TU/e Innovation Day 2015

Poster presentations about educational innovations

Innovators of Engineering Education

TU/e Technische Universiteit Eindhoven University of Technology

3TU. CENTRE FOR ENGINEERING EDUCATION

TU/e Innovation Day 2015

Poster presentations about educational innovations ‘Innovators of Engineering Education’

Contents

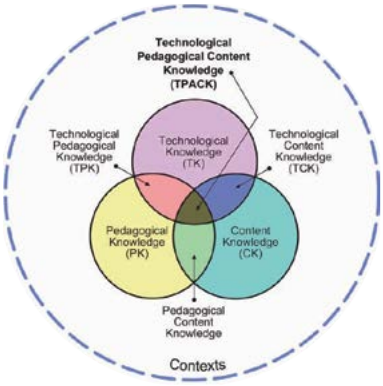
6 Steps to Blended Learning

Abstract

The Mechanical Engineering department wants to introduce blended learning to innovate education. One of the concerns is that introducing blended learning is a time consuming process. The project developed a tool to help lecturers and supporting staff implementing blended learning in an efficient way. The result is a web based step by step approach, tested in three courses as a pilot. The tool is part of a redesign project, in which lecturers and supporting staff develop a new setup for a course, using blended learning.

Objective

- Develop a tool for TU/e lectures and support staff to that helps to make the introduction of blended learning easy and attractive.
- Make a plan for the communication about the tool.
- As a pilot, test the tool in three Mechanical Engineering courses and elaborate and implement blended learning activities for the three courses.



Context

Student numbers are increasing and that is, amongst others, one of the reasons for the Mechanical Engineering department to look for ways to make education more efficient. We believe blended learning can contribute to this. But how do you do make your course blended?

Introducing blended learning is not easy. A lecturer has to consider all elements of the course. In order to make the right blend, choices have to be made, taking aspects on both a pedagogical and an IT level into account. The objective of this project is to develop a tool – also applicable in other TU/e courses – that guides lecturers through this process.

Practice

The project was executed by a core project team (Jacobs and Van der Aalst), that developed the 6 steps approach within a project management framework. Also, the supporting documents have been created by the core team.
For the pilots the project team worked together with the lecturers and student assistants.

For the development of the platform, the project team cooperated with an external consultant and the CEC team.
With respect to the communication objective, the process is still ongoing. Amongst others, a workshop for supporting staff will be developed. Participating in this CEE Innovation Day is also part of this objective.

Results

The result is a tool for departmental blended learning teams that do a course redesign using blended learning. The tool is an online platform based in the intranet for TU/e employees, called '6 steps to blended learning'. A redesign process is done in 6 steps: analysis, experimenting, design, production, implementation and evaluation. On the platform the activities per step are clarified and checklists and documents support the team during the steps. The 6 steps method has been used and tested in three pilot project at the Mechanical Engineering department.

Department of Mechanical Engineering
Ir. Suzanne Jacobs
s.h.p.a.jacobs@tue.nl

Education and Student Service Center
Bianca van der Aalst
b.v.d.aalst@tue.nl

A Heuristic to Understand Curriculum Change: Towards Comparing 3 Course Program Overhauls within the Dutch 3TU Coalition

Abstract

In recent years the three universities overhauled their bachelor programs to improve the learning experiences of the students and, ultimately, improve graduation rates and diminish time to graduation. Such projects are not usually documented in such a way that the process and outcomes can be easily understood and this limits the capacity of an organization to learn from such projects. In this first project of the CEE the overhaul processes are mapped, evaluated and compared ex post facto using heuristics that were developed specifically to understand curriculum change in the context of engineering education.

Objective

The goal of this innovation is to present the heuristic that will be used in this project and some preliminary experiences with the heuristic as a research instrument.

Context

The special focus in this project is the uniqueness of developing and implementing engineering course programs. Engineering is an interdisciplinary field where scientific knowledge is applied to design solutions to solve complex problems in an "engineering kind of way". This creates many challenges for those who design course programs, but also for those who implement them and this is reflected in the goals of engineering curricula and to some extent in the way these curricula are implemented. The heuristic developed in this project needs to include elements pertaining to attributes of engineering education, attributes of successful change and attributes of successful interventions.

Practice

Curriculum design as we know it is mostly based on the Tyler rationale:

- What educational purposes should the university seek to attain? (Defining appropriate learning objectives.)
- How can learning experiences be selected which are likely to be useful in attaining these objectives? (Introducing useful learning experiences.)
- How can learning experiences be organized for effective instruction? (Organizing experiences to maximize their effect.)
- How can the effectiveness of learning experiences be evaluated? (Evaluating the process and revising the areas that were not effective.)

