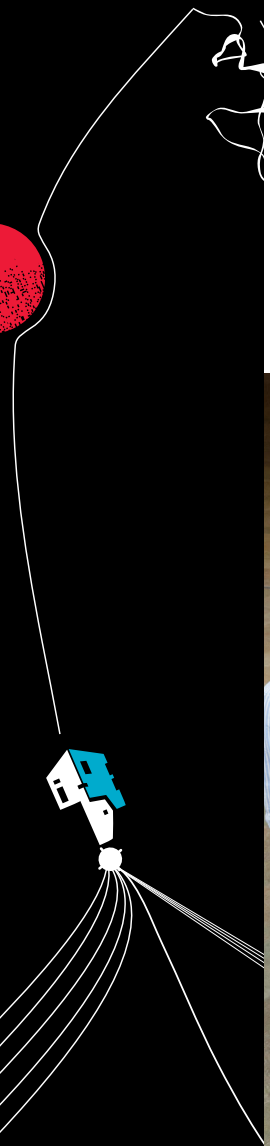# SENIOR UNIVERSITY
TEACHING QUALIFICATION
UNIVERSITY OF TWENTE
PROJECTS OF 2018-2019

UNIVERSITY OF TWENTE.

THIS BOOKLET CONTAINS THE PRODUCTS OF THE SECOND GROUP OF TEACHERS WHO HAVE BEEN WORKING ON THEIR SENIOR UNIVERSITY TEACHING QUALIFICATION (SUTQ).
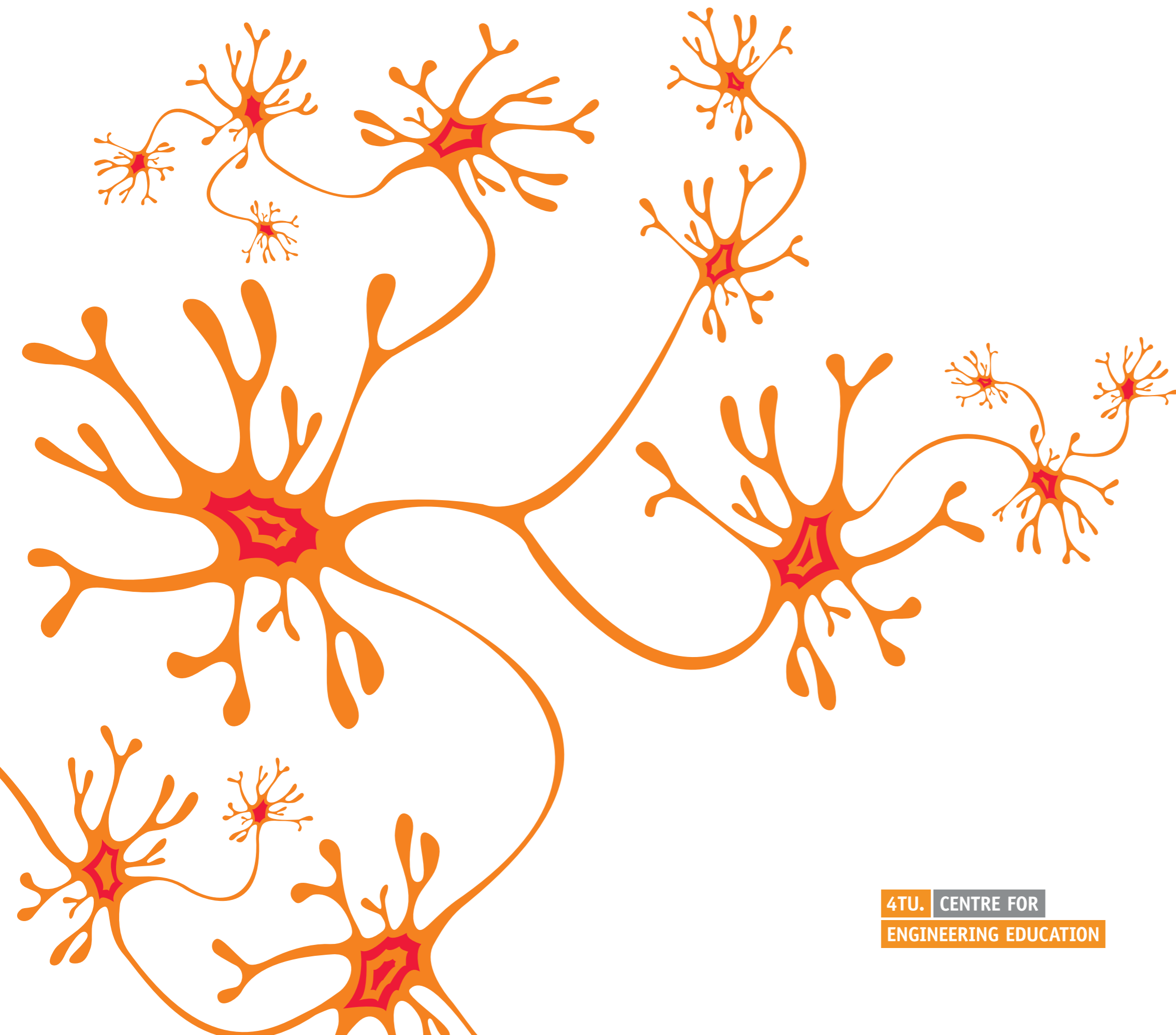
THE SENIOR UNIVERSITY TEACHING QUALIFICATION

The teachers did research to improve/innovate education practice and/or designed innovative education within the area of education practice. For about nine months, the participants worked 160 hours on an educational question. The participants determined their own personal learning path (Student-driven Learning). During this period the participants received supervision, advice and expertise from the Centre of Expertise in Learning and Teaching (CELT) and the Centre of Engineering Education (CEE) in order to gather the necessary information, skills and answers.

SUTQ IMPROVES EDUCATION

The University of Twente educates the professionals of tomorrow. To be able to provide a high standard of education, the UT emphasizes the importance of highly skilled teaching staff. Teaching excellence is stimulated by a wide range of activities. The SUTQ is designed for experienced teachers who achieved their University Teaching Qualification (UTQ) and have the ambition to improve the/their education. The UTQ and SUTQ are embedded strongly in the HR policy of life-long learning. CELT coordinates the UTQ and SUTQ programs.

www.utwente.nl/sutq

4TU. CENTRE FOR ENGINEERING EDUCATION

✉ a.martinetti@utwente.nl

ALBERTO MARTINETTI

Alberto Martinetti (1985) is Assistant Professor in Maintenance Engineering in the department of Design, Production and Management at the University of Twente. He is track coordinator of the Maintenance Engineering and Operations specialisation in Mechanical Engineering. Previously, he worked for the Polytechnic of Turin and for the University of Turin. He obtained a Master Degree in Geo-resources and Geo-technologies Engineering (2009) and a PhD degree in Environmental and Land / Safety and Health at the Polytechnic of Turin (2013). His research mainly focusses on Maintenance and Safety Engineering and on the application of emergent technologies to these sectors.

In addition to the present work on Student-driven Learning, Alberto's educational researches focus also on Adaptive Learning (Comenius Teaching Grant) and on Cooperative eLearning for Higher Education in Industrial Innovation (Erasmus+ CEPHEI).

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT

My SUTQ project offers a framework for helping students to deal with possible knowledge gaps and personal interests in order to match the defined learning goals of academic courses but improving at the same time their engagement with the specific topic.

Firstly, a literature research has been conducted on the modern and successful techniques of Student-driven Learning (SdL) for identifying best practices to use and possible pitfalls to avoid. Secondly, an anlysis of the target group has been carried out. Thirdly, the research identified which are the most effective way to create such a tool to take into account the possible entry points of the students. Finally, the framework has been evaluated by representatives of the target group.

WHAT HAVE I LEARNED

There is so much potential in the minds of the students that we need to find an effective way to stimulate it and to give them the opportunities to create their own paths within and without the boundaries of the Intended Learning Outcomes. But their minds are so various and diverse that hoping to crystallize a unique method for this purpose is extremely difficult.

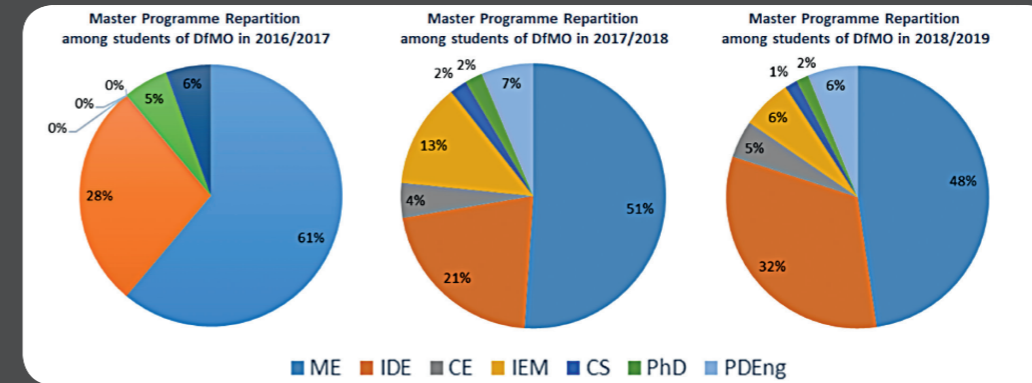### WHAT WAS THE BIGGEST CHALLENGE

Two main challenges characterised my SUTQ path. Firstly, the time frame of the project. I found very hard to restrict the boundary of my research at the beginning of the process. Secondly, Student-driven Learning (SdL) can be tackled in several different ways; finding the proper structure of the Framework in order to encompass all the needs of such a big variety of students (in terms of background, knowledge and expectations) has been quite a challenge.

WHAT ARE YOU PROUD OF

Embedding Student-driven Learning (SdL) in a course is not an easy job. The framework developed during my research has been designed to be scalable and easily adaptable to different course levels. Checking in advance their actual level of pre-knowledge and, based on that, creating personalised paths for compensating the existing gaps will bring benefits in terms of student performance.

OPTIMISING STUDENT-DRIVEN LEARNING (SDL) THROUGH FRAMEWORK FOR TAILORING PERSONAL STUDENT PATHS

Master Programme Repartition among students of DfMO in 2016/2017

Master Programme Repartition among students of DfMO in 2017/2018

Master Programme Repartition among students of DfMO in 2018/2019

Legend: ME, IDE, CE, IEM, CS, PhD, PDEng

THE CHALLENGE

The influx of students exhibits a high background diversity. In addition an increase in influx from post-master students (PhD and Professional Doctorate in Engineering – PDEng) is observed, which requires flexibility in the exit level

THE APPROACH

The research adopted a Design-based approach supported by a qualitative evaluation
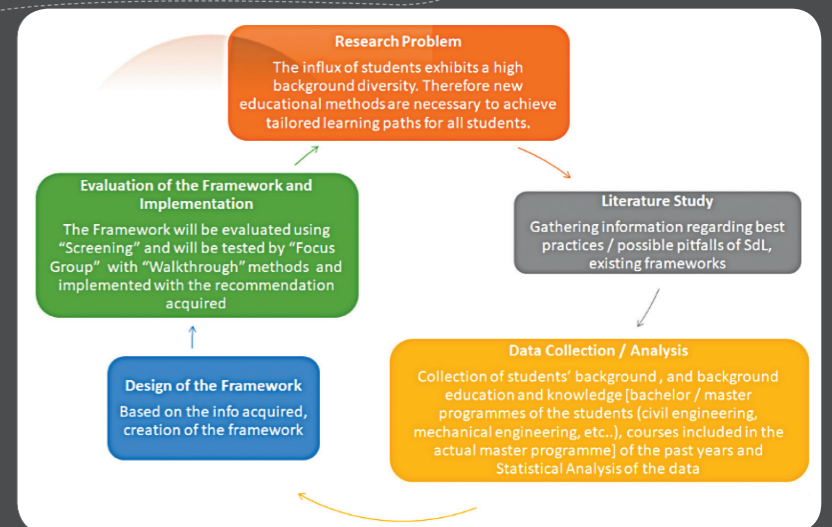
THE SOLUTION

The Framework is designed to offer to students the possibility to fill the knowledge gap for both the topics, receiving dedicated materials and extra-support.
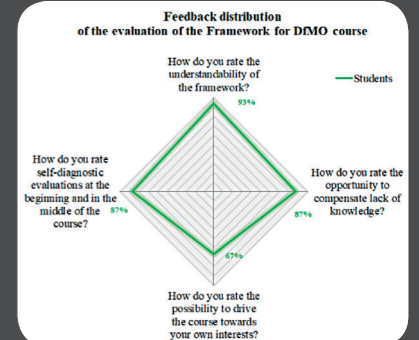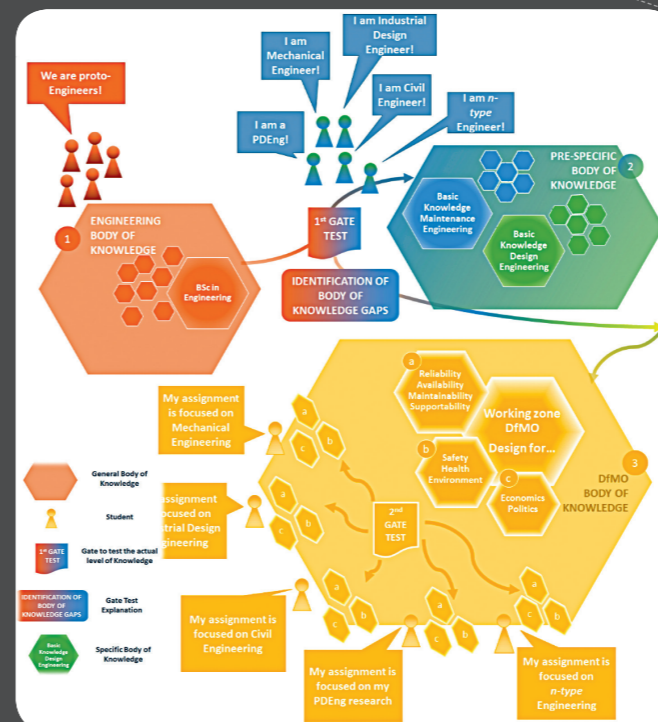
THE TEST

The evaluation looked for suggestions and remarks on understandability of the Framework, user-friendliness of the Framework and on representability of the possible domains of interest

TANYA BONDAROUK

Tanya Bondarouk is Professor of HRM and Technology at the University of Twente (The Netherlands), where she is the head of the HRM research department. Authoring more than 100 international journals and book chapters publications, 12 scholarly books, and editing 12 special issues in international refereed journals, T. Bondarouk has been conducting research into an integration of HRM and Digitalisation, examining conditions for e-HRM implementations, contextualising of e-HRM success, benefits of digitalisation for the HRM function, and involvement of managers in digital HRM. Her current academic services include work as the senior/ associate editor of The International Journal of HRM; European Journal of International Management, and Advanced Series of Management (Emerald Publishers BV). She has conducted research with and provided advice to both private and public sectors like Dutch and Belgian Ministries, Shell, Dow Chemical, KLM Air France. In 2018 she won two awards, "The Best HRM Professor in the Netherlands", and "The Inspiration Award of the University of Twente".

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
This project contributes to the discussion about globally oriented university graduates and the internalization of university education. It examines the effect of an international orientation of a study program on the intercultural sensitivity of students (ICS). Little research has been done on ICS as such, and specifically on how the design of a study program can contribute to creating a valuable cultural experience for students. Questions that need to be addressed are what different actors (teachers, students) should do, how cross-cultural student interaction can be facilitated, and what kind of learning/ experience opportunities should be offered to students to generate the most stimulating intercultural environment for them.

This project is engaged with the research question of to what extent an international orientation of a university study program increases the ICS of students. It reports on questionnaire-based research conducted among second-year bachelor students (N=235) from seven bachelor programs at the University of Twente. The research has shown that ICS as a collective construct, consisting of a cognitive, affective and behavioural component, cannot be explained by the three independent variables of intercultural orientation: the teaching style, perceived intercultural orientation of group work, and perceived intercultural orientation of the study environment. However, actual appreciative behaviour, one of the three components

of ICS, is positively influenced by the perceived intercultural orientation of group work.
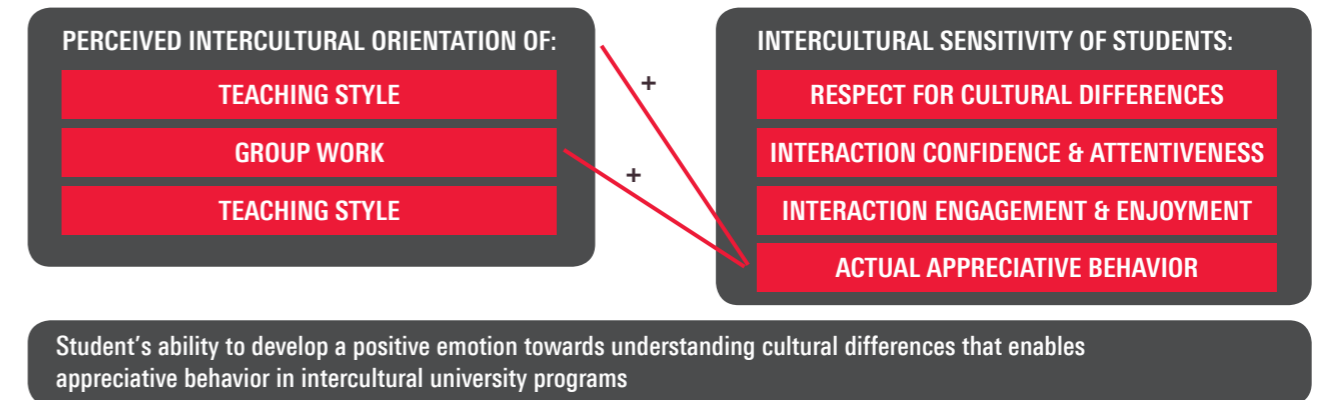
WHAT HAVE I LEARNED?
I position myself within the constructivist teaching paradigm, and see my role to construct the learning environment for students, where they are actively involved in understanding the world, through experiencing things and reflecting on those experiences. It involves a number of different teaching "rituals", from teaching design to teaching evaluation. In the most general sense, I usually encourage and train students through active techniques (case-based teaching; debating; real-business problem solving). I wish I could say that I create knowledge together with students, and that we reflect on it together, and we talk about what we are doing and how our understanding is developing. I joined this project as I needed a new trigger to shake my teaching routine. I wanted to learn new techniques, new methods, and discuss latest developments in the field. I felt that my teaching has become a monotonous entertainment that needed to be cracked down. With this in mind, I especially thankful for the feedback from colleagues and supervisors during SUTQ. I got many ideas, tips, and extra information sources. Based on the feedback on my SUTQ proposal, I dove into the multilevel analysis in SPSS. It was recommended to conduct it as my survey went to students nested in programs. Unfortunately, in the end, I could not run this analysis as the set of the data did not

ENHANCING INTERCULTURAL SENSITIVITY OF UT BACHELOR STUDENTS

7 bachelor programs
Biomedische Technologie, Creative Technology, Public Administration, International Business Administration, Industrial Design, Communication Science

Respondents (N = 235):
46-54% female-male
20.4 years of age (avr., SD= 2.01)
79,6% have international friends
27% lived abroad
57% have plans to work/study abroad

PERCEIVED INTERCULTURAL ORIENTATION OF:

TEACHING STYLE

GROUP WORK

TEACHING STYLE

INTERCULTURAL SENSITIVITY OF STUDENTS:

RESPECT FOR CULTURAL DIFFERENCES

INTERACTION CONFIDENCE & ATTENTIVENESS

INTERACTION ENGAGEMENT & ENJOYMENT

ACTUAL APPRECIATIVE BEHAVIOR

+
+

Student's ability to develop a positive emotion towards understanding cultural differences that enables appreciative behavior in intercultural university programs

allow it. I still hope to be able to do it next year. I was very glad to follow up on the advice from the SUTQ colleague – to check for the content of the cross cultural orientation in the documents of the KIT/ Royal Tropical Institute. I have adjusted scales for the survey based on information I found there.

WHAT WAS THE BIGGEST CHALLENGE?
Implication of the results on student learning. My project was guided by the research question, to what extent an international orientation of a university study program increases the ICS of students. I must admit that in my sample, with the scales I used, the results were very different from assumptions. First of all, results have shown that the study programs can do little to influence the total ICS of students. Only the behavioral component was possible to influence, while affective (emotional) and cognitive (internalization of knowledge) – were not. Several factors can be responsible for this observation. To start with, second year bachelor students probably did not develop yet deep appreciation of intercultural sensitivity at the emotional and cognitive levels. But they learnt how to behave "appropriately". I hope to repeat the survey next year, when the same students reach their 3rd bachelor year, and to see the evolution of their ICS. Secondly, methodologically speaking, I had some troubles with the scales. Although I worked with established validated scales, I had to make slight edits. For example, a conventional expression like "students from different cultures" appeared to be quite outdated.

Nowadays we talk about cultural backgrounds but not about cultures.

WHAT AM I PROUD OF?
I have chosen the quantitative design as I usually do not like it. As I wrote in the beginning, by this, I wanted to trigger my own learning curve. I learnt new stat techniques and I rejected my hypotheses. And I was again convinced that it would be better to do a qualitative study with interviews or focus groups. For example, my results did not show significant differences in the ICS of students of BMT (Dutch-based) and other programs at UT (English-based). Through the analysis of the questionnaires I could not find an explanation to this observation. I would like to make a bachelor or master assignment for a student to figure out reasons for this. Further, as I indicated in the report, because of certain practical research limitations (available time, resources, deadlines in the project), it was impossible to rich the full randomised sample across the whole UT. Therefore, the combination of convenience sampling (non-probability technique) and random sampling (probability technique) was used. On its own, it should not be seen as a limitation, but participation in this project was strongly driven by personal motivation of teachers and program directors.
The true and final reflection point is that I will miss this SUTQ… It was difficult, time consuming, it felt that it stood always on the way of other "more important" activities…. However, it triggered my self-awareness, my traditional look at the ways I was teaching; and it shook my teaching habits.

TEAM-BASED LEARNING IN A FUNDAMENTAL MATH COURSE

ANALYSIS: 😓 🙄 😟   **LECTURES:** 😶 😐 😑

THE THREE YEARS BEFORE TEM:

- About 24 percent of the students use compensation and are satisfied with grade 5

- 15 to 20 percent of the students decides not to take Analysis in their first year of study

THE FIRST FOUR YEARS IN TEM:

- Percentage of students with a pass for this course:
  - 2013: 50%   2014: 71%
  - 2015: 60%   2016: 58%

- About 10% of the students use a compensation rue for Analysis.
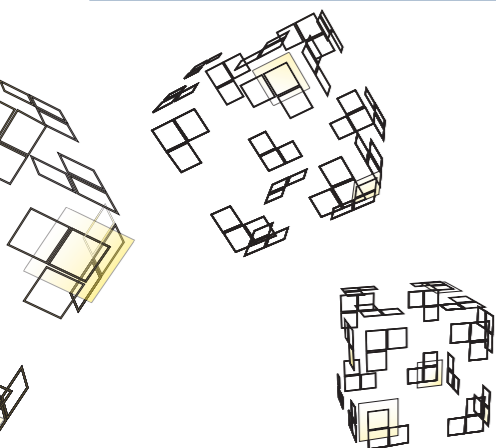
CAN TBL IMPROVE PERFORMANCE OF STUDENTS IN ANALYSIS

The three phases of Team-Based Learning

| PREPERATION | → | READINESS ASSURANCE TEST | → | TEAM ACTIVITIES |

- Individual
- In teams
- Discussion

- Writing proofs
- Peer Feedback
- Inspect and improve own test
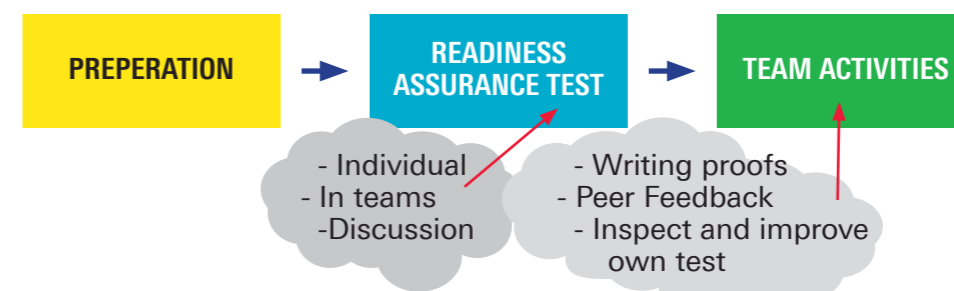
Results: **74%** of the students has grade 6 or higher

| 2013 | 2014 | 2015 | 2016 | 2017 |
| 50 | 71 | 60 | 58 | 74 |
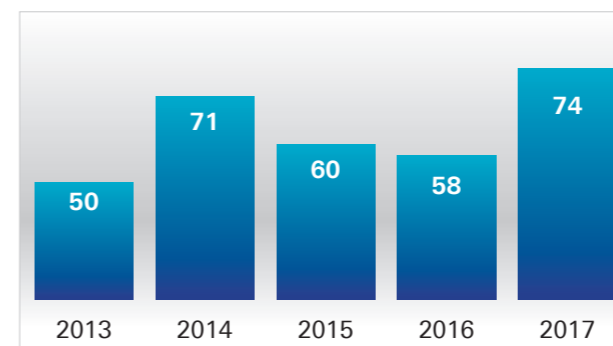
From students survey:

- 75% increase in reading the textbook
- Students like the discussions
- Half of the group agrees that learning with TBL helps to understand Analysis 😃

MY EXPERIENCE WITH THE SUTO

WHAT WAS MY SUTQ PROJECT ABOUT?
In my SUTQ project I designed an educational model for a fundamental mathematics course, founded on the concept of Team-based Learning. The aim was, to activate the students and to reach a better understanding of the abstract theory. This should lead to students who have the skills to write crystal clear proofs and solutions.

WHAT HAVE I LEARNED?
Student really appreciate discussions in teams about mathematics. You can give students the responsibility to prepare well for the Team-based Learning sessions and to give their fellow students feedback on their written solutions.

WHAT WAS THE BIGGEST CHALLENGE?
Previously, I always used my intuition in ideas about educational improvements. Now, I had to do research on which I had to base my educational design. Another challenge was to develop multiple choice questions for a fundamental math course.

WHAT AM I PROUD OF?
I spoke at different meetings and conferences about Team-based Learning. Other lecturers visited my Team-based Learning sessions. Most of them are enthusiastic about this didactic model. I am proud of the fact that I can inspire other teachers.

✉ b.m.geveling@utwente.nl

BRIGIT GEVELING

Brigit Geveling is a lecturer at the department of Applied Mathematics of the University of Twente since 1984. She teaches Calculus, Linear Algebra, Analysis and Algebra. For many years, she has been a tutor for first year students. From 2000 until 2015 she was the Bachelor Coordinator of Applied Mathematics. In 2018 Brigit won the Brinksma Innovation Grant, the price for an educational innovation at UT.
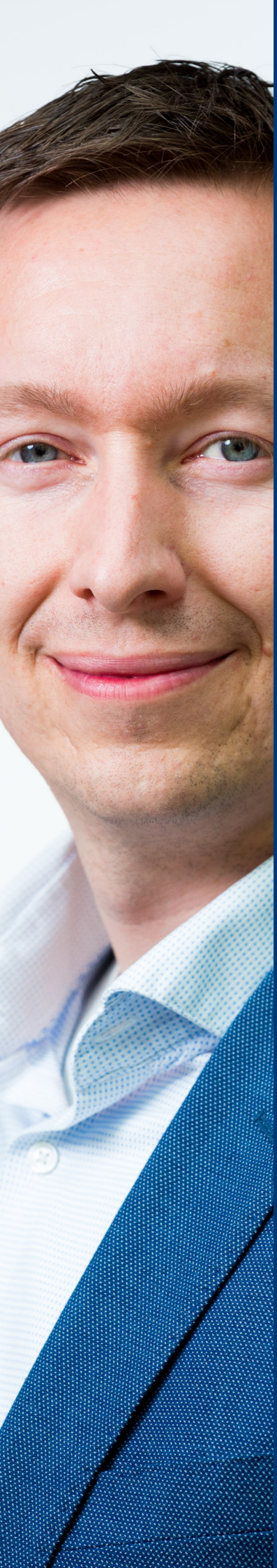
✉ r.g.j.damgrave@utwente.nl

ROY DAMGRAVE

As an assistant professor in the department of Design, Production and Management (ET), I work mainly for the educational program of Industrial Design Engineering. My field of expertise and research is enhancing product development trajectories by using 'Synthetic Environment' to support multi-stakeholder decision making. This incorporates the use of technology (Virtual Reality, Augmented Reality, Internet of Things, Robotics etc.) in order to understand and visualize the consequences of decisions. The application field is mainly on Smart Industry / Industry 4.0

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
This research focussed on gaining insight in which stakeholders are involved in the design of learning environments. This information is used to propose an approach and tool that stimulates collaboration between stakeholders, and facilitates gaining insight in the perspective of the other stakeholders. This information can be visualized so that the impact and dependencies of decisions can be communicated and discussed. The provided tool aims to come to a more predictable and robust learning environment, with the rationale on how this is related to the form of education, available resources, educational programme, etc. This tool will support the decision-making process towards the most appropriate learning environment.

WHAT HAVE I LEARNED?
Looking back at what the SUTQ trajectory brought me as a teacher, I think that especially being more aware of my own development as a teacher is the key value. With the knowledge and insights gained during the trajectory, I feel more confident to discuss and present my research into education. Especially participating in educational conferences and meetings is something I feel more comfortable on at this stage. This is perhaps something which is difficult to explain or assess, but the feeling of being part of the educational research community does help becoming a better teacher.

WHAT WAS THE BIGGEST CHALLENGE?
The biggest challenge was to narrow down the research topic and to find the most appropriate approach for it.

WHAT AM I PROUD OF?
To achieve my goal with SUTQ – getting more grasp on my research into education –, I approached this research as part of a bigger whole. I was already busy with learning environments before I joint SUTQ and used this trajectory to get a better underpinning and approach to my activities. This means that for me this research is not finished after SUTQ. But with the knowledge gained during this trajectory, I think that I am more capable of determining the right next steps to take. I feel being more in control on 'doing the rights things', than only on 'doing the things right'.
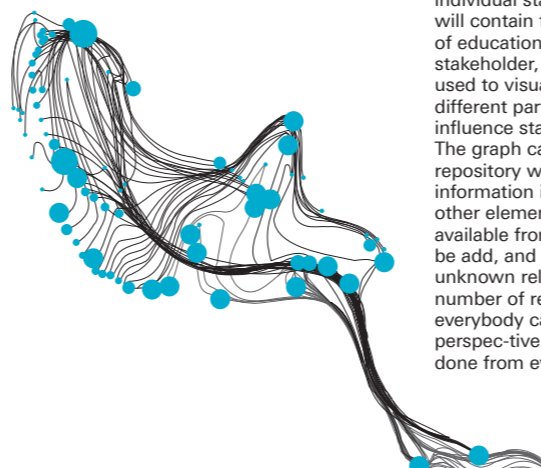
THE IMPACT AND DEPENDENCIES OF DIFFERENT STAKEHOLDERS IN THE DEVELOPMENT OF A LEARNING ENVIROMENT

INTRODUCTION
During the development of an educational curriculum, many decisions have to be made throughout all the development phases. All of them will influence the possibilities and eventual quality of education, and many stakeholders are involved with this process. The relation and interdependencies between the factors and aspects that eventually result in a curriculum are not always clear, nor can they always be influenced freely. This research focusses on the physical environment in which education takes places, and how these environments are de-signed, how they influence each stakeholder and how each stakeholder influences the design process thereof.

OBJECTIVE
In this research it is not the aim to determine a general defi-nition of positive learning environment, since this can be dif-ferent from each perspective, depending on the performance indicators related to a stakeholders' role in the learning envi-ronment. The goal of this research is to get more grasp and insight in the design process of the environment in which ed-ucation takes place. The aim is to facilitate and stimulate the decision-making process towards a most appropriate environ-ment, and to understand and give insight in the relations and dependencies different stakeholders of the environment have with each other.

> How are the demands for a learning environment from different stakeholders related to each other, and how do they influence each other?
>
> What are, in the perspective of the individual stakeholders, the key characteristics and/or elements of the learning environment that will have a certain impact on the quality of the environment.

RESULT
An approach to make all the information visible and to relate information to each other can be found in the use of graph overviews. These information repositories relate information to each other by adding meta data to the collected informa-tion. This meta data will consist of adding tags that contain information about the relation of information to the provid-ed data from each individual stakeholder or external source. These tags will contain for example information about the form of education, the number of participants, the type of stakeholder, the costs involved, etc. These tags will be used to visualize similarities and relations between the different parts of an educational environment and the influence stakeholders have on it.
The graph can be considered as an information repository where everybody can add information. This information is di-rectly put into context by linking it to other elements in the environment. Also, information available from current learn-ing environment could be add, and used to recognize clusters or visualize unknown relations between stakeholders. Since the number of relations is endless, and not predetermined, everybody can add the information from their own perspec-tive. Navigation through the information can be done from every perspective.

INPLEMENTATION
Visualizing the information makes it communicable and will trigger discussion, but also re-quires that the tool should be kept up to date. From a managerial vision the decision must be made to use this tool as the standard infor-mation repository for learning environment. In that case it can also include future visions or wishes from individual stakeholders. Every de-sired functionality can be added to the graph with a relation to for example a lecturer, study programme and form of education. These open initiatives could trigger others to make a link to the new desired functionality themselves. This collective data source has not a single own-er but should be a collaborative initiative. The goal should be to also add the rationale and decisions-making process of each learning en-vironment. If that information is available, the impact of changes to the environment can be visualized on beforehand, and the risks can be better managed.

CONCLUSION
Using a shared information repository, acces-sible via a graph interface, can stimulate and facilitate this process without steering the out-come or adding more overhead. Since this is only a tool, it can only become useful if it is be-ing used. The provided approach will not pro-vide automatically the most appropriate solu-tion in the form of a learning environment, but it will enable all stakeholders to contribute to it, and to see the impact of decisions. The ex-pertise of each individual forms the base for the intelligence of this system.

DESIGN RESEARCH IN DESIGN EDUCATION

SUMMARY

In this educational research project I have investigated how we can best strengthen the position of design research within the Industrial Design Engineering (IDE) master curriculum. By analysing the way in which design research is actually implemented in the courses I have built a clear picture of the scientifi c component of the programme.
By investigating the students' experience of this scientific component of the programme through Student Evaluations and two Focus Group sessions, I have been able to formulate specifi c recommendations how to improve the students perception of design research.

Research question:
How do (Industrial Design Engineering Ma) students experience design research in their/our education?

1 MASTER TRACK

3 TYPES OF DESIGN RESEARCH

6 CURRICULUM MANIFESTATION LEVELS

39 ASSESSMENT PLANS

2 FOCUS GROUP DISCUSSIONS

5 RECCOMMENDATIONS

1 POSTER

First Focus Group Discussion

Capita Selecta [Research] (na)	Design & Behaviour Change (na)	Product Life Cycle Management (0)	Embodied Interaction (20)	Ethics and Technology II (na)	Create the Future (10)	Multisensory Design (0)	3D printing; processes and use (35)	Brand Management (0)	Product Life Cycle (15)	Study Tour (na)
	Ethics and Technology I (na)	Philosophical Anthropology and Technology	Science & Technology Studies (na)				Design Histories (0)	Design & Emotion (na)	Virtual Reality (30)	Packaging Design & Management (0)
	Scenario Based Product Design (25)							Graphic Language of Products (25)		
								TRIZ (0)		

Exercise "research component" according to students (most research on the left) and lecturers (most research in blue).

Second Focus Group Discussion

Electric Vehicle system design (0)	Integrative Design of Biomedical Products (na)	Embodied Interaction (20)	Design for Maintanance Operations (0)	Intellectual Property in Product Design (35)	Design of Surfaces for Comfort & Touch (0)	Surface Engineering for Look & Feel (30)	Graphic Language of Products (25)	Design and Behaviour Change (na)	Brand Management (0)	Virtual Reality (30)	Design & Emotion (na)	Product Life Cycle Management (0)
Science & Technology Studies (na)		Empirical Methods for Designers (80)					Create the Future (10)	3D Printing; processes and use (35)	Scenario Based Product Design (25)		Design Histories (0)	Multisensory Design (0)
TRIZ (0)									Advanced 3D Modelling (20)			Systems Engineering (na)
Ethics & Technology I (na)												
Capita Selecta (na)		not applicable	no research (0)	10-15% research	20-25% research	30-35% research	>35% research					

Research for Design, Research about Design, and Research through Design [1]

Research for design is research that is conducted in preparation of, or during a design project and is meant to inform a particular design solution. Research about design is research about the act of designing, mostly studying designers practice or the history of design, resulting in recommendations, tools and methodologies. Research through design is the type of design research that diff ers the most from research in behavioural and natural sciences. In this type of research, the act of designing itself is the source of new knowledge.

It is 'researching designing' (onderzoekend ontwerpen), so while designing you are along the way researching different aspects to get familiar with a unfamilair subject.
-x- daaf

Table 8. Summary of research results for the different curriculum manifestation levels [2].

manifestations		summary of research results
intended	visionary	A university is a place where research and education are intertwined.
	written	Research is one of the seven aspects that constitute the Domain Specific Reference Framework of Industrial Design Engineering.
		This means that graduates should be able to acquire new scientific knowledge through research, which entails the development of new knowledge according to systematic methods.
implemented	interpreted	Throughout the curriculum, more than half of the courses have a substantial research component, resulting in 16% research overall.
		Most courses practice Research for Design or Research through Design. One course is characterized as Research about Design.
	in action	Research activities are mostly reading papers, literature/desk research, and design research.
		Research is mostly assessed indirectly in a design assignment or directly by writing a paper.
achieved	experienced	students appreciate courses with a substantial research component less than courses without. Also do they render courses without a research component more 'relevant for a future engineer'.
		Students report that research and academic level are important aspects for a master education
		Students are mostly not aware of the three types of design research, however recognize them in their educational experiences. They report a preference for Research through Design. Research for Design is the least important for an academic education, however seen as most important for being a designer.
		In most courses, the students assess the research component differently than in the lecturers intentions.
		Some courses are experienced as academic because they are very open and address different perspectives.
	learned	students score on average slightly better grades for courses without a research component.

[1] Frayling, C. (1993). Research in Art and Design.
    Royal College of Art Research Papers, 1(1), 1-5.
[2] van den Akker, J., Kuiper, W., & Hameyer, U. (2003).
    Curriculum landscapes and trends., Dordrecht: Kluwer Academic Publishers.

MY EXPERIENCE WITH THE SUTO

WHAT WAS MY SUTQ PROJECT ABOUT?
My SUTQ project was about the position of design research within the Industrial Design Engineering (IDE) master curriculum. Although research has a prominent place in the educational vision of the programme, national student evaluations show that the scientific component of the curriculum scores insufficient. I investigated the students' experience of the scientific component of the programme through Student Evaluations and two Focus Group sessions, in order to strengthen the position of the university as a place where research and education are intertwined.

WHAT HAVE I LEARNED?
That we have a very nice, clever and engaged student population, that is however also very diverse. Students experience and evaluation of the programme is not so much a matter of good or bad, but more about matching the expectations. Alignment of the sometimes latent wishes of the individual students with the many research opportunities of our curriculum is therefore key. A complication is that

the student's image of 'research' is often different than we as researchers have. On a personal level I experienced once more that reflection is key in developing yourself.

WHAT WAS THE BIGGEST CHALLENGE?
Getting all the things done in time. Fortunately the strict agenda of the SUTQ and the competent supervision of the CELT staff helped tremendously in keeping a clear eye on the content and the end goal of the project. This was, together with the inspiring atmosphere among the SUTQ participants, very motivating for keeping up with the schedule

WHAT AM I PROUD OF?
That my conclusion was that we actually have a very nice programme in terms of research and scientific education on the one hand, and that we have students that are very interested in doing design research at the other. It came out that the lower evaluations of our students are actually due to misalignment issues, that are although not easy to solve, also rather secondary.

✉ w.eggink@utwente.nl

WOUTER EGGINK

I am a designer, design researcher, and design historian at the faculty of Engineering Technology. I have been for a long time involved in the development of new educational activities at the University of Twente, from Industrial Design Engineering, via Creative Technology, to the DesignLab. Currently I am coordinating the Human Technology Relations master track within Industrial Design Engineering, targeting at the development of people-oriented designers with a clever mix of Engineering, Psychology and Philosophy of Technology.

✉ f.h.c.dejongh@utwente.nl

FRANS DE JONGH

Frans de Jongh is Assistant Professor at the department of Engineering Fluid Dynamics of the Faculty of Mechanical Engineering at the University of Twente. He also works at the AMC hospital of Amsterdam as a researcher and at the Medisch Spectrum Twente hospital at the department of Pulmonology where he is head of the pulmonary function lab. He is specialised in the respiratory system of humans, from ventilated premature neonates to elderly. Working on the boundary of technology (especially fluid flow projects) and medicine (the lungs) he is nationally and internationally involved in many projects in the field of technical medicine and biomedical technology.

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
I tried to implement student driven learning in the bachelor phase of technical medicine. In the master and PhD phase you see that students are almost always intrinsically motivated to learn. In the bachelor phase, many students still have competing interests. I investigated methods to challenge a large group of bachelor students (125) of technical medicine to become (more) motivated in student centred activities (instead of listening to traditional classical lectures) and how technical facilities, like digital exams can be used as tools for this purpose.

WHAT HAVE I LEARNED?
Although I thought that my way of teaching was not bad (I won amongst others the best teacher price of the University Twente in 2012/2013) I did many things on my gut feeling. I learned that there was a "complete world" dedicated to optimise teaching and knowledge exchange in a structured way. This goes much further than the more traditional methods most teachers use and tries to improve the way we teach and learn today, but also in the future.

WHAT WAS THE BIGGEST CHALLENGE?
One of the biggest challenges is "time". As teacher you are already often overfilled with educational activities and you are happy with the materials you developed in the past and can re-use. To systematically study, develop and improve your way of teaching and use new tools costs a lot of energy and evening hours.

WHAT AM I PROUD OF?
The knowledge I gained from amongst others the feedback from as well my supervisors as my students for this project. When I thought something would work the reaction could be opposite or the other way around. I gained in depth insight and knowledge of educational processes, also from my SUTQ colleagues who did the same trajectory and am proud to be able to teach at the Utwente at a higher standard.

HOW TO IMPLEMENT STUDENT DRIVEN LEARNING IN THE BACHELOR PHASE OF TECHNICAL MEDICINE

INTRODUCTION
Student driven learning is a relative new way of learning in which "classical" education, with mainly plenary lectures given by teachers (in which the students play a "passive" role), is shifted to student centred learning in which students take an active role/are responsible for their learning.

The intention of this project is to develop student centred material which can be used in module 6 of Technical Medicine (The cardio-respiratory system) of which I am the module-coordinator to investigate how a mind chance/mood chance can be introduced in education.

RESEARCH QUESTIONS
Can traditional lectures in the bachelor phase of the study Technical Medicine be replaced by more student centred activities with equal or improved knowledge exchange.

A sub question is:

How can digital/technical facilities available at the University Twente improve student centred learning and examination.

METHODS
Target group
The students included in the study are the Module 6 (= second year bachelor) Technical Medicine students (125 students = 25 groups of 5 students).

Three lectures, are replaced by sessions using the Immediate Feedback Assessment Technique (IF AT®) in three different styles:

Plenary lecture (as last year) but with 10 question slides throughout the lecture. Each question slide was directly placed after slides containing relevant information
Plenary lecture with the same slides as previous years. After a regular 15 minutes break 10 questions related to that lecture
Slides on intranet (blackboard) with additional/explanatory texts and session directly starting with 10 questions

A digital exam of module 6 was introduced with help of the CELT team made on the Chrome books in the "Term building".

Bloom's Taxonomy
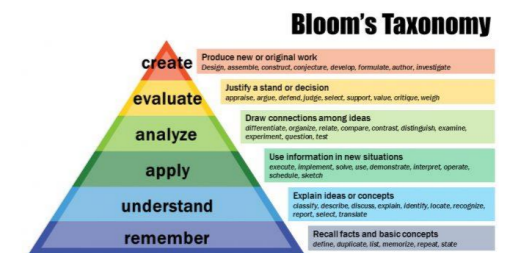
Immediate Feedback Assessment Technique (IF AT®)

RESULTS
Session 1: Time was overspent, (1 hr instead of 45 minutes) and still the session went too fast for almost all students.
Session 2. On average 4.3 (SD 2.0) mistakes on 10 questions.
Session 3. On average 4.4 (SD 2.2) mistakes on 10 questions.

All students preferred session 2.

Digital exam was equal to written exam for students, all teachers preferred the digital form.

CONCLUSION
Plenary lectures in the bachelor phase of the study Technical Medicine can be replaced by more student centred activities using the Immediate Feedback Assessment Technique (scratch cards).

Implicitly this process transforms "education" from a "remember/reproduce" level to an understand/apply level.

On top of that digital/technical facilities available at the University Twente can be used for examination (with open questions) for a large number of bachelor students.

FUTURE
Incorporate knowledge gained by this SKO project throughout the entire module 6, as well for students as for teachers.

Use digital forms of the (IF AT®) technique to get an immediate feedback as teacher so you know wen extra attention is needed.

✉ i.c.vanduren@utwente.nl

IRIS VAN DUREN

I am an ecologist by background. Most people probably see me as an enthusiastic, creative and practical person. Since I am employed in ITC (almost twenty years ago), the focus of my work has been on the application of geo-information in the field of "Natural Resources management". With satellite images, and aerial or UAV-based sensors we can observe what happens on the Earth's surface. Also with new technologies like mobile apps, lots of spatial data can be generated. These technologies help us to map the quality of our environment, assess the environmental impacts we make and develop more sustainable use of natural resources. Some examples of what this involves are: estimating the amount of carbon in vegetation or soils (to avoid and to mitigate CO_2 emissions), assess changes in land use because of food production, generation of bioenergy and other bio-based products or the protection of biodiversity and high conservation values. I enjoy being scientifically on the move. Besides publishing scientific papers I hold a diploma in journalism because I see talking to society equally important to communication within the scientific community.

My passion is coaching students and designing education. I supervise students at all levels: PhD, MSc and post graduate. In my free time, I give guest lectures for WWF on nature conservation in high schools and primary schools and help WWF-Netherlands with shaping their education strategy. Besides the contact with students during my teaching, I also enjoy designing innovative (e-learning) materials. I can put all my creativity in e.g. editing educational films or designing quizzes. Since two years I am involved in the Programme Committee in ITC because I feel it is important to have a saying in issues related to the quality of education.

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
ITC has a unique international student population and I wanted to have a look closer at how these students experience and appreciate the teaching and learning in ITC. So I designed two surveys and a workshop to look at (1) the differences and similarities between international students in how experienced they are in various teaching and learning methods before starting their education in ITC, (2) the differences and similarities between international students in how they appreciate teaching and learning methods used in ITC and (3) the reasons why students appreciate or dislike particular teaching methods in ITC.

WHAT HAVE I LEARNED?
From my SUTQ research I learned that international students generally are used at teaching methods like classroom lectures, reading and memorizing and supervised practical's. Many student indicated they are less familiar and experienced in internet-based lectures and question and answer sessions, peer review, or something like interviewing an expert and concept mapping. It appeared that there are no large differences between nationalities in the way how students appreciate the teaching methods applied in ITC. Likely personal character has a larger influence than nationality. Especially the workshop revealed a number of reasons behind the "like or dislike" of teaching and learning methods. These findings were translated in recommendations which hopefully will help in further improving the learning experience of our international student population.

From the SUTQ trajectory I learned that it is fun and useful to spend a period of time solely on thinking, reflecting or studying education. However, I also learned that the way how the trajectory was set up is not yet fully matured and needs further development. The objectives of what the UT wants to achieve with the SUTQ are in my opinion rather vague and miss the definition of what the S or "senior" really stands for. Educational research or design, like what current participants did, makes that we focused on just a tiny little portion out of a whole range of educational issues. I would love to see a somewhat different set-up in the future. A setup that equips SUTQ-ers with more skills and know-how to be effectively involved in education at a higher level e.g. in program and curriculum design, quality control of education or accreditation processes. The good thing is however, that the number of people in the SUTQ community is growing so we can work on this with a growing team of dedicated teachers.

WHAT WAS THE BIGGEST CHALLENGE?
One of the biggest challenges was the data collection during my research. The timing of the SUTQ with a start in May and the end in February was unfortunate for the type of information that I needed to collect and analyse. So I had to use two different student groups to collect my data which brought some inconsistency in the dataset. Also the amount of work that came along with organising two surveys and a workshop was substantial. So doing the SUTQ while my regular teaching and research activities continued too, felt sometimes as if I was juggling with 26 balls up in the air.

WHAT AM I PROUD OF?
I am proud that I succeeded. And I am even more proud that I have many dedicated colleagues in ITC who helped me with relevant comments and suggestions or the opportunity to use a bit of their teaching time to conduct the surveys.
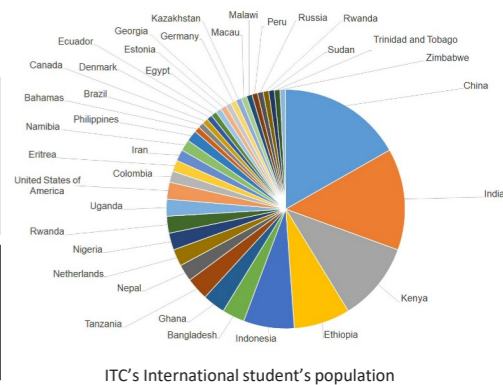
LESSONS LEARNED FROM TEACHING INTERNATIONAL STUDENTS

What to expect and take into account while teaching international students?
This SUTQ study created insight in the educational background of international students. Also the appreciation or dislike of teaching methods in ITC was evaluated. These insights are translated into recommendations for teachers and students.
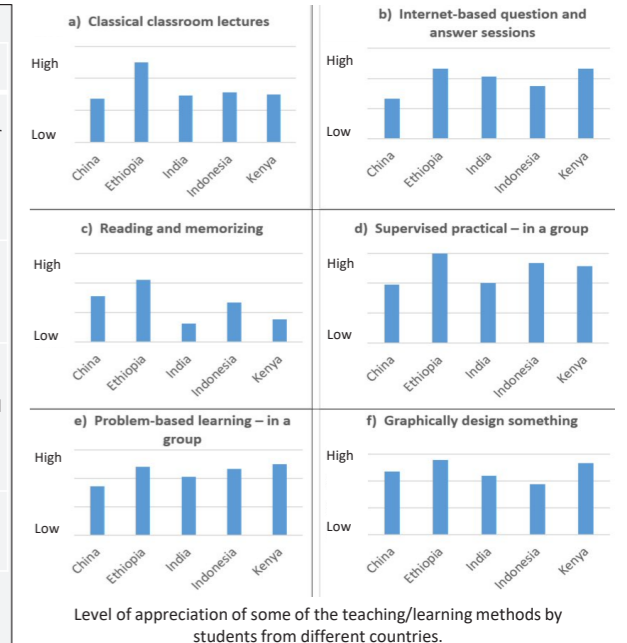
Main approach:
A list with teaching/ learning methods was compiled. Survey 1 revealed student's experiences with these methods. Survey 2 scored the appreciation level of teaching methods. A workshop answered why students prefer or dislike particular methods.

ITC's International student's population

Quotes by students on teaching methods:

Highly appreciated	Not appreciated
Classroom lecture: 1) real time feedback from student is easy for teacher to turn their pace. 2) student can also ask their confused part.	**Self-tests and quizzes:** Makes students stressful. For me I will try to memorize some knowledge within short time. It's easy to forget later. That is not useful.
Supervised practical: it gives me time to extract/obtain everything from supervisor.	**Unsupervised practical:** If is unsupervised I could got stuck on one problem for a very long time.
Recorded classroom lectures: Most liked because I'm not good in listening in classroom. And to reherse the lecture again.	**Concept mapping:** Hard for me to locate the concept and too complicated to review (like one chapters' knowledge)
Present to an audience: In doing so brings the depth in understand the topic.	**Fieldwork or excursion:** Time consuming and bad weather.

Note: These individual responses are not always representative for the entire student group or all students from the same country.

Level of appreciation of some of the teaching/learning methods by students from different countries.

Some highlights and recommendations
- Perception of what a teaching method involves may differ between staff and students (also between staff and between students). Examples are "unsupervised practical" or fieldwork. Therefore teachers should **EXPLAIN THE TEACHING METHOD** just as they explain the content of a topic.
- Avoid that students get stuck for too long in unsupervised practicals. Monitor and reconsider the timing of feedback.
- Lack of fluency in English is a major barrier for several students to follow lectures, submit written assignments and answer exam questions. We should think of ways to stimulate new students more forceful to improve their English before coming to ITC and in the first year of the curriculum.
- Several students do not dare to ask questions. Students must learn to do this. Help them with it.
- Be aware that students may be "polite" instead of telling what they really think. We need to find ways to make them more confident and make them aware that we need their honest opinion.

Discuss your teaching with students.
Both staff and students can benefit from understanding each other's expectations, challenges and choices.

DESIGN OF A COMPUTER-SUPPORTED COLLABORATIVE LEARNING APPROACH TO PROMOTE POSITIVE INTERDEPENDENCE IN A GROUP ASSIGNMENT
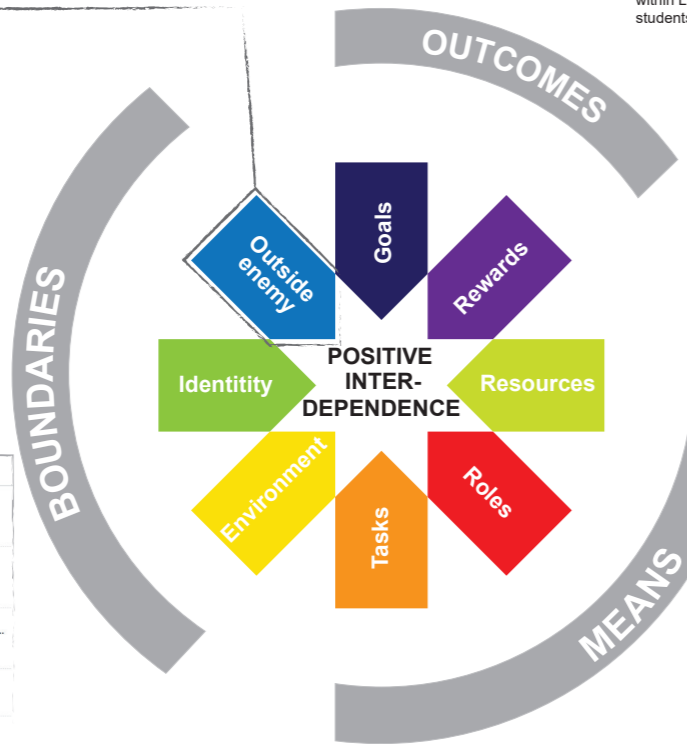
"My goal was, regardless of whether we have to finish the assignment; I had to understand all the aspects of the assignment. For instance if it was about spatial analysis and even if I am not the one doing the spatial analysis I have just to do it and get to know how has this person done the spatial analysis."

"If we had a group discussion the class was the perfect environment because at the class you were able to know what the other groups were doing, are you also at the right direction?, and the lecturers were able to pop in and see if you were working well. So the classroom was the perfect place for group discussion."

RECOMENDATIONS
1. Add clear learning objective to the group work.
2. Make more explicit why group work is relevant for the assignment.
3. Improve instructions and discuss with students face to face if they have difficulties interpreting the assignment.
4. Reconsider the use of WebPA to peer assess participation, preferably within LMS and in consultation with students before starting the group work.

[no outside enemy = inter-group collaboration]

RECOMENDATIONS
7. Keep the classroom as the place where students can work in group, physically interact with group members, across groups and staff.
8. Invite students to choose a name for the group as it stimulates positive identity interdependence.

RECOMENDATIONS
5. Keep in LMS group pages as students valued the possibility of storing and sharing data within CANVAS.
6. Keep group dynamics workshops and evaluate possibility of introducing social skills as part of the core training in the MSc Geo-information Science and Earth Observation (e.g. during academic skills or internationalization).

"[put] different strengths together to succeed."
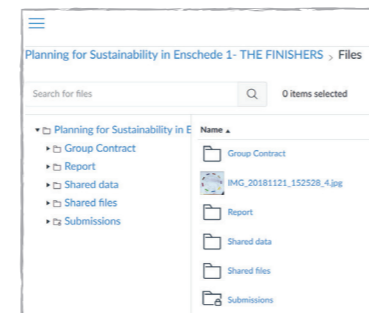
The quantitative analysis shows a slight improvement in the perception of positive interdependence after the group work. The mode and mean in positive interdependence increased from 4 to 5 although the standard deviation and strongly disagreement responses increased.

in class...
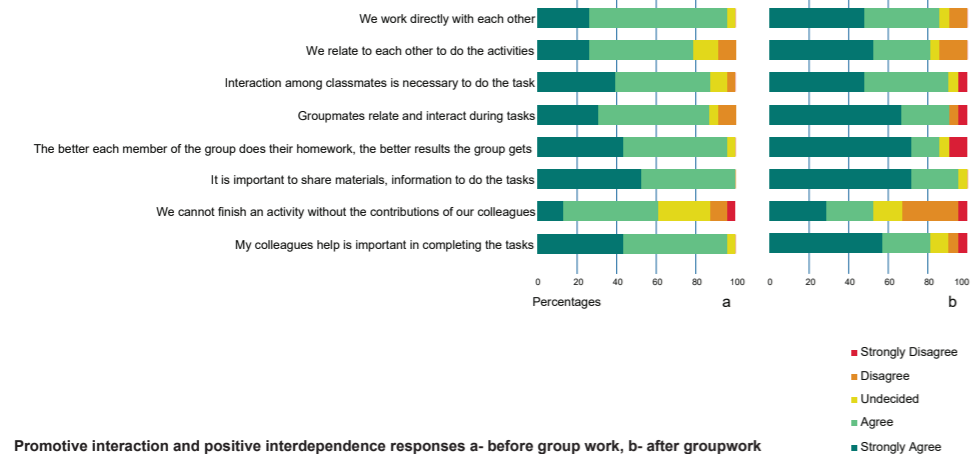
Promotive interaction and positive interdependence responses a- before group work, b- after groupwork

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✉ j.a.martinez@utwente.nl

JAVIER MARTÍNEZ

Javier Martínez is Assistant Professor in the Department of Urban and Regional Planning and Geo-Information Management within the Faculty of Geo-Information Science and Earth Observation (ITC). He is also coordinator of the Urban Planning and Management specialization of the 2-year Master's degree in Geo-Information Science and Earth Observation. He graduated as an architect from the Faculty of Architecture, Planning and Design of Rosario National University (UNR), Argentina, and obtained his MSc degree in Geo-Information for Urban Planning from ITC. He received his PhD from the Faculty of Geosciences, Utrecht University, for his thesis Monitoring intra-urban inequalities with GIS-based indicators: with a case study in Rosario, Argentina. His research, publications and education experience are focused on the application of GIS, mixed methods and indicators for policy-making, urban poverty, and quality-of-life and intra-urban inequalities. From 2010 up until November 2014 he was co-coordinator of the Network-Association of European Researchers on Urbanization in the South (N-AERUS). Since 2017, he has been a member of the board of directors of the International Society of Quality of Life Studies (ISQOLS).

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
The main goal of my SUTQ project was to develop a (computer-supported) collaborative learning approach that promotes positive interdependence in a group assignment.

WHAT HAVE I LEARNED?
In cooperative learning there are three main types of positive interdependence: outcomes, means and boundaries interdependence. Outcomes interdependence relates to the goals and rewards that are defined in the group work. Means interdependence includes for example the roles and tasks assigned within the group. Boundaries interdependence is related to the specific space where the group work takes place and what binds students together.
The quantitative and qualitative analysis show that means interdependence is the most predominant characteristic of positive interdependence present in group work and positively perceived by the students. In the collaborative learning approach that was designed, both the group dynamics workshop (analogue/in class) and the group pages in the learning management system (LMS) seem to help in improving means interdependence. Outcomes interdependence requires further attention as the objectives of the group work and the instructions uploaded in CANVAS are not always clear.

In terms of boundaries interdependence it seems that working in class in different groups is favoured by the students and even more when there is the possibility of contacting the staff in class (e.g. to receive feedback). I also learned that students favour inter-group collaboration and do not see other groups as "outside enemy".
Johnson et al., (2007) summarize the core of positive interdependence by asserting that the precondition for any cooperative learning situation is that students "must perceive that they are positively interdependent with other members of their learning group, that is, students must believe that they sink or swim together" (Johnson et al., 2007, p. 23). The way that the LMS and the collaborative learning approach is designed and implemented could help students to "swim together".
Johnson, D. W., Johnson, R. T., & Smith, K. (2007). The State of Cooperative Learning in Postsecondary and Professional Settings. Educational Psychology Review, 19(1), 15-29.

WHAT WAS THE BIGGEST CHALLENGE?
I started the SUTQ with a new MSc structure that required the development of new material, including the use of a new learning management system (LMS) environment (CANVAS). I tried to capitalize the challenges of starting the SUTQ with a cohort of students using Blackboard as LMS and developing the collaborative approach with another cohort of students using CANVAS.

WHAT AM I PROUD OF?
In my role of course and specialization coordinator I could discuss with other staff members the challenges they face while implementing group work assignments and how they cope with it. Furthermore, since our students learn to use similar research methods as those I had to use for my SUTQ, I could run the Focus Group Discussion as part of the students' practices of research skills. Similarly, I could explain to my students the type of questionnaire I was using in my SUTQ and why I had distributed consent forms. This was one of the most inspiring and motivating moments of my SUTQ as I could explain and apply research methods with my students.

HOW TO SOLVE IT?

SYSTEMATIC APPROACH TO PROBLEM SOLVING, TRESHOLD LEARNING CONCEPTS, DECODING THE DISCIPLINE AND STUDENT AS PARTNER

INTRODUCTION
Educational institutes have to educate a new generation of engineers that will develop low impact, clean, low noise, minimum energy use, flexible new technology for a resilient society. Engineers solve problems. They analyse, combine insight and information into a suitable model, design a strategy leading to a solution, obtain it, and verify the result. The result should be realistic within an operational envelope. Each step is essential. Misconception, errors in design or calculation, in real applications can be catastrophic. How to teach students the engineering problem solving approach ? This question has been subject of many studies, but, in the present "digital" society where they are exposed to an overload of (often not reliable) information and constant media distraction causing a reduced span of concentration, it is more difficult to answer. Teacher centred methods (classic lectures and exercise classes) appear out of date. Problem (Project) based learning is widely introduced but also criticized [1]. This project is about the redesign of a convective heat transfer course to improve actual problem solving ability and learning experience by emphasizing systematic problem analysis (SAP) and using recent educational developments as threshold learning concepts (TLC) , Decoding the Discipline (DtD) and student as partner (StAP).

EDUCATIONAL CONTEXT
The Twente Educational Model (TEM) is a modular BSc program. Module 7 (year 2) in Mechanical Engineering "Thermal Fluid Engineering" contains courses "Fluid Mechanics" and "Heat Transfer" and Project Based Learning (PBL) using a practically relevant complex design involving fluid mechanics and heat transfer. The courses are evaluated by classic solving problem exams. Teaching is by lectures and supervised exercise practicing classes. Only 20% of the students attend these exercise classes, whereas solving problems is exactly what is needed to pass the exam. Most student (groups) pass the oral project exam, and deliver acceptable project reports. The course exam scores are much lower. In

Figure 1: Todays learner in transformation to engineer for resillient society

Vygotski
1896-1934
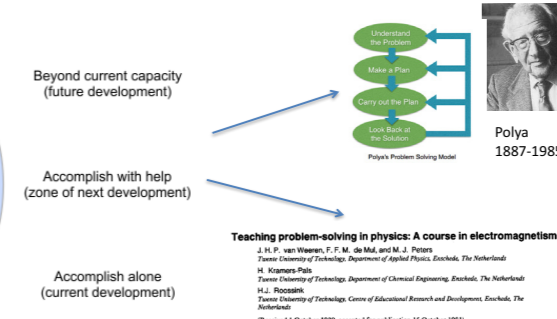
Galperin
1902-1988

Polya
1887-1985

Figure 2: From Vigotsky, zone of proximal Development (ZDP) to Systematic problem solving (4 step approach Polya [3], and SAP [4,5])

this project the effect of partial redesign of the heat transfer course on the individual problem solving skill shown at the exam is investigated. The project is carried out as part of the Senior Teaching Qualification project. Implementation first done in february`may 2017.

PROBLEM SOLVING AND THEORY OF LEARNING
Learning is cognitive development in social contact (Vigotsky/Galperin) [2]. Students learn optimal in Zone of Proximal Development (ZPD) with more knowledgeable other (MKO) e.g. teacher. Essential element to arrive "in" ZDP is motivation. Scaffolding towards internalization via guided repetition, and evaluation. Polya [3] introduced a 4 step approach problem solving method widely used. A very similar Systematic Approach to Problem solving (SAP/SPA)[4,5]) was successfully used in teaching in the 1980's at the University of Twente but attention has faded in the past decades.

REDESIGN/INTERVENTION CONVECTIVE HEAT TRANSFER
• MSc Student as partners in redesign and execution.
• Threshold Learning Concepts identified (heat transfer coefficient, dimensionless numbers and scaling).
• Student interaction in lectures.
• SAP manual introduced.

• Decoding the Discipline: Convection problem roadmap "specialists work systematically" but also "go back and forth" and look for specific forms of results.
• Exercise class transformed to active "How to Solve it" session.
• Pre`class digital inquiry form with questions from "daily life all around" to enhance motivation and insight in relevance. Results discussed in class.
• SAP analysis specific problem in each session in groups (hand in)
• Bonus score for exam "earned" by presence, inquiry form, and SAP analysis.

RESULTS (PRELIMINARY)
Results of "intervention" measured in exam score. Student evaluation and teacher/assistant evaluation. 99 % attendance of working classes

Exam scores

After "bonus" correction marginally improved results. Overall still too low. Pass 51 %
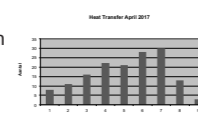
Student, student assistent, teacher evaluation

Positive feedback on "How to solve it sessions" , good atmosphere, and learning experience.

Students scoring high seeking more challenge. Students scoring extremely low have been interviewed separately. No specific clear new TLC observed. Student assistant and teacher evaluation positive. Teacher experiencing major transformation.

CONCLUSION & CONTINUATION
Student learning experience has significantly been improved. Better problem solving ability measured by exam not (yet) seen in preliminary result. Possible cause is that the improvement is obscured by the fact that convection heat transfer is only part of the course and exam. Student feedback provides motivation for repeating the research in the next student generation (february 2018). Study will be continued. SPA part further intensified using specific forms for exercises. Reader of exam and exercise problem with analysis will be written.

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✉ c.h.venner@utwente.nl

KEES VENNER

Kees Venner is chairman of the Engineering Fluid Dynamics group in the faculty of Engineering Technology, and heads the "Thermal Fluid Engineering" specialisation of the MSc. program Mechanical Engineering.
He is also involved in the international Double-Degree program Mechanical Engineering-Aeronautical Engineering with the Brazilian aeronautical institute ITA. Kees' group aims to provide high level teaching and research in fluid dynamics for problems engineers face in the transition to technology for a resilient society and in health technology. Themes involve thin layer flows aerodynamics and aeroacoustics (noise of wind turbines and airplanes), Computational Fluid Dynamics, and biomedical fluid dynamics. Kees obtained his MSc. and PhD. in mechanical engineering at the UT and spent several years at the Weizmann Institute of Science, Israel. He teaches courses in the BSc. and MSc. curriculum Mechanical Engineering. In addition to this academic teaching experience he is holder of a 3rd degree black-belt (Sandan) in Shotokan karate with a teaching experience of some 20 years to both adults and children.

MY EXPERIENCE WITH THE SUTO

WHAT WAS MY SUTQ PROJECT ABOUT?
The redesign of a heat transfer course in the 2nd year BSc. Curriculum in Mechanical Engineering to improve the engineering ability of students to model and solve practically relevant problems systematically, obtain realistic answers, and obtain better scores at regular exams as well as achieve a deeper learning. The redesign involved reintroduction of systematic problem analysis, enhancement of student engagement towards active learning, aspects of Student Driven/Student Centered Learning, Students As Partners, Decoding the Discipline, and Threshold Learning Concepts.

WHAT HAVE I LEARNED?
I have learned a lot about the fundamental nature of learning processes, developments in Science, Technology, Engineering and Mathematics education, the educational literature, and the pedagogical language of this field. I learned how to integrate classic engineering topics such as systematic problem solving, with ideas about teaching that had been in my mind for many years and educational theories such as Decoding the Disciplines and Threshold Learning into an

active learning environment in which I as a teacher learned together with the learners. It has once more become clear to me that in the end it is always enthusiasm and motivation of both teacher and learner that should come together to make a learning process successful. The SKO project has given me much more confidence and possibilities to create a positive and active learning environment.

WHAT WAS THE BIGGEST CHALLENGE?
The biggest challenge was to find the time to search and study educational literature, to integrate all ideas into a real plan, carry out the plan, and evaluate, and do all this in addition to the already high workload.

WHAT AM I PROUD OF?
I am very proud of the positive feedback that I have received from students who participated in course, and from various colleagues on the report I wrote at the UT and abroad.

The project has significantly changed my view on teaching and myself as a teacher, it has given me a lot of positive motivation to keep on searching, and flexibly develop the best learning environment for the right occasion.

ON THE INTEGRATION OF SOFT AND ACADEMIC SKILLS IN THE MODULES WITHIN THE BSC. PROGRAM OF TECHNICAL MEDICINE

Introduction
Soft skills and academic skills are considered to be of high importance for the success of students after their graduation.
To be able to propose methods to integrate, assess and monitor learning objectives related to soft and academic skills in the bachelor curriculum of Technical Medicine (TM), more insight should be gained in 'whether' and 'at what level' integration is currently applied.

Results
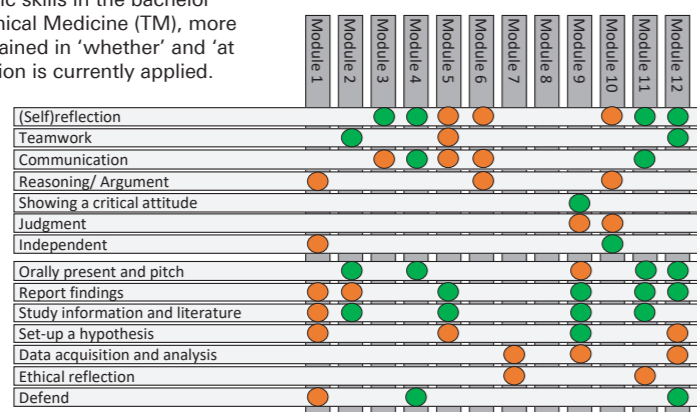
Figure 1 Overview of skills development in the BSc. curriculum of TM
🟢 = skills that are made explicit both in the learning objectives and the assessment matrices.
🟠 = skills that are mentioned in the learning objectives or in the assessment matrices, but not in both.

Methods
Screen
• the competence profile of the program of TM,
• learning objectives in the course information and
• criteria in assessment matrices to identify soft and academic skills
Conduct interviews:
• with 3 lecturers on soft skills, the educational manager and
• with a focus group of 4 third-year bachelor students of TM.

Discussion
As proposed in the Biggs' model of constructive alignment (Figure 3), the curriculum design of each educational program should aim at coherence between assessments, teaching strategies and intended learning outcomes. As can be observed in Figure 1, the constructive alignment is not found for about half of the learning objectives. However, it may be that constructive alignment is found within parts of Modules, but that the intended objectives are not made explicit in the Module information or Module's assessment scheme. Furthermore, the importance of skills are perceived differently by lecturers and students and the perceptions do not always reflect the weight given to the skills in the curriculum.
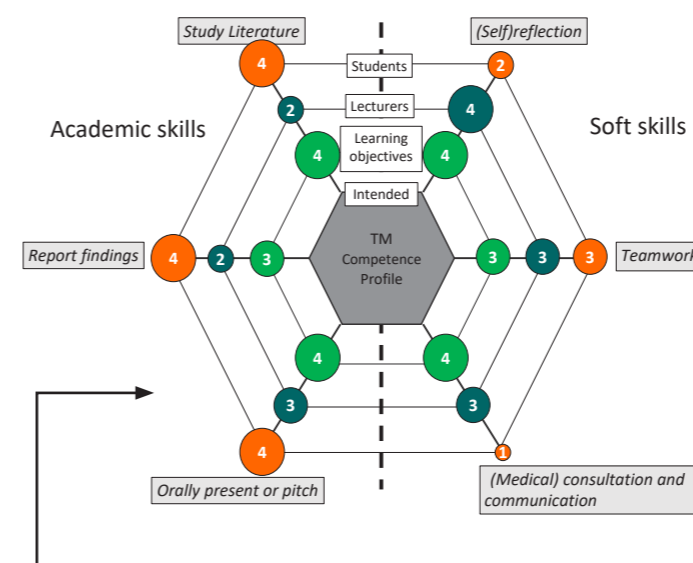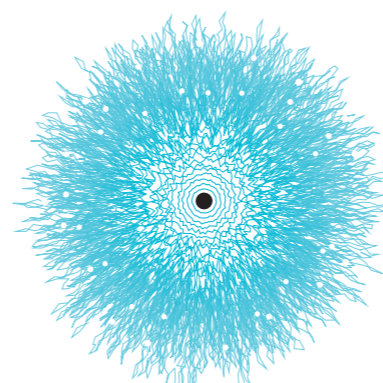
Figure 2 Perceived import-ance of skills. In the inner circle of green balloons a numerical value is given for the appearance of the skills in the learning objectives and assessment matrices.
The number of lecturers in the interviews and the number of students in the focus group that mentioned or confirmed the skill as important are show in two outer circles.

Conclusion
Learning objectives and assessment criteria are not always explicitly aligned. Skills development has to be better designed, implemented and evaluated both at course and at curriculum level. Objectives can be formulated based on the competence profile.

Figure 3 Adapted schematic of the Biggs' model of constructive alignment. The competence profile of a TM graduate could serve as a guide in formulating the intended learning outcomes.

Reccomendations
• Make learning objectives related to skills not only explicit in course information but also highlight the importance to students by contextualizing the purpose of the skills and by offering educational methods that allow for the development of the skills.
• Ensure constructive feedback at an individual level to fast forward students' development.
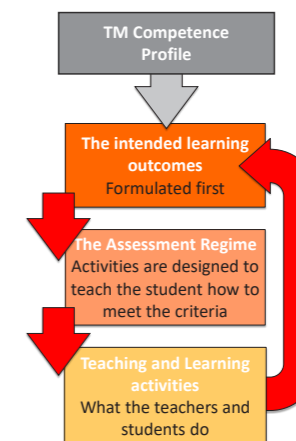
MY EXPERIENCE WITH THE SUTO

WHAT WAS MY SUTQ PROJECT ABOUT?
My SUTQ project focused on the integration of 'soft' and academic skills in the bachelor program of Technical Medicine. I was curious to which extent these skills were explicitly highlighted and integrated in the Modules of the curriculum. I also wanted to know how these skills can be trained, assessed and monitored such that the development and assessment of other skills and knowledge is not compromised.

WHAT HAVE I LEARNED?
I have learned that integration of skills from different fields of expertise into modules, projects and courses can be a challenge. In quite some modules constructive alignment of the learning objectives, the implemented methods and the assessment criteria could not be observed. Definitions of skills and methods to train and assess them differ between educational managers, lecturers and students.

WHAT WAS THE BIGGEST CHALLENGE?
To study learning objectives and assessment criteria of Modules and courses a lot of written documentation was required. Although this information should have been available according to the education and exam regulations (EER) for quite some modules the information was outdated or incomplete. Furthermore, this was the first time that I conducted interviews and a focus group. I have never coded and analyzed transcripts before.

WHAT AM I PROUD OF?
I am proud of what I have learned during my trajectory. I have seen some of the challenges faced by the educational management team of the program with respect to clarifying course content and motivating lecturers to communicate their objectives and methods. I believe that I gained more insight in the program as a whole and that this can help me to conduct my tasks as chair of the program committee better.

✉ a.m.leferink@utwente.nl

ANNE LEFERINK

Anne Leferink studied Biomedical Engineering and conducted a PhD in the field of Tissue Regeneration both at the University of Twente. After her PhD she worked as a Post-Doc at Maastricht University (0.6FTE) and as lecturer at the University Twente (0.4FTE). After two years she decided to work full-time for the University of Twente and to dedicate more time to educational development and teaching. In the limited spare time she conducts research in the field of organ-on-a-chip technology and medical device development in the group of Applied Stem Cell Technologies. Anne teaches in the program of Technical Medicine her courses are related to Cell Biology, Biomaterials and Clinical Biotechnology.

✉ l.l.oldescholtenhuis@utwente.nl

LÉON OLDE SCHOLTENHUIS

Léon olde Scholtenhuis, assistant professor, Faculty of Engineering Technology, Department of Construction Management & Engineering (CM&E). I occupy this position since 2016, when I started as researcher in underground infrastructure networks, and construction innovation through digitalization. Currently, I am the lead researcher in my group's ZoARG | ReDUCE unit, which focuses on the development and research on reduction of damages to utilities and careful excavation. I also teach in courses related to this. I developed and coordinate the B.Sc. minor Smart Ways to make Smart Cities Smarter (for which we won the ECIU Team Award in 2017). I am also a lecturer in the CM&E master. Here I teach in Building Information Modelling, 5D and Planning; Digital Technologies for Civil Engineering; and, Subsurface Utility Engineering. One of my core philosophies in teaching is that it should be engaging for both students and staff. To this end, I try to use real life cases, and involve industry. This enables me to learn myself as well from the project work that students do.

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
The goal of my SUTQ was to assess whether modern, IT-enabled, instructional methods 'outperform' frontal lectures. I therefore investigated the impact of such methods on student performance and their enjoyment. More specifically, I conducted a semi controlled experiment in which I taught one of my classes to a control group of students using the frontal lecture style. The experiment group, instead, watched five micro-lectures (online videos with a duration of 2-7 minutes) and attended an in-class session. Both groups covered the same lecture content and made a pre and post-test. I also conducted a focus group to assess the students' enjoyment of the micro lectures. Unfortunately, the population of students was 27, and after deducing invalid measurements, this means that the study sample is too small to draw valid conclusions. Results are nevertheless interesting, as the micro-lecture students (experiment) seemed to significantly outperform the frontal-lecture (control) students. Also a focus group discussion revealed that students found the new instructional method more enjoyable.

WHAT HAVE I LEARNED?
This learned me that video lectures – and probably similar technology – cannot substitute for a high-quality in-class discussion. Students really appreciated videos shown upfront, but all indicated that mastering instructional material usually requires contact with peers, tutors and lecturers. I do believe, though, that most unilateral transfer of knowledge through presentations or readings, should be moved outside the classroom as much as possible to create rewarding and dynamic sessions.

WHAT WAS THE BIGGEST CHALLENGE?
The largest challenge for me was to prepare my experiments. Writing a script, preparing slides, and recording micro lectures really takes time. For five short lecture I easily spend 4 hours recording time, and at least 8 hours preparation.

WHAT AM I PROUD OF?
What surprised me in a positive way was that many colleagues and students were interested in my SUTW topic and liked to contribute to it. I therefore am happy that this personal project actually impacted more than just myself. Even more specific to the course that I experimented with, I can say that it may chance the way in which we deliver our lectures in the next year. This is a rewarding outcome of my SUTQ.

FLIPPED MICRO-LECTURES: MORE ENJOYABLE AND HIGHER PERFORMING CLASSROOMS?

INTRODUCTION
Multimedia recording facilities and broadband internet access create the opportunity to use videos as instructional means in teaching. In engineering courses, for example, videos demonstrated that students study effectively outside lecture hours, and on their own pace to obtain modeling skills. However, little research exists that focuses particularly at one type of video: the micro-lecture. Micro-lectures are online instructional videos of around five minutes. They explain the basics of a concept. It is unclear how micro-lectures influence learning.
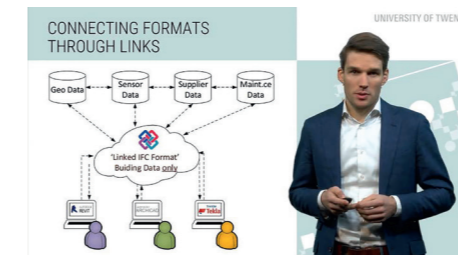

RESEARCH QUESTION AND APPROACH
This study investigates how micro-lectures influence satisfaction and performance of students. Research questions are (1) to what extent does the micro-lecture contribute to increasing students' performance? And, (2) to what extent do students perceive the micro-lecture instructional method as enjoyable? We compared two conditions: a traditional frontal lecture (control) and a micro-lecture with a follow-up in-class session (experiment condition).
We randomly allocated 27 M.Sc. students of our Building Information Modelling (2018|19) class. The control group attended a 90-min regular lecture, the experiment group watched five micro-lectures (of resp. 3:55, 6:36, 3:24, 2:42 and 6:45min) and spent 75 min. in class

to make exercises and discuss learning material.
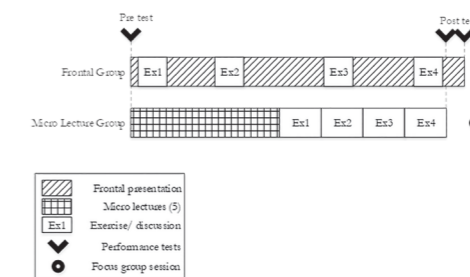
We quantitatively assessed the achievements of both groups with pre- and post-tests and held a focus group to qualitatively study the experiments group's enjoyment with micro-lectures.

RESULTS
The Wilcoxon 2-tailed sign test shows that both the experiment (p=0,00) and control group (p=0,039) performed better at the post-test. Outcomes of the Mann Whitney U Means test further reveals that there was no significant difference between the pre-test scores of the two groups (p=0,121, U=50,0; α=0,05). The difference between the post-test scores of the groups was significant (p=0,021, U=25,5; α=0,05).

Condition	Pre-test		Post-test	
	Mean	Mean	Mean	Mean
Frontal (control, n=12, 10)[a]	4,1108	1,600	5,3770	2,792
Micro (experiment, n=13, 12)[a]	4,8200	1,568	6,8250	0,814

[a] number of participants in the pre-test and post-test

The focus group findings are that micro lectures:
• helped to study learning material more concentrated,
• were more attractive to repeat and replay, and
• gave increased control over learning processes.

In combination with the in-class session, the lectures:
• triggered participants to prepare for in-class engagement,
• increased their sense of understanding,
• created livelier in-class sessions, and
• helped retain knowledge.
Participants stated that micro lectures were more enjoyable than frontal lectures.

DISCUSSION AND CONCLUSION
Despite the enhanced performance and enjoyment, we cautiously interpret the results, since the sample was small (n<15) and the scale of the experiment was one lecture only.
This study contributes:
• To the literature on multimedia learning: insight on the benefits of short instructional videos and their impact on students' performance and enjoyment.
• To (civil) engineering education: a basis for discussions about micro-lectures as an alternative to frontal teaching.
• To our BIM course: the motivation to adopt more micro lecturing in the future.

EXPLORING OPPORTUNITIES FOR REVISING ENTERPRISE EDUCATION IN THE IBA PROGRAM: A PRACTICE DRIVEN APPROACH

WHAT IS ENTERPRISE EDUCATION?
Enterprise education is concerned with the application of creative ideas and innovations to practical complex real life situations

The aim of enterprise education is "to produce individuals with a mind-set and skills to respond to opportunities, needs and shortfalls, with key skills including taking the initiative, decision making, problem solving, networking, identifying opportunities and personal effectiveness"

Learning takes place through experiential learning
Learning enterprise skills requires the availability of real-life or simulated entrepreneurial/business contexts
Learning and the assessment of what has

been learned occurs almost simultaneously and is dominantly formative

WHY REVISING ENTERPRISE EDUCATION IN IBA?
National Student Survey (n=148) of the year 2018, IBA students evaluated the relevance to the professional practice with a 3,59 of 5 (satisfactory)
Industry 4.0 puts new demands on businesses and need for skills

Practical council: strengthen the relationship with practice through a closer engagement with the program and define specific roles of practice in the business administration programs (IBA and Master BA)

ENTERPRISE EDUCATION IN IBA
Enterprising philosophy embodied in intended learning outcome. Presence of a skill line for developing transferable skills (communication, self, collaboration) Internship (elective)

Aim and research questions
Exploring the opportunities for "practice driven" enterprise education and provide recommendations for enterprise education in the IBA in a pedagogically responsible manner

1. Which enterprise skills are identified as most important by the business community?
2. How can the identified enterprise skills be translated into measurable learning goals?
2. Which methods related to entrepreneurial/business contexts are considered effective as learning context to learn the enterprise skills identified?
3. How can the identified learning goals effectively be assessed?
4. implications for revising enterprise education in IBA?

RESULTS

Assessment practices
• Objective criteria linked to learning goals
• Co-assessors (company, educator, peer)
• Formative assessment (tips and tops)
• Reflection of the learner is part of the assessment

Learning goals
• Stakeholder mobilization
• Virtuously engaging with others
• Business problem analyzing and solving
• Acting independently
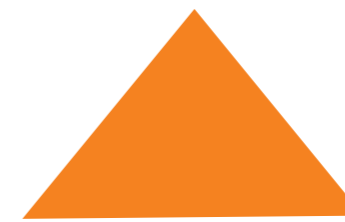
Learning methods
• business context (real life experience)
• Focus on real life problems
• Coached by mentor from the firm
• Within UT: Hackathons, Gamification, virtual lab, cases
• Individual learning over group learning
• Longer involvement (project based) re-visits

METHODS
Interviews with managers from six regional firms to explore skills and subject areas

Workshop (World Café) to explore opportunities following constructive alignment approach

20 participants; managers, educators, students, staff (CELT member)

CONTRIBUTIONS AND IMPLICATIONS
A fresh set of practice driven demands about which enterprise skills matter for contemporary businesses, and why

Ideas on effective learning environments and activities for student centered learning aimed to develop enterprise skills including learning activities and assessment practices
Focus on "low hanging fruit", expand current assignment with enterprise skills, revise skill line in IBA based on new enterprise skills and align with methods and assessment, revise internship elective in IBA
Train the trainer (educators on enterprise education practices), establish strong structural industry connections, align mutual benefits and expectations, establish coordination mechanisms within the IBA program and align with ongoing curricula.

✉ r.p.a.loohuis@utwente.nl

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
My SUTQ project was driven by the desire to explore the opportunities for a revision of enterprise education in the UT's current International Business Administration (IBA) program. I was basically triggered by the question of what the business world would consider as important enterprise skills for students to develop during their study and the implications for a revision of the current enterprise educational efforts in the IBA, including its pedagogical ramifications regarding assessment practices and coordination.

WHAT HAVE I LEARNED?
I learned that involving a variety of participants in the research process at the same time is very helpful. My SUTQ research sample consisted of business managers, educators, educational leaders, students, alumni and a member from CELT. While all attending in a creative workshop session,
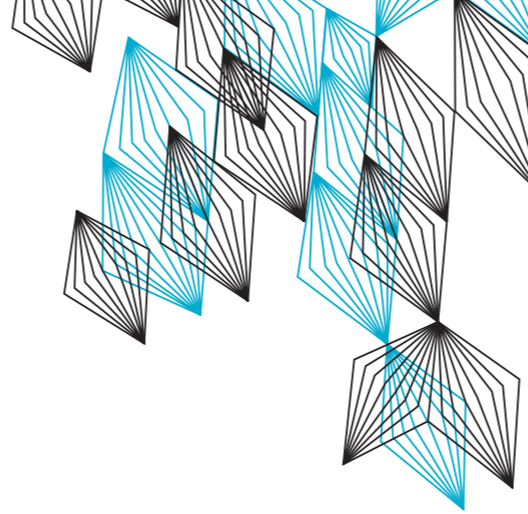
not only fresh ideas could be exchanged but it also lead to the development of novel and solid insights emerging from a fruitful discussion. This highly "engaged" research approach appeared to be efficient and also lead to an amount of commitment for follow up. I believe that this is a nice example of a social constructionist approach to renew educational practices.

WHAT WAS THE BIGGEST CHALLENGE?
My biggest challenge was to integrate my research question and approach in the literature on higher education, and particularly enterprise education. This literature stream was previously unknown to me and yet, very helpful to define the scope of my research, framework and the research design, and reflecting on the findings.

WHAT AM I PROUD OF?
I am particularly proud of the fact that I was able to finish everything in time while continuing my regular work in difficult times.

RAYMOND LOOHUIS

My name Raymond Loohuis, and I am a senior lecturer and researcher at the University of Twente where I work for the research group for Entrepreneurship, Strategy & Innovation Management (NIKOS). I coordinate the Strategic Marketing Management master track in the Business Administration program and teach courses in the area of business marketing, business development and new technology management in various education programs. My current research focus revolves around the question how SME's (Small and Medium size enterprises) anticipate on the challenges and opportunities of smart industrial technology. I am also co-promotor of three PhD candidates conducting research on personal branding, value experience and strategizing in emergent industrial ecosystems. Next, I am a frequent reviewer of the Industrial Marketing Management Journal (Elsevier) and presented my research work at various leading management conferences, such as AOM and EGOS. I published in Research in Management Consulting (IAP) on the dynamics of strategic alliance formation and in Research in the Sociology of Organizations (RSO, Emerald) on emergent routine dynamics.

IMPROVING LEARNING OUTCOMES OF SMALL GROUPS WORKING ON AN ASSIGNMENT DURING LECTURES

INTRODUCTION
The importance of collaborative learning has increased substantially in recent years, for example in the form of Problem Based Learning and Team Based Learning. However, much remains to be learned on how to design and implement collaborative learning in education.

RESEARCH GOAL
The goal of this SUTQ research is to design an intervention protocol that teachers can use to improve collaborative learning outcomes of small groups working on an assignment during lectures.

FAST DIAGRAM
The assignment is the development of a FAST diagram. A FAST diagram is a scheme of boxes and arrows in which the functionality of a system (product, process or service) is modelled.

METHOD
1. Five groups working on the FAST have been videotaped. The groups were from Module 4 'Designing Constructions' of Civil Engineering.
2. The video recordings were analysed and related to the groups' FAST scores.
3. The findings were used to develop the draft intervention protocol.
4. This draft protocol was applied and validated in Module 10 (8 groups).
5. The interventions were adjusted, resulting in the final intervention protocol.
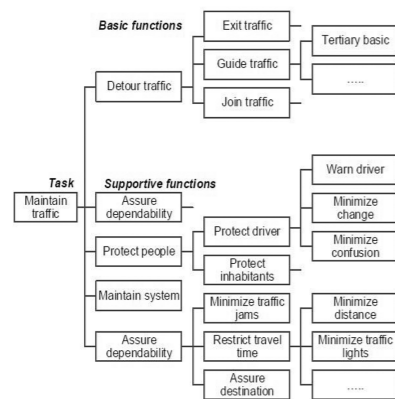
INTERVENTION PROTOCOL

1 Include the students' point of view when designing the assignment.
Reason: there is a risk that teachers overestimate students' capabilities.

2 Separate theory and application of the assignment.
Reason: it is difficult for students to learn and understand new concepts and immediately apply it. Some digestion time is needed.

3 Hand out the assignment instructions in parts and in sequence (chunking).
Reason: chucking reduces cognitive load for the groups.

4 Stress the importance of reading and applying instructions.
Reason: students sometimes forget to follow instructions during the assignment.

5 Stress that the groups should devise a working strategy.
Reason: groups that just start without discussing a strategy, work less efficient and effective.

6 Use Error-Flagging and Hints to provide quick feedback.
Reason: there is no time to give extensive feedback when working with several groups.

7 Design groups strategically.
Reason: the results indicate that the composition of the group may affect learning outcomes substantially.

✉ r.s.degraaf@utwente.nl

ROBIN DE GRAAF

Robin de Graaf is a lecturer at the Department of Civil Engineering at the Faculty of Engineering Technology at the University of Twente. His teaching, research and projects focus on the design management of construction projects in general, and on Systems Engineering and Value Management in particular. Robin is responsible for teaching two Master Courses: Systems Engineering in Construction and Value Management in Construction. In addition, he is involved in the course Systems Engineering for PDEng and in several Bachelor Modules. Robin is also a member of the Educational Committee of Civil Engineering. He has an MSc in Civil Engineering & Management and a PhD in Strategic Urban Planning.

MY EXPERIENCE WITH THE SUTQ

WHAT WAS MY SUTQ PROJECT ABOUT?
Over the past years, the importance of collaborative learning has increased substantially. Many teachers acknowledge this and apply collaborative learning in some form in their courses, for example in the form of project work, Problem-Based-Learning, or Team-Based-Learning. However, despite the attention for collaborative learning, and the existing body of knowledge on that topic, still much remains to be learned on designing effective collaborative learning environments. My SUTQ research contributes to theory and practice with regard to designing and implementing such environments. The specific goal of this research is to design an intervention protocol that teachers can use to improve collaborative learning outcomes of small groups working on an assignment during lectures. The research is a design-based research, aimed at systematically designing an intervention protocol to inform and improve teachers' actions and education. This research is relevant for teachers who apply group work in their courses, because it reveals the mechanisms behind collaborative learning and provides insight in the variables that can be adjusted for further improvement.

WHAT HAVE I LEARNED?
Throughout my career, I have tried many things to enhance the learning of students. However, the changes did not always lead to improved results. However, after having conducted the SUTQ research, I now understand why previous measures were not always effective. The SUTQ research has revealed that measures sometimes have to be implemented at different levels (group level, lecture level, course level). A total package of interventions needs to be carried out in a coherent and consistent way, before effects may become visible. My earlier attempts had always focused on one single intervention, but not on a total package of interventions at different levels of teaching.

The SUTQ has also confronted me with the 'curse of knowledge'. What is easy for me as a teacher, appeared to be quite difficult for the students to digest and to apply. Although I was aware of this phenomenon, I still underestimated its effects. Over the years, I seem to have forgotten how difficult and stressful it can be to learn new and sometimes complex things. As a result, I have become a bit more patient with the students.

WHAT WAS THE BIGGEST CHALLENGE?
In my SUTQ, I have made video recordings of five groups at work on an assignment during lecture times. Each recording was 2 hours, resulting in 10 hours of video recordings to be analysed. That was a rather challenging task.

WHAT AM I PROUD OF?
I am proud of having been able to conduct and finish the SUTQ on top of all the regular work and amidst all the changes in the curriculum that had to be implemented as well, all at the same time.

ENTREPRENEURSHIP IN GEOSPATIAL EDUCATION: A BRIDGE TOWARDS SUSTAINABLE DEVELOPMENT

DRIVER

There is a shift in in development corporation-- giving a mayor role to the private sector in the aid to trade agenda. This is also apparent from the intrinsic desire of M-GEO students and alumni to be more employable and involved in creating socioeconomic revenues for their communities (Fig1).
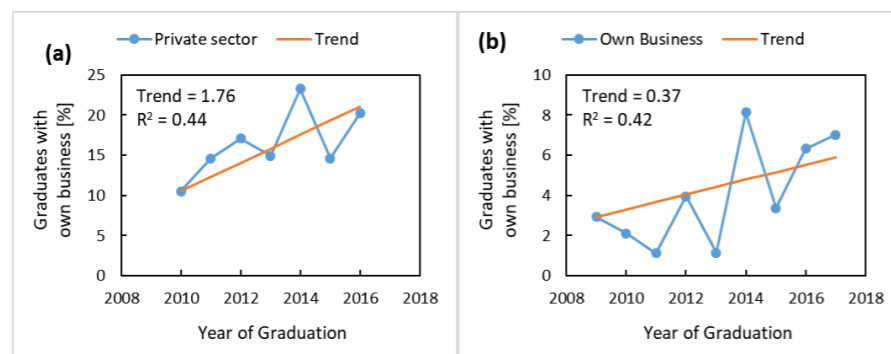

Fig.1: Trends of M-GEO graduates: a) working in the private sector, and b) starting their own business.

CONCEPT

The proposed entrepreneurship education shall address cognitive (behavioural) skills: and non-cognitive (attitudinal) skills. It is anticipated that targeting these skills in the course will stimulate lifelong learning and ultimately establish a knowledge-based society promoting thereby sustainable developments (Fig.2)
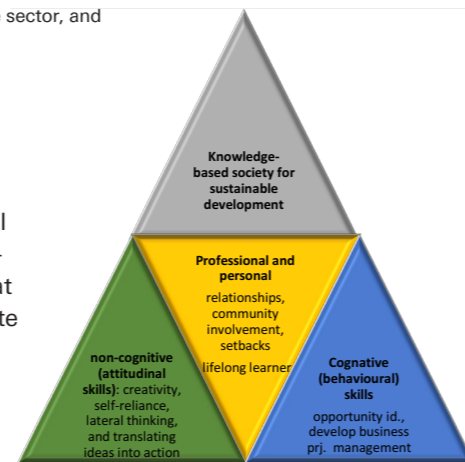

Fig.2: Illustration of the proposed concept of entrepreneurial mind-set course in M-GEO.

DESIGN METHOD

The course underwent three cycles of design-evaluate following the Double Diamond Model in Fig.(3)
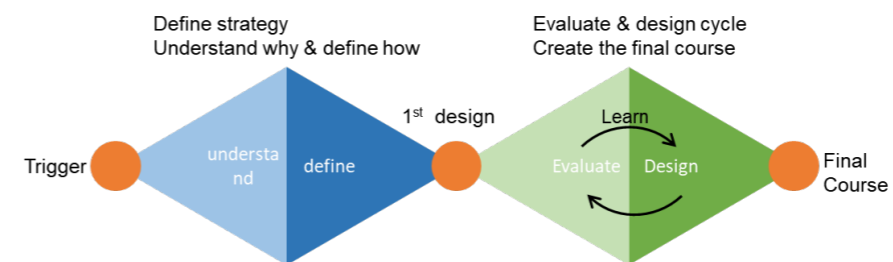

Fig.3: Double Diamond Model and design-evaluate cycles of the course.

COURSE DESIGN

Final design of the course includes instruction and project/team –based learning activities as show in Fig.4.
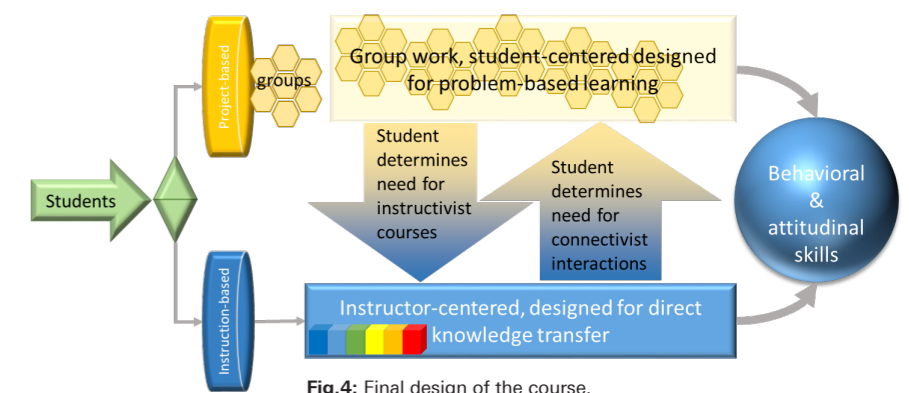

Fig.4: Final design of the course.

✉ s.salama@utwente.nl

SUHYB SALAMA

Suhyb Salama is an expert in remote sensing of hydrology, with focus on deriving spatial information on water quality and quantity and increasing the consistency and accuracy of remote sensing retrievals. In education, Suhyb has dedicated his activities to teaching, development and coordination of the education curricula in water resources and environmental management. In his capacity as the director of Master's Geoinformation Science and Earth Observation(M-GEO) Suhyb contributes to the faculty vision and policy on education and foresees the development of the programme, quality assurance and (re)accreditation.

MY EXPERIENCE WITH THE SUTO

WHAT WAS MY SUTO PROJECT ABOUT?

Entrepreneurship in Geospatial Education: a Bridge Towards Sustainable Development. The short-term question of this research is: What are the characteristics of an entrepreneurship course, optimal for M-GEO education and students? Whereas the long-term question of this research is: Would incorporating entrepreneurial mind-set in the M-GEO education programme contribute to the creation of industrial innovation and the establishment of a knowledge-based society, ameliorating thereby sustainable developments in targeted countries?

WHAT HAVE I LEARNED?

Education is more than teaching, it is a scientific journey of continuous discoveries and enhancement.
All education resources should be designed on the same concept. That education is not just a collection of teaching materials. That, above all, education should be absolutely simple, flexible and entertaining to learn and teach. This trajectory was a conceptual gateway, it has caused a significant shift in my perception of education, has exposed the previously hidden features of teaching effectiveness and it is unlikely to be unlearned.

WHAT WAS THE BIGGEST CHALLENGE?

Provide objective analysis of textual information consisting of more than 15,000 words.

WHAT AM I PROUD OF?

Today we face a range of complex and wicked problems, from climate change to sustainable development of resources and the well-being of citizens and their environments. The Master's Geoinformation Science and Earth Observation(M-GEO) programme is confronted with the challenge of graduating professionals that are capable of using geospatial science to address these eminent problems while contributing to economic and social gains. In this context and understating the changing paradigms in development corporation -- giving a mayor role to the private sector in the aid to trade agenda -- my proposed entrepreneurship course will empower M-GEO students with the skills to innovate solutions that are sustainable and have socio-economic relevance.