers of international students enabling both Dutch and international students to have an intercultural learning experience. But also a challenge to communicate and cooperate with each other in a



foreign language in a proper way. To cope with this challenge, it is necessary that students and teaching staff are culturally sensitive and able to communicate well. In an international environment, this can be applied and practised. In engineering programmes, students often work in project groups. This makes group dynamics instructive, but also troublesome. Developing a joint design in such a diverse environment is a challenge that fits the competences of students for their future work environment. A variety of tips and tools is available to support students working in an intercultural engineering project group. There is also a need for supporting materials for project tutors supervising the group processes. An inventory will be made by 4TU.CEE of existing materials and activities for intercultural teamwork support for students and tutors. Based on this inventory, a specific offer can be made to programmes within 4TU, for example material for teamwork support or a workshop for project tutors.

Besides the project work perspective we will also support intercultural competence development in engineering programmes. This will help students learn and cooperate well during their studies. Furthermore will it prepare them for international settings during and after their studies. In order to achieve this, students have to be able to react in a creative and reflective way to situations by examining them from another perspective. This may be another cultural perspective or a confrontation with another discipline's 'language'. We will organise an inspiration tour on intercultural cooperation with experts visiting a number of TU's. Also one or more programmes will be supported to integrate intercultural competences into their programme.

6. Teaching Excellence

In the teaching excellence topic we work together with a project group of international universities and Ruth Graham who coordinates this project on behalf of the Royal Academy of Engineering (UK). The project has delivered a model (see figure 2) which, through our workshop at the Ministry of Education, is now also being used by the Ministry.

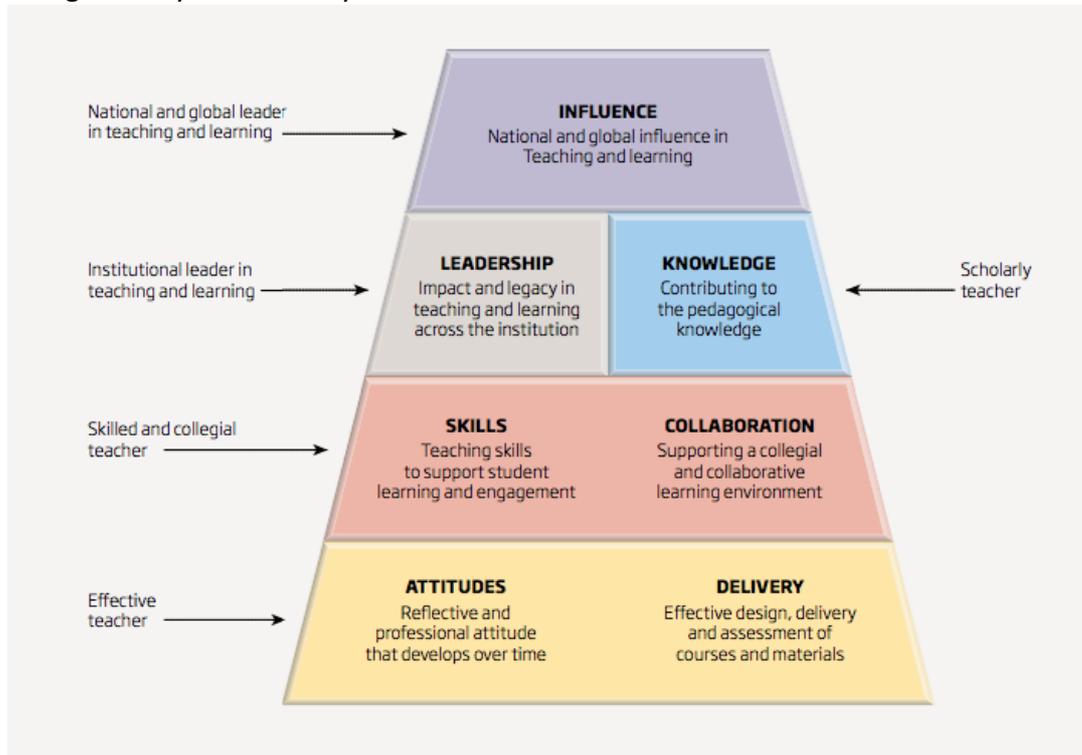


Figure 2: Teaching model by Ruth Graham

This will help improve portability of professional development across universities in the Netherlands and abroad. Both at Eindhoven and Twente pilots are supported in which teaching staff go beyond the basic teaching qualification. These colleagues will then be part of our network of teaching experts that will inspire other colleagues. The combination of national Comenius grants, new NRO research grants for Higher Education and 4TU.CEE projects will offer these excellent teachers a range of opportunities to engage in engineering education research and development well connected with the engineering subject matter. The Royal Academy project also provides means to enhance the evaluation of educational achievements in relation to career steps. Two Twente faculties are piloting and evaluating these approaches. Outcomes will be shared with international colleagues in 2017. Improving the balance between research and education in career paths is one of the goals of this topic, of course in relation to the strategy of each university of technology.

7. Inspiration

4TU.CEE undertakes several activities to disseminate research, good practices and tools for innovative engineering education to teachers, educational managers and researchers. This is for example done by providing access to innovations through our online Innovation Map and by offering thematic workshops and interactive lectures at the four universities. At the same time 4TU.CEE staff also visits engineering universities abroad to get inspired and learn about innovations they have implemented on our topics described above.

a) Workshops

Throughout the year 4TU.CEE regularly organises workshops on several topics to inspire lecturers and support staff on innovations in education. At the same time these events are also an opportunity for us to gather feedback from staff on themes they are interested in and to keep in touch with our target audience.

Already planned workshops are:



- Rewarding teaching excellence
- Dealing with diversity in engineering students
- Gamification as a motivation tool
- Exploring innovation and innovative digital questioning
- Team Based Learning

b) Study tour & outreach

We will visit ETH Zurich and EPFL Lausanne in 2017 to learn about virtual labs, interdisciplinarity and online education. Also, we will visit and present at conferences such as SEFI, CDIO to stay up-to-date on the newest innovations and research in education within Europe and even worldwide level. Both Twente and Eindhoven will become a member of CDIO (Delft already is a member), a network of like-minded universities of technology.

c) Innovation Map

The online Innovation Map that has been developed over the last two years will be kept up-to-date to inspire teachers with examples from colleagues. Also the overview of lessons learned from innovation projects and collected cases will help

instructors and educational support staff. Our new partner WUR will upload their innovations in the Innovation Map as to complete the current overview and help disseminate gained knowledge.

Organisation

During the past two years 4TU.CEE has developed into a respected and visible Centre for Engineering Education that is valued by many teachers, support staff and educational management of our own universities and by international colleagues and university network organisations such as SEFI and CDIO. In order to achieve our goals (see appendix 1) a horizon of at least the end of 2021 is a necessity. In the coming 5-year period we will concentrate on strengthening our engineering education aiming for the highest international standards. Many of engineering education staff are eager to work together and initiate developments. However, they want to be sure that our commitment is not a short temporary one, but lasts over a longer time span.

Evaluation

As we have done through our present progress report we will report on our progress and plans every two years. This evaluation will involve expert reviewing by our Advisory Board (see appendix 2) and international colleagues, with input from engineering education staff supposed to benefit from the 4TU.CEE activities. An updated set of kpi's will be set.

Collaboration

Collaboration will prove to be even more fruitful with Wageningen University on board of our Centre for Engineering Education. Their education track record and numerous innovations are valuable when sharing expertise and inspiration. This strategic plan shows the activities we will undertake for the next two years. It describes the prioritisation of topics. Not all universities will be involved in all themes to the same level, thus limiting the complexity of joint projects. In the meantime outcomes will be made available for all, using the inspiration and professional development means that fit the 4TU and local context.

Within each university we aim to position 4TU.CEE clearly and emphasise how our network approach connects with the local institutes and educational support centres that may have related or overlapping goals and tasks. We continue to aim for synergy over competition. This is more efficient and will further increase our impact. Involving staff of these educational support centres in our activities is also a way to increase their expertise. Collaborating in our activities will give them a state-of-the

art overview of engineering education in the Netherlands and abroad. We will further expand and fill the Innovation Map that is already operational online. The innovation map is showcasing best practices at our Technical Universities to inspire our own staff while increasing visibility of high class engineering education internationally.

Involvement

We have learned to appreciate the benefits of a networking organisation with short lines and easy connections. One of the challenges that 4TU.CEE has faced the past two years and that is likely to remain is the limited priority and thus availability and time of both teachers in faculties as well as support staff to be involved in innovations, research or other activities that are conducted by 4TU.CEE. We want the best and highly motivated colleagues in helping to improve engineering education. Strong connections with all relevant institutes and groups at each of the



four technical universities should stimulate active participation and availability of relevant staff. In the past couple of years local innovation grants and fellowships have proven to work well in terms of getting teachers and other staff involved in projects, and these will be continued in subsequent years. Senior teaching qualification schemes will also help increasing the group of senior staff

that can participate in projects and in coaching new generations of excellent engineering educators. OCW Comenius-fellowships and higher education research grants may help improve the climate for scientific staff members to decide on temporary or long-term emphasis on high quality engineering education. Of course new developments in the area of rewarding teaching in academic careers are also expected to have effect on the motivation to invest in engineering education pilots and coaching of colleagues.

Opportunities

Finally, and this relates to the next topic as well, the availability of research and support capacity seems to be easier to organise when the projects and themes involved comprise a longer period of time. This may open up opportunities for constructions such as PhD trajectories or postdoctoral involvement and the development of specialists in engineering education. While doing so we always keep in mind how our lecturers in the classroom will benefit from our work.



Appendix 1: Mission, Vision and Strategy

Mission

To jointly inspire, stimulate, support and disseminate effective and high quality Engineering Education through research and application of evidence-based innovations within the Engineering Education domain.

4TU.CEE is the place for teachers and scientists with questions and ambitions in the domain of Engineering Education.

“Innovating engineering education for tomorrow’s engineer”

Vision

The world needs more and differently educated engineers who are geared to the grand societal challenges in the areas of energy, health, mobility, safety and environment. 4TU.CEE contributes to inspiring and effective Engineering Education within the Netherlands as well as abroad to prepare the student for tomorrow’s challenges.

Strategy

4TU.CEE fulfils this mission with the following strategies:

- Mapping recent innovations, trend, tools and (didactic) insights from the engineering education domain at 4TU and keeping these overviews up to date;
- Tracking and counselling engineering education innovations at 4TU, if part of 4TU.CEE;
- Pitching and initiating own (accompanying) research on the development and functioning of innovative engineering education at 4TU;
- Disseminating tools, research results and best practices via the 4TU.CEE website and participating in or organising events, congresses and contributing to journals;
- Organising events for teachers, focused on the exchange of knowledge and experience within the engineering education domain and offering inspiration and support;
- Setting up and maintaining an international partnering network in the engineering education domain

Appendix 2: 4TU.CEE Staff

The Centre of Engineering Education consists of a managing board, coordinators, researchers and ambassadors, each of which have their own work packages and responsibilities. Hereafter this will be explained in more detail.

4TU.CEE Board

4TU.CEE aims to be a small flexible organisation with a broad network of allied researchers and ambassadors. The board of the Centre consists of four leaders, each supported by a coordinator. The board is responsible for managing 4TU.CEE. The daily activities as well as building the Centre are a responsibility of the coordinators. For each project we identify teaching staff, educational researchers and support staff that can do the job.

	Leader	Coordinator
UTwente	dr. J.T. (Jan) van der Veen (Chair)	drs. C. (Chris) Rouwenhorst
TU Delft	ir. A. (Aldert) Kamp	dr. R.G. (Renate) Klaassen
TU/e	prof. dr. B. (Birgit) Pepin	C.H.T.A. (Chantal) Brans Msc
WUR	ir. E.A.M. (Emiel) van Puffelen	drs. M.A.A.U. (Marijke) van Oppen

4TU.CEE Advisory Board

The Advisory Board is a sounding board and the conscience of the 4TU.CEE board. They meet twice a year and reflect on the 4TU.CEE plans and activities. They also function as ambassadors of the Centre. The board consists of:

- Kristina Edström (KTH)
- Prof. dr. Marc de Vries (TUD)
- Prof. dr. ir. Lex Lemmens (TU/e)
- Prof. dr. Rikus Eising (UT)
- Christiaan Meijer (Student TUD)

A representative of WUR will soon join the Advisory Board.