Results

The goal of this innovation was to develop a heuristic that will be used to document course program overhauls within the 3TU coalition in the second phase of our project. This heuristic may serve as a tool for pioneers who are to embark on a curriculum change, who seek to implement or evaluate efforts in curriculum change.

The heuristic helped to structure the narrative of the change process and it helped to clarify misunderstandings that evolved before, during and after the process. The list can serve as a checklist for a large number of relevant items that need consideration when curriculum overhaul is contemplated.

Eindhoven University of Technology
dr.ir. Henk Schellen
h.l.schellen@tue.nl

Leiden University
dr. M.E.D. van den Bogaard
m.e.d.van.den.bogaard@iclon.leidenuniv.nl

University of Twente
dr. M.J. Verkroost
m.j.verkroost@utwente.nl

University of Twente
drs. C. Oude Alink
c.oudealink@utwente.nl

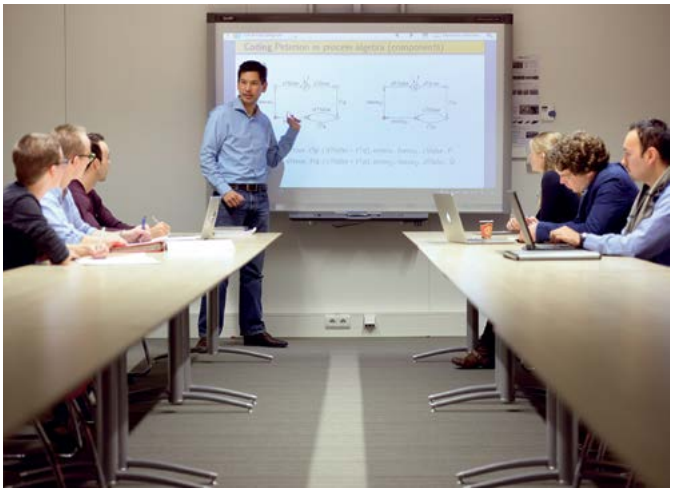
BASIC: Boosting the Activity of Students in between Contacts

Abstract

By boosting the study activity in between contact hours we aim to enhance the student's activities. Students visit the relevant webpage to watch a video clip, do some activities and to receive feedback on their current assessment of the course objectives. Because web-based, participation can be monitored and collected either per student individually or group-wise. We choose to have seemly development of video and activities: feasible within limited time, requiring low-tech and easy accessible software only, and being under direct and full control of the educator. We seek forms that are appealing and have a clear benefit to the student.

Objective

We experiment with a web-format called WTA, containing *wrap-up*, *test* and *advice*. The WTA is offered in between the half days of the course. A video clip gives a summary of high-lights or addresses a topic relevant for a smooth transition between meetings. A small test is offered to provide feedback, or challenges and issues are raised to foster further deliberation. Furthermore, a student may be advised to revisit a specific part of the material.



Context

Many courses in the Bachelor education at the Department of Mathematics and Computer Science alternate *lectures* in large lecture theaters and *tutorials* in smaller class rooms. Typically, tutorials are overcrowded at the beginning of the quartile allowing little time for tutor-student interactions, but have rather low attendance near the end with students giving priority to practical assignments or otherwise diminishing their engagement in the course. The BASIC project aims to provide a means to students to participate more effectively by stimulating the self-study of material, the reflection on own assessment of knowledge and skills, deliberate exercise and focused tutor-student interaction.

Practice

We are exploring various ways to combine video of the lecturer with slides or screencasts into a clip. One approach is fully html-embedded, decorating a separately taken video stream with slides. Another approach makes use of Adobe's Presenter to integrate video, speech and slides within one of-the-shelf tool. A third approach addressing hands-on topics exploits the editing facilities of QuickTime to combine audio with screen activity. Material is uploaded to the Moodle-based OnCourse web system available at TU/e, which provides support for multiple choice tests. In bi-weekly meetings we evaluate intermediate results, and discuss didactics and technicalities.

Results

Aiming at an accessible tool environment supporting mathematical formalism we have been picky in the software to use. Still, the three approaches chosen provide a diverse palette of video-slides integration. Clearly, within the three lines of development a preferred way of working starts to emerge which will consolidate by the end of the project. Didactics, both regarding presentation and structure, will likely remain the subject of debate for the years to come. However, elements of good practice are being identified to pave the way for smoothened usage and further enhancement. An illustrative webpage will be made available.

Department of Mathematics and Computer Science
dr. Erