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EXPERIENCES WITH THE TWENTE EDUCATION MODEL IN ONE VOLUME THE FIRST TWO YEARS

UNIVERSITY OF TWENTE.



CONTACT

Program Office Educational Innovation

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Our reference: POV/237/15/Sts

Authors:

Charlotte Oude Alink, MSc

Anne Muller, MSc

Irene Steens, MSc

T 053 489 2437

E onderwijsvernieuwingen@utwente.nl

University of Twente

P.O. Box 217

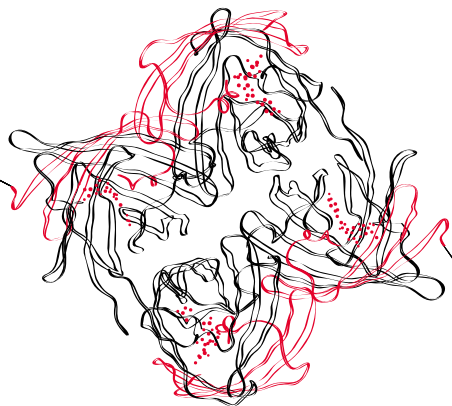
7500 AE Enschede

The Netherlands

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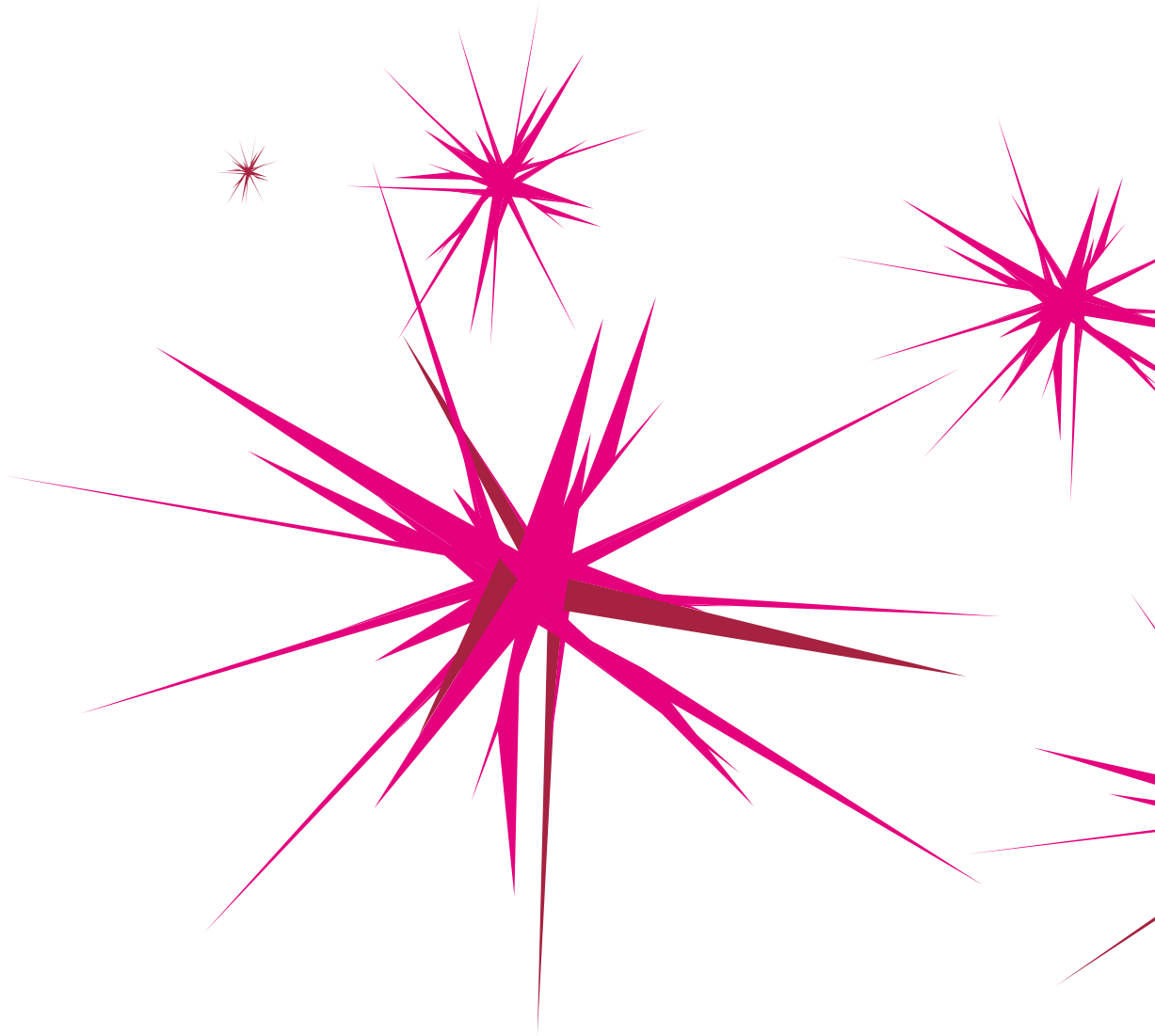
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PREFACE

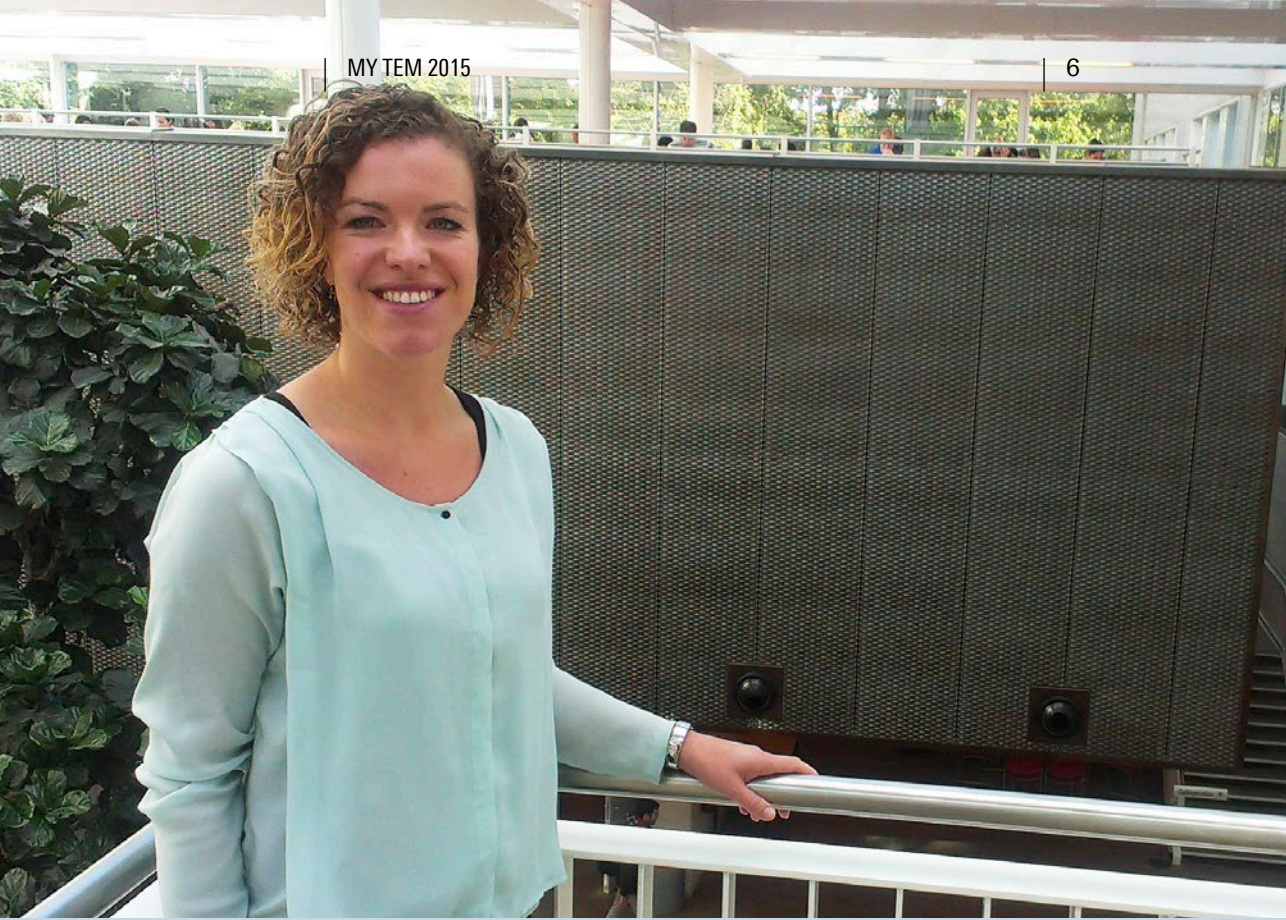
Dear reader,

The University of Twente has chosen a new approach to learning: the Twente Education Model (TEM). The last few years, UT staff has put a huge amount of effort into turning all undergraduate courses into TEM modules. Teams of teachers have worked together to incorporate the TEM principles into their modules. They have designed projects to guide students in gaining and applying knowledge and skills. They have developed new tests, not only to determine the mastery of the learning goals but also to help students monitor their learning progress. In addition, they have developed ways to increase interaction in the classroom, used innovative teaching methods, chosen new learning sources, and experimented with different ways of tutoring students. In some cases, the first implementation experiences were not as hoped. In other cases, experiences exceeded expectations. In all cases, it led to new and unique experiences worth sharing with others.

In this booklet, you will find a number of unique and personal stories from teachers, support staff and students, reflecting the first two years of the TEM implementation. They share their experiences, challenges, and tips. The stories demonstrate the broad variety of learning experiences that are possible within the boundaries of the TEM principles.

I hope you will find these stories a source of inspiration for your plans, either with TEM if you are a colleague or in a different direction if you have received this booklet as a friend of our university. We will continue to collect new experiences as a reflection of TEM's progress.

Dr. Irene Visscher-Voerman
Director of Programme Office Educational Innovation (POV)



STOP SPILLING ALL THE INFORMATION

SEPTEMBER, 2013

Renske is tutor and course coordinator for the health sciences bachelor programme and has been involved with the implementation of the Twente Education Model (TEM) since February 2013. Prior to this, she was working on her doctoral research full-time. She currently works on her research two days a week and spends the other three working on education. Renske enjoys the variation in her work. She has studied at Maastricht University, where she has experienced the problem-based learning model, which makes use of tutors as well. Her experience has proved to be very useful for establishing the new tutor groups and being a tutor herself at the University of Twente.

'I BELIEVE THE MAIN CHALLENGE FOR THE TEACHERS IS TO HOLD THEMSELVES BACK'

WEEKLY TUTOR MEETINGS

The first module has weekly tutor meetings, with one tutor assisting three project groups at the same time. The programme board has assigned four students to every project group. Within the health sciences programme, tutors are mainly meant to assist students in the process rather than to provide substantive advice. Renske says this means the role of the teacher is going to change: as a tutor, you are to focus on the process of working as a group rather than to convey knowledge. "I believe the main challenge for the teachers is to take a step back, as you do want to help your students along if you know where they should be looking." However, this would exactly go against the goal of the project: having the students find their own way. The project assignments do not have one final solution. Furthermore, "the more you give answers to them, the more a student assumes a dependent attitude and relies on you."

ACADEMIC ATTITUDE

Granting the students responsibility fosters their academic attitude. Renske therefore believes project-based education is a great way to have students develop this attitude. The students will have to find their sources of knowledge themselves. The first few tutor meetings, the students still found this rather challenging and difficult. "The students were aware things are different here than in secondary school. They had some difficulty with not being presented with the relevant information on a silver platter, but they did realize this is part of studying at a university." It took just one week for the students to learn how to cope. "The students were enthusiastically working

on the subject and meeting each other to arrange all sorts of matters." This proved to be a necessity, for they were required to present their group findings by the end of the third week.

FIELD AND ALUMNI

Two Q&A sessions with health sciences alumni were held in the first week to help students obtain a clearer image of their future academic field. "Both the students and alumni were very pleased with these sessions, so the sessions are sure to stay!" A number of students stated they had some difficulty with not knowing exactly what was expected of them for the project. One alumnus answered that the same now applies to his job: goals and methods of his assignments are not always clear, forcing him to look for information and frameworks.

Working on such a project therefore provides a realistic image of what is expected of alumni in the field.

Renske is very curious as to the effect TEM will have on the students and is eager to find out whether the 'new' students have acquired a different attitude by the end of the module than their seniors have. She is very enthusiastic about the model and advises all other teachers to show this enthusiasm. If the teacher is enthusiastic, it will rub off on the students!



A TEACHER'S GAME NO LONGER

OCTOBER, 2013

Gijs Krijnen is a lecturer of Electrical Engineering at the Faculty of Electrical Engineering, Mathematics and Computer Science.

For the last eight years or so, he has also taught Advanced Technology classes. Within the Advanced Technology programme, he also serves as coordinator of the first module: Man-Machine.

Interactive working methods characterize this first Advanced Technology module, which require the students to dive in, both within and outside the confines of the project. As module coordinator, Gijs has met with his colleagues to investigate how to implement Problem-Based Learning (PBL).

'IT'S ABOUT GETTING THE STUDENTS TO DISCUSS THE MATTER WITH EACH OTHER'

PROBLEM-BASED LEARNING

The Engineering section of the module involves giving the students problem scenarios twice a week for which they need to find a solution. The students, divided into small groups, are given two days to find and present a solution. The real fun starts when groups find different ways of solving the problem. "It is about getting the students to discuss the matter with each other and to understand it as a result." Gijs notes that the teacher only rarely stands in front of the group during a Problem-Based Learning session. "The students are given more room and responsibility, which I believe is exactly what we want."

This working method has the students spend quite a bit of time on their assignment and the subject matter, Gijs says. On the one hand, this is a very positive development: the students truly spend their time studying. On the other hand, this may result in them disregarding the other sections of the module. The teacher really has to watch out for this.

QUIZ MEETINGS

Gijs also mentions the existence of a 'quiz meeting'. During these meetings, the students are presented with short assignments they need to complete in about three minutes. They may then vote with which of the answers provided they agree. Again, this results in the students discussing the various answers with each other, having to explain why they vote for a particular answer. This is peer instruction at work!

PROJECT

The module contains a project intended to have the students apply their existing knowledge as well

asto gain new knowledge. "We wanted a project that is more than just illustrative. This project contains quite a few open questions that the students can already work on prior to discussing the relevant subject matter in class." Therefore, the students have to find the sources they need to tackle the problem themselves. To Gijs, the most exciting part is that the project involves much freedom: students choose the subject of and approach to the project themselves. It has presented him with a nagging question though: "How much should a teacher guide and interfere?" In the end, this 'open' sort of project was opted for, because "you do want the students to be excited about the work and make use of their own understanding and interest." Each of the groups has its own student teacher assistant, who acts like a tutor. The assistant encourages the group to perform to the best of their abilities, regarding the process as well as the subject matter.

INTEGRATION BETWEEN MODULE SECTIONS

Gijs points out that it is impossible for students to finish their project without having a proper understanding of the other module sections. To a certain extent, all the sections are integrated into the project. He would think it a shame if the module just became a package of old courses. "Try and make something fun out of this module and take the project very seriously." Gijs is aware that redesigning your way of teaching takes much time as he has personally experienced this burden. Yet he can also say with certainty that it offers many new possibilities. "It allows you to take a fresh look at the way you teach your class."

THE FUNCTION OF A LECTURE IS CHANGING

NOVEMBER, 2013



Mike Boldy is a lecturer of mathematics at the Faculty of Electrical Engineering, Mathematics and Computer Science (EWI).

He started working for the University of Twente in 1989. When applying for his job, he was surprised to find he had to come to Leeuwarden. The University of Twente used to have its own college in Friesland, the Vestiging Friesland. When this college was closed, he started to work at the Enschede campus. Last year, he became involved with the Twente Education Model (TEM), being a lecturer of mathematics in the mathematics course of the first module, as he lectured mathematics to a group of some 800 first-year students twice – an exciting experience. 'It is as if you are participating in a talent show and suddenly have to sing in front of a large audience.'

A HUGE ROOM

Mathematics lectures are delivered in rooms 1 and 2 of the Waaier building. Due to the enormous size of this room, it is infeasible to have lectures progress as you would in a 'normal' room. 'You cannot simply deliver a linear lecture, just providing definitions and theories. If you do that, you lose the group's attention.' Writing formulas down on the blackboard is useless, as students in the back of the room are unable to read the notes. Mike says it is imperative to be more verbally active and use gestures. Prior to the implementation of the Twente Education Model, lectures involved explaining the subject matter and providing examples. This is now the province of the tutorials. 'Nowadays, lectures serve mainly to inspire students.'

PREPARATIONS

This changing role of lectures and the fact that you are to deliver them to such a large group means you need to teach your class differently. You also need to prepare differently, as standing before this large audience can be intimidating. 'I took a special Masterclass performance skills to learn how to give lectures to huge groups.'

In addition, together with his colleague, he practised bits of the lecture he was going to deliver. 'You really need to make sure you connect with the entire room. Sometimes, students are all the way in the back, and you need to be able to interact with them too.'

INTERACTIVE MOMENTS

One way to do so is to involve the students in the lecture actively and to employ interactive moments. 'We now use a system allowing them to answer a multiple choice question on an internet site accessible through smartphone, tablet or laptop.' Such interactive moments have become part of every lecture. 'Sometimes, half the group answers incorrectly, indicating you have to pay more attention to the topic.' The questions asked always

refer to the concepts just covered in the lecture. Instead of requiring calculations, these questions are some sort of mini tests, designed to establish whether the students had understood what has just been said.

COORDINATION

Though Mike likes to give more of these lectures, there have been some nags. 'The mathematics course is open to all technical faculties, so it turned into a massive administrative and logistic puzzle.' Mike believes coordination could have been better: the ship had too many captains. Clear communication on who was responsible for what was lacking. The lectures were divided over a team of lecturers, the lectures were provided in English as well as in Dutch and the tutorials were the province of the various programmes. It is no longer a case of "one course, one teacher", which does tangle up things a bit.' Clearly, there are some points of improvement for next year. Still, Mike believes it will all work out fine in the end. Looking back on the past module, he is very happy to have been part of it. He has one piece of advice for next year's lecturers: 'Have fun and go for it!'

**'NOWADAYS, LECTURES
SERVE MORE TO INSPIRE
STUDENTS'**

WORKING TOWARD A CULTURE OF QUALITY TOGETHER

DECEMBER, 2013

Jan van Diepen works at the Faculty of Behavioural Sciences (GW). Prior to his current position, he has studied biology and worked in the Science Shop for ten years. At the Faculty of Behavioural Sciences, he has first served as programme coordinator for a small master's programme, Philosophy of Science, Technology and Society (PSTS). As of this September, he is the faculty's quality coordinator. 'I actually enjoyed leaving it all behind and focusing on something completely new and different.' These days, his work mainly consists of assessing educational quality and gathering other information on educational performance. Jan is not a teacher within the Twente Education Model (TEM), but is responsible for the university-wide Student Experience Questionnaire (SEQ), built on the EvaSys system.

'EVERYONE SHOULD BE PROUD OF THEIR RESULTS'

A CULTURE OF QUALITY

What is important to Jan is realizing a culture of quality. Assessing educational performance is only part of the package: the results should also be made transparent. 'If you truly want to realize a culture of quality, you need to be willing to take a hard look at the quality as it is perceived.' Jan possesses a clear view of what the culture of quality at the University of Twente should be like and strives for a culture of transparency and openness. 'We are fully aware of our level of quality and you should therefore be able to find all information available; we talk about it openly and do not sweep the matter under the rug.' Jan believes society is mature enough to do so.

FROM THE PROGRAMME TO THE FACULTY TO THE UNIVERSITY LEVEL

A lot has changed at the Faculty of Behavioural Sciences as concerns evaluations these past years. Jan has been involved with the course evaluations for quite some time now. 'Ever since 2008, I have been responsible for all course evaluations at the faculty of Behavioural Sciences. Before that time, a rather disjointed system was used for evaluating course quality.' In 2008, the first EvaSys pilot was carried out at the Faculty of Behavioural Sciences – the same system currently used in a university-wide pilot.

A faculty-wide evaluation form has been in use at the faculty of Behavioural Sciences for a while now, as well as a uniform procedure and reporting system. 'The evaluation process has become increasingly centralised and has thereby gained clarity and efficiency. We are now also better able to rise above people's personal experiences.' In early June 2013, Jan also offers to take care of the university-wide evaluations – an offer the Executive



Board readily accepted. 'I had no qualms about taking care of those 20 modules. They are nothing compared to the amount of course evaluations I am responsible for each time, so I will not lose any sleep over it.'

DIFFERENCE BETWEEN THE PROJECTS

EvaSys provides tons of ways of rendering the results. 'Everyone is very happy with the speed and flexibility of the system.' Jan has provided all programmes with their module results. He has also provided each and all of them with a 'profile line', a global overview of how their module compares to the others. 'What is striking is that student assessment follows the same pattern for all modules, but results are all over the charts when it comes to the individual projects. These results amuse Jan. 'The projects are where it varies: they are all evaluated differently.'

EXECUTIVE BOARD INVOLVED WITH EDUCATION

'What really fascinates me about the Twente Education Model is that, to my knowledge, it marks the first time in the history of the UT that the Executive Board is involved with the actual education.' The Twente Education Model has resulted in attention being given to education on the level of the entire organization. This mainly used to be the field of the faculties and individual programmes. 'Centralised evaluation is the latest step in this process.' Jan notes that we are in the midst of a true culture shift. 'Thanks to the implementation of the Twente Education Model, the culture of quality we are currently fostering will be realized over the entire organisation.' To improve this culture of quality further, Jan believes more transparency and openness is in order. This should pose no problems, as 'everyone should be proud of their results'.



A BOTTLENECK ALSO IS A LEARNING EXPERIENCE

FEBRUARY 2014

Katja Haijkens is Educational Manager for the Biomedical Engineering (BMT) educational programme, which is where the TEM pilot took place during the past few years. 'I was involved in revising the BMT curriculum almost from the start; the groundwork had been done, but I stepped in as soon as design got under way'. Katja came to the University of Twente as a freelance Educationalist; she temporarily replaced the head of the Language Centre (TCP) and then started working for the Educational Services department. When BMT started with the pilot, she was initially seconded to BMT, but she has now been working there full-time for one-and-a-half years.

'THIS DOESN'T MEAN A STEP BACKWARDS, IT IS SIMPLY A LEARNING OPPORTUNITY'

COMPLETELY NEW DESIGN FOR THE EDUCATIONAL PROGRAMME

The programme seized the opportunity provided by the pilot to reform the curriculum completely. 'Not just the design, but also the content'. Katja says that the programme has been put together well now. That same uncertainty that is now surrounding the UT-wide implementation of TEM, Katja also saw when the new BMT curriculum was introduced. One of the bottlenecks, for instance, was that not everyone agreed with the system. Katja was there during the design stage of all the modules. 'This is where I tried to work towards a single idea'. Responsibility and loosening the reins on students were recurring topics during many discussions.

PROGRESS IN A LIBERAL ENVIRONMENT

In the BMT, there is a clear progress in the degree of freedom students are given within projects. The further they are in the curriculum, the more freedom they have. 'In their third year, students are expected to work with increasing independence'. Sometimes a module may be more limited due to a number of fixed components. 'In those cases, students generally complain in evaluations that they want to be given more freedom'. Katja finds it difficult to say whether this attitude is different from the 'pre-TEM' days. She does think that students currently in their third year are more pro-active. 'The students are quite capable of planning their work and are good at seeing possible applications of the theory they are currently learning'.

CONFIDENCE IN THE STUDENTS, THE LECTURERS AND THE EDUCATIONAL PROGRAMMES

The ability to 'let go' and 'promote confidence' is something that keeps coming up, both within the

BMT and throughout the entire UT. An example of failing to let go is the many tests that were held at several programmes during the first TEM modules. 'This is at odds with the idea of giving students a growing amount of responsibility'. According to Katja, the trepidation with regard to letting go applies not only to lecturers, but also to the whole university. 'As an educational programme, we also notice the relative lack of confidence; there are many checks, which is comparable with the large number of tests students have to take'.

STILL UNDER DEVELOPMENT

Providing education within the TEM scheme is not only new for lecturers; introducing TEM is also an entirely new project for the institution. This means there are many learning opportunities for the entire university throughout the process. In other words, the whole university is currently under development. This even rings true for the BMT, where the B1 TOM modules will be used for the third time this year. Katja emphasizes: 'We are clearly involved in a process of development and I think that, for people who are just starting, it is good to know that this is a learning process and that you will not have a perfect new curriculum within one year'. Katja says that errors are only to be expected during development. 'This does not mean a step backwards; it is simply a learning opportunity'. The BMT is still involved in a learning process as well. Although adjustments are still being made to the module, much progress has already been made. 'So just have confidence that things are progressing and that we are taking steps forward.'

CHOICES HAVE TO BE MADE

MARCH, 2014



In this month's issue of 'My TEM', the students have their say. Two first-year students talk about their experiences with the Twente Education Model (TEM). **Lisa Verhoeven from Amsterdam is a Biomedical Technology student and Dirk van Teijlingen from Leiden is a Chemical Engineering student.** Lisa and Dirk now live on campus and are happy with their programmes. In addition to their studies, they are both active in their study association and play a sport: Lisa plays hockey and Dirk is a rower.

STUDYING FULL-TIME

The new bachelor's programmes in line with the TEM principles have been set up in such a way that students can study full-time. Nevertheless, both Lisa and Dirk are a member of their respective study associations. "It is certainly very busy, you cannot do everything," admits Dirk. Lisa agrees: "You have to make choices; sometimes you need to spend more time studying and sometimes you can do more fun things." Both indicate that two groups have emerged within their educational programmes: the active students and the students who are only concerned with their studies. "There is one group that is fairly active and, for example, does a lot of work for the information team, and one group that really has trouble keeping up with everything," says Dirk.

EXPECTATIONS

TEM has been incorporated in the Biomedical Technology programme for three years now, so when Lisa joined the programme for one day last year, she saw how it was structured. "I knew that I would have many contact hours." For Dirk, the situation was different; this is the first year of TEM for Chemical Engineering and what Dirk noticed was that the programme was larger in scale than last year. "I now spend much of my time in large lecture theatres with 150 students who are all enrolled in different programmes." Dirk would prefer to see a bit more variation in the lectures. For example, he would welcome shorter lectures and group work from an earlier stage. Lisa says that the Biomedical Technology programme is more varied, and that only mathematics has many students at the same time. "In other parts of the module, we have good contact with both the lecturers and the tutors." The large-scale lectures make things more impersonal. "Not that they are not interesting, they are just more impersonal," says Lisa.

TIMETABLES

According to Lisa and Dirk, the timetabling of the programmes could be improved. "Sometimes we have a lecture in the Spiegel building, followed by a tutorial with the same teacher in the Horst building." Both students have the Horst building as their 'home base', and they would prefer to have all their educational engagements there. They would also like to have a room for their own year, so they would always have a place to study. "We can always find a few spaces available, but these are all in the library or in the Bastille building." If there was a room specifically for our year, you would have other students present to ask questions and you would sit close to the lecturers.

PROJECTS

A positive aspect of TEM is the project. "I think it is really nice that the projects correspond to the subject matter we learn and the lectures we attend," says Dirk. Both Lisa and Dirk are positive about that coherence. "For example, you have to use your newly-acquired mathematical skills for other parts of the module and for the project. In that way, you keep up with all the subject matter at the same time," says Lisa. Lisa is also positive about the collaboration within projects. "I learn very much from working together with all kinds of different people. I think this is an advantage compared to other universities."

A piece of advice Lisa and Dirk would like to give to their fellow students is to keep doing fun things. "If you unwind, even though you do not always have the time to do so, you remain motivated to work hard."

TEACHING IS TWO-SIDED

APRIL, 2014



Marloes Jansen is a lecturer of Communication Studies within the Faculty of Behavioural Sciences. She has studied at the UT and has been working for the department of Media, Communication and Organisation (MCO) since 1 October 2013. Marloes is occupied with education full-time, but in the future, she would like to obtain a doctoral degree. Within TEM, she is primarily a tutor, but she also gives a number of lectures and, together with her colleagues, she has designed the third module for the first year. In addition, she supervises a number of senior students, for example when they are writing their bachelor's thesis.

TEACHING

Marloes has given her first lecture this year and says she finds it quite exciting to stand in front of the group. To prepare for teaching optimally, she is working on obtaining her University Teaching Qualification (BKO) and has followed the tutor training course. "Because I had little experience, I thought it was important to follow these courses." Marloes has experience in giving presentations, but indicates that giving lectures is different. "Doing presentations is more one-sided, teaching is much more two-sided." In addition to taking courses, Marloes tries to obtain ideas about teaching by, for example, visiting the faculty's Educational Consultant, reading, digging through the course material and frequently talking with experienced colleagues. "Sometimes I just attend a lecture given by one of my colleagues to see how they do it."

ACTIVATING LECTURES

Marloes finds it very important to activate students during lectures. "It is also much more interesting for me to come into contact with students and to talk with them about the subject matter." To activate the students, Marloes employs many different methods. For example, she has them discuss things together or prepare propositions in small groups, which are then discussed with all of the students. "I aim for them to think about

whether they agree with something and whether there are other theories, and to learn to articulate their point of view properly."

SHAKESPEAK

Another method that Marloes uses to activate the students during lectures is to deploy the ICT tool 'Shakespeare'. Shakespeare is a program that makes it possible for lecturers to have students vote or have them answer questions by mobile phone. It is a great way of activating students during lectures. "First-year students really like to give answers using their mobile phone." Marloes adjusts the use of Shakespeare to the level of the students. For example, she uses more multiple-choice questions for first-year students, while senior students are more frequently given open questions or propositions. With the pre-master's students, the questions also lead to further discussions. "The students then ask why, for example, answer D is not correct."

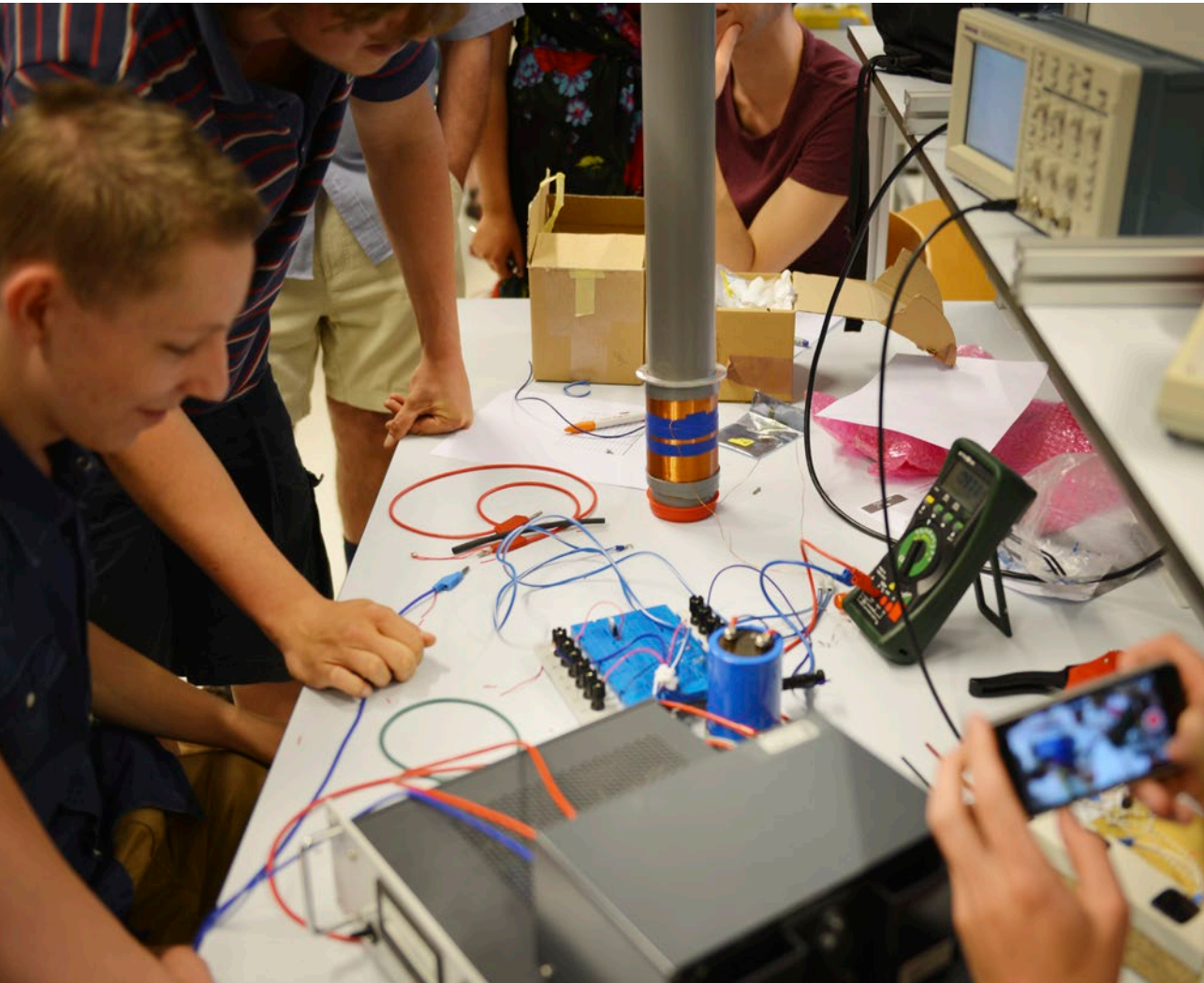
DO THEY UNDERSTAND?

Marloes says that she, as a teacher, also likes using Shakespeare. "Because I can see the answers given by the students, I can see what they do not understand and I am better able to explain the subject matter." It therefore gives her greater insight into whether students understand what the lecture is about and to which subjects they need to pay extra attention. It therefore makes it possible to check the learning objectives of the relevant lecture. "What I try to do is directly or indirectly explain the learning objectives in advance, and then return to where I started at the end of the lecture." Marloes also says that asking questions with Shakespeare helps her return to these learning objectives and thus complete the circle. "It forces me to stay focused."

As a lecturer, you can use Shakespeare free of charge, for every size of group. The UT has so-called credits for Shakespeare. For more information, see: <https://www.utwente.nl/telt/solutions/shakespeare/>

PHILOSOPHIZING WITH STUDENTS OF SCIENCE

SEPTEMBER, 2014



Marc Dhallé and Fokko Jan Dijksterhuis have developed the project for the fourth module of Applied Physics and Applied Mathematics. Marc is an experimental physicist. In the course of this research, he is especially busying himself with superconductive magnets for CERN. Fokko Jan is working at the School of Management and Governance and involved in ATLAS. He is originally a mathematician, but he has also explored the field of history of science and technology. He is conducting historical research and has personally developed his knowledge of philosophy of technology and society.

INTERDISCIPLINARY MODULE

Applied Mathematics and Applied Physics students have fully shared the fourth module. For the project, the students have built an electromagnetic experiment, also involving the historical context; a real High Tech Human Touch module. Marc indicates that the “Vector Calculus and Electricity and Magnetism are both very honourable disciplines, which have developed over the course of 250 years”. This development has occurred almost parallel and both have strengthened each other. The development of these disciplines and the experiments involved have made it possible to provide the module with an historic twist. “The students had to pick from a list of historic experiments and recreate it, only with modern means.” At the end of the module, the students have to demonstrate their chosen experiments to each other.

DIFFERENT CULTURES

“We have consciously made mixed groups from the start,” Marc explains. The groups consist of students from both physics and mathematics. In the beginning, there is some resistance; the students have to get used to each other. “It is funny to see differences in culture already in the first-year students,” Fokko Jan says. Marc elaborates on the differences: “for the applied physics student, it

means that they will sometimes think more strictly and cleanly about a problem, like an applied mathematics student does, and for the applied mathematics student, it means that they learn to cut corners pragmatically sometimes, because it is simply more efficient.” These differences in culture remain visible, even if someone has graduated years ago. “Fokko Jan is a mathematician and I am a physicist, and we still notice it when we talk to each other,” Marc says.

FIGURE IT OUT THEMSELVES

The personal responsibility of the students was heavily called upon in this module: the students often had to dive deeply into the theory long before the material was offered in lectures. “Sometimes the subjects would only be discussed in the courses halfway through the quartile,” Marc explains. This was a conscious choice. “It is important that you do not always know in advance what you need. That is what we have to do, too; we sometimes have to figure things out,” Fokko Jan continues. In addition, it had the added benefit that the students immediately understood the usefulness of the offered material. “The students have already run into the questions themselves; they now recognize the issues and the material is less abstract because of it,” says Marc. In this type of education, the students’ ability to schedule well is very important, because “a side-effect is that the students do not start until late”, according to Marc.

HISTORIC POSITIONING

During the module, not only the aspects of physics and mathematics came to the fore, the historic side was important as well. “The students had to create an experiment and they had to do three things: build it, explain it and put it in a historical perspective,” explains Fokko Jan. How did the experiment contribute to the development of our knowledge about Electricity and Magnetism? Students investigated how certain knowledge came about. The level of enthusiasm varied amongst students. Marc explains: “there are people who are ready for it and people for whom it will all remain a little vague.” Marc attended some of Fokko Jan’s lectures and he thought those lectures were at least very interesting!

IT'S LIKE TRACTOR PULLING

JANUARY, 2015

When walking around campus on 30 January 2015, one cannot ignore the buzz about the final presentations of Module 6 of Mechanical Engineering, Industrial Design and Industrial Engineering and Management. Today, the teaching staff involved will expound on the module. **Module and project coordinators Eric Lutters and Winnie Dankers (both of the Faculty of Engineering Technology) indicate that they, just like their colleagues Roy Visser (Mechanical Engineering) and Erwin Hans (Industrial Engineering and Management), do not quite understand what the fuss is all about.** "Industrial Engineering and Mechanical Engineering have already launched similar projects. Ours is simply the next step: we combine those projects and have Industrial Engineering and Management join in. Moreover, design education more or less by definition has to be innovatory," Eric says.



OPEN AND REALISTIC PROJECT

The model this year is centred on an assignment for Philips. Students of the three programmes involved are placed in mixed project groups, each forming a 'design agency' competing with the others in designing a vacuum cleaning robot for Philips. The assignment's instructions leave the students with much freedom to put their own mark on it. As it should be, Eric believes. "It is like tractor pulling. You know you will never reach the finish line, so it is all about trying to come as close to it as possible." Once the client has kicked off the project, the students have much freedom. They are responsible for figuring out what they need to do in order to best perform their assignment and they need to weigh all factors impacting the consumer product design process. This means students are to set priorities themselves, to substantiate and reflect

on their choices, and to manage the project properly. Do you choose to take the time to give your prototype a glossy coating, or do you believe that this would add little to your 3D computer model and that you are better off focusing on other details? The students have to work on the product, but are fully subject to academic assessment. Philips is happy to receive all these new ideas, the students enjoy their work and the module is of high academic quality. Both coordinators are justifiably proud.

CHALLENGES

Providing an integrated module to students coming from multiple programmes is quite a challenge. "The students have highly varying backgrounds," Winnie says. "Because they come in with quite different sets of knowledge and expertise, the



students have to follow different courses.” Industrial Engineering and Management students, for instance, follow parts of module 2 of the Industrial Design programme, while Industrial Design students follow that module’s subsequent course. “It all requires quite a bit of flexibility and improvisation in terms of scheduling and having the right rooms and supporting systems, for instance. Nevertheless, at the same time, it allows students from various programmes to lean on each other. You notice they start extensively explaining their way of thinking and acting to one another. This does put them in danger of taking too much time focusing on this aspect though, possibly impacting the quality of their final product.” One may question whether that is really a bad thing, however, as learning to cooperate and set priorities are among the module’s main learning objectives.

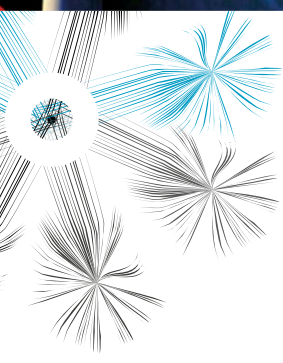
SUCCESS FACTORS

Those learning objectives form one of the module’s primary success factors. Eric believes the module is not really about the product of the project, but about the process. “Students do not have to be able to design a vacuum cleaning robot by the end of the module,” he explains. “It is important for the students to be able to use a multidisciplinary approach in tackling a design challenge.” One important tip to other module teams: be practical. Do not spend too much time thinking about what went wrong or could go wrong, but try to think in terms of solutions. Do not stifle the project by laying down too many rules. Freedom is the source of magnificent products.



PREPARING STUDENTS FOR THE FUTURE

JANUARY, 2015



Nieck Benes is professor and Module Coordinator for module 2 of the Chemical Engineering degree programme. He has also studied Chemical Engineering at the UT and obtained his doctoral degree here. After obtaining his PhD, he has worked at various places in the Netherlands, such as DSM in Limburg and as an assistant professor at the Technical University of Eindhoven. He eventually comes back to Twente. Nieck believes that the University's educational task is very important, and that the greatest added value for the quality of students and doctoral candidates is the University's primary output. Nieck has just received the education award within the Chemical Engineering degree programme.

CHEMICAL ENGINEERING

Chemical Engineering is a completely different degree programme to Chemistry. The Engineering aspect is very important, Nieck says. In order to make this difference clear for the students in the degree programme, Nieck has already made sure right at the beginning of the curriculum that attention would be paid to the engineering aspect of the degree programme. "I really tried my best to ensure that engineering received enough exposure as soon as possible in the curriculum". This has been successful! The second Chemical Engineering (CE) module has a strong focus on engineering aspects. "So that the students see what a chemical engineer does, and in what kind of environment they will work".

COMMON THREAD IN THE MODULE

An attempt has been made to ensure that the different parts of the module are properly connected together from a teaching perspective, but also to strengthen the realistic picture of chemical engineering. CE partly shares the second module with Advanced Technology (AT) and Applied Physics (AP), with the Thermodynamics part being provided by Marcel ter Brake. Marcel is the module coordinator for AT and AP and has spent a lot of time on this module. The practicals, the project and the mathematics case are specifically aimed at CE; these components are entirely connected. The students must directly apply the concepts they are presented with during lectures to practice and incorporate them in an assignment. This assignment consists of the global design of a chemical process with raw materials being converted into valuable end products. Students have to discuss which different pieces of equipment should be used in this process, and how they must be linked together in order to produce the best possible process.

MOTIVATION MORE IMPORTANT THAN CALCULATION

The students work on assignments in groups of four. "The focus is very much on the discussions between the students." Nieck indicated that motivation is more important than the calculation. "It is especially important that they can explain why they made a particular choice." In order to apply the presented knowledge to a relevant context

correctly, the students must really understand the subject matter, and it will then sink in properly. From the choices and especially the reasoning of the students, you can clearly see whether they have indeed mastered the content. Each group of students writes a joint report based on their findings. Furthermore, they also have to prove themselves individually during an oral examination. "It becomes clear during the oral examination if there is a student who has done nothing or does not understand the contents".

STUDENTS' INDEPENDENCE

Nieck believes it very important that students learn to adopt an academic attitude. "The student's individual responsibility is the first matter of importance." When students arrive at the University, they must learn that they will have to work independently. At secondary school, the teacher still takes them by the hand, while at University they really have to do things for themselves. "That also means that you must be able to make mistakes; otherwise you do not learn what responsibility is." Nieck believes that this latter point is still a point of concern within TEM. The consequences of not passing a component are certainly severe and there is a considerable tendency to keep students from making mistakes, while it should be expected that people with a university degree are independent and critical. "You can look at output in many, many ways: you can look at numbers of patents and publications, or at the number of students that graduate, but you can also look at the kind of people that you deliver. For me, the added value of our University, and the Chemical Engineering degree programme, is especially evident in the high quality of our graduates."

'THE ADDED VALUE OF OUR UNIVERSITY IS ESPECIALLY EVIDENT IN THE HIGH QUALITY OF THE PEOPLE WE DELIVER. A LEARNING OPPORTUNITY'

DIVING INTO UNKNOWN WORLDS

FEBRUARY, 2015

Rainer Harms and Erwin Hofman are teachers involved in the project of the sixth module of IBA: **Innovation & Entrepreneurship**. Rainer has studied Economics in Munster, including getting his PhD. He is one of the first Germans with a dedicated PhD in entrepreneurship. He has much experience as a teacher: he has taught in 12 different schools over 8 different countries! Erwin has studied at the UT. He holds a master in Industrial Engineering Management and he has a PhD from the faculty of Engineering Technology. After his studies, he has gone to New York University and North-eastern University as visiting scholar, after which he has returned to the UT.



INTERACT WITH THE REAL WORLD

The philosophy of the module was similar to a 'lean start up idea'. "The students should not write a fully developed business plan before the beginning, nor should they just go out and do it." The students had to think of a hypothesis about what might be a problem and what could be a solution, then they had to test it in the real world actively. "Do not sit at the desk all day, but go out and interact with possible costumers." This way, in a contained time and with the safety net of the teachers, the students experienced what their future work environment could look like. "The students were given the experience, so that they are prepared to make better career choices later.

UNKNOWN WORLDS

"The students were asked to dive into unknown worlds". The students could choose their own project area in the domain of innovation and entrepreneurship. The 'star groups' (option offered

for excellent students) searched their own company or target group for which they had to develop a business plan. The 'non-star' groups were given a list of companies and problems that they could choose. The worlds the students came in contact with varied extremely, from disabled children who wanted to do sports, to party organising, to the learning habits of secondary school children, and to surgeons who perform minimal invasive heart surgery. To make the connection between theory and practice even stronger, the theory was given just-in-time. That means the content of the lectures and the assignments of the project lined up with each other; when the students needed to write a problem description, this was handled in the lecture of that same week.

BUSINESS COACHES

Next to the teachers of the UT, many of the project teams also had business coaches. These coaches



were very involved in the project and the students could ask them questions. The business coaches also visited the market, where the students presented their final work. The coaches were very enthusiastic; they said that the students had come up with some new and valuable ideas. "They all stressed how much they liked it and how usable the outcomes were". Not only the business coaches were very enthusiastic; the students evaluated the module very positive as well. "The fact that they could work on real assignments, visit the companies, and make sure that they understood the question properly was very motivating".

CONTINUE AFTER THE MODULE

The UT is known for its many spin-off businesses, and due to this module, the number might grow even more! The students of the star groups received 500 Euros to continue with their product ideas and maybe launch them. The students do not

have to continue, because it is outside the course, but most of the groups are really excited about it. The teachers have offered to support these groups beyond the course. "It is fun to work with those who are really enthusiastic". This module does not only interact with the real world; it also gives the students an opportunity to make the step into the real world.

**'DON'T SIT AT THE DESK
ALL DAY, BUT GO OUT AND
INTERACT WITH POSSIBLE
CUSTOMERS'**



STEADILY AIMING FOR SUCCESS

MARCH, 2015

Hil Meijer has been a lecturer at the UT since 2007. Within MIRA, he researches how to understand clinical signals, especially concerning epilepsy. He has always been a member of the Department of Applied Analysis and lectured Ordinary Differential Equations. When designing module 6, Hil considers whether he is to stick to the existing subject or to the topic for his module 6. He chooses the latter, with success!

DYNAMICS OF THE HUMAN BODY

Hil indicates that he wants a project on a topic that the students can easily imagine and in which they can apply ordinary differential equations. He has therefore ended up modelling the dynamics of the human body, which - not entirely by accident - is the subject his research covers. "It has taken me a while to get my way", quips Hil. However, the module is just right; the other subjects of Numerical Mathematics and Systems Theory fit in well. "You can see the human body as an inverted pendulum. Therefore, a model quite quickly involves a differential equation. It is unstable, so you have to adjust it. If you want to simulate this, you need numerical mathematics. Without fellow lecturers Bernard Geurts and Gjerrit Meinsma and guest lectures by Herman van der Kooij and Geert Folkertsma, this module cannot succeed."

OPEN PROJECT

Students had to choose the topic of their project themselves, which they found exciting. "Of course the students sighed that they had never modelled before, or that they found it annoying that it was not known what the answer should be." Hil threw them into the deep end, but did give them the confidence that they could do this. "Getting cold feet is part of this; it happens to you too as a researcher."

The final projects are, for example, about walking on a tightrope or walking patterns. One group has been able to model that you walk more slowly when your muscles are stiffer due to muscle pain or age. "That sounds like a truism, but try to model that." Yes, Hil is certainly proud of his students. Pointing to a number of research posters made by students: "They have really done a good job." Laughing, he adds: "I was secretly hoping for rehabilitation technology-related research. It is not quite that yet... Well, you should always have something to dream about for the years to come."

PEACE AND QUIET

The students are very satisfied with this module. The formula for success is 'the peace and quiet'. "There is no running from deadline to deadline, but only two comprehensive tests covering all the material up until then." Based on his experience with the BMT pilot, Hil has deliberately opted for few tests and few mandatory meetings. His experience is that students really get to work on their own. If they know they have to complete something and there is nothing else on the timetable, they take the initiative to sit down together. You do not have to do everything for them."

SELECTED TOPICS

The subjects mainly focus on ability, but mathematics is also about understanding. Hil's team of lecturers have a selected topics method for this: the Sum of the Week. Students are invited to stand in front of the blackboard to work out a sum. If you do well, you get a bonus point. "I am playing with the idea of doing this in the form of an essay next year. Students are then able to explain one aspect of the project. This way, you immediately have an individual test opportunity within the project, and the relationship between the theory and the project is even stronger."

FUTURE PLANS

Hil would like to make the project part even bigger in the future, so that he does not have to give as many lectures. "Because as a lecturer, I should not have to show what I can do. Students can also read the book." Nevertheless, for the time being, he is not going to make any adjustments. Being a coordinator is extremely labour intensive. It is a nice module, but until October Hil does not want to hear any more about it...



COHERENCE IN BUSINESS

JUNE, 2015



Jos van Hilligersberg has been a professor at UT since 2005 and is chairman of the department that deals with research and education within the educational tracks Industrial Engineering and Management (IEM) and Business & IT (BIT). At one time, he has also studied computer science. Currently, Jos is conducting projects in the area of supply chain integration. Jos is the module coordinator for module 7 'From product design to online business', a module in which IEM and BIT students set up a supply chain for their own company. Koos Sipma and Robert van Steenberg are second-year IEM students and, in this module, have launched an electronic lock for consumers.

COHERENCE

The module has been redesigned from the ground up. "We want to do something entirely new and different," Jos says. The module team has multiple ingredients for this module, such as the desire to do something "entrepreneurial", the idea of a challenge and two participating bachelor programmes. The themes supply chain, ICT, strategy and marketing have to be part of this. That is all possible at this stage in the programme,' Jos explains. Prior to this, they did more specialist things and we are trying to integrate that in this module." According to Jos, the purpose of the module is to show students how all of the abstract components they have done in their schooling up to that point coordinate with each other in a business. According to the students, this objective is indeed achieved. "We have found out that when you change just one thing, things change in the rest of your business too".

STRUCTURE

The module is structured in such a way that students are given theory components in phases during brief lectures – concerning supply chain, finance and legal aspects, for example. This theory also includes scientific articles and a small, individual test. The project runs in parallel. The students, in mixed groups, have to set up a company with a website, to which they apply the theory in phases. The students consider this a pleasant and educational structure. “We have noticed that the students want to work on their own projects immediately after these lectures,” Jos says.

One dilemma in this module is the choice between breadth and depth. ‘You want to go deep, but some topics pass really quickly’. Furthermore, you want to include a ‘hands-on’ portion. Jos indicates that it is important to experience the practical application yourself: you can discuss some things - like ERP systems - for ages. However, you cannot truly understand them just by clicking around in the system. During those 10 weeks, you cannot treat everything as thoroughly as you wish. As Jos says, this is always going to be a point of discussion.

COLLABORATION AND STUDENT-DRIVEN

In the module, the BIT students and IEM students work together in a single group. Koos and Robert say that this is tough sometimes, but also quite instructive. Koos/Robert: ‘It is good to experience that it is not just birds of a feather you are working with, but also entirely different people. People in other disciplines also work differently.’ The BIT students and IEM students are free to work on the projects as they wish. The students like this. “At first it is a shock - walking into a lecture and having them say: ‘think up an idea and, uh, good luck’...” Koos says. ‘I do think this is better than having an assignment already worked out half way and being forced into a particular mind-set. If you look at our results, you will see that things have come out pretty well’. The students do not mind being thrown off the deep end. ‘The criteria for the report are quite clear, for example. That is great!’ Jos indicates that letting go is a conscious decision. ‘We give them a week to think up their business concept and also offer a session on creativity. However, I think

that the students have made a decent point that you really need more time for this. Still, if you look at the final results, it is actually better than we had hoped for.’

THE CLASSROOM OF THE FUTURE

The entire module takes place in The Classroom of the Future. The students are quite busy with this. ‘On the computer, thinking up and drawing components on the screen... Every choice has its advantages and disadvantages, and whenever the theory offers a new facet, you have to adapt your idea again.’ The adjacent Design Lab is also used. ‘Ultimately, we use the laser cutter for the prototype’. Jos is one of the initiators of The Classroom of the Future, inspired by the studios in Silicon Valley. In his view, the space is perfect for these types of modules. ‘We still have to discover what the best practices are with the screens and provide the students with more instruction about this’. Nonetheless, he still advises teachers to make use of this space.

In the public closing presentation in The Classroom of the Future, all of the groups present their prototypes, websites and business concepts.

‘EVEN IF YOU THINK IT WON’T WORK, INTEGRATE THE THEORY AND THE PROJECT VERY DIRECTLY’

INTEGRATE!

The most important tip Jos gives to other teachers concerning his experience with this module is: ‘Even if you think it will not work, integrate the theory and the project very directly, so that the project does not just hang in the air without context’. Jos admits that they have been extremely sceptical about integrating “sustainability” into the module. In the end, it works out quite well. By making a real link between theory and the project, the module is much more pleasant - both for the students and for the teacher!’

University of Twente
Program Office Educational Innovation
Drienerlolaan 5
7522 NB Enschede

P.O. Box 217
7500 AE Enschede

T +31 (0)53 489 2437
E onderwijsvernieuwingen@utwente.nl

www.utwente.nl/mytem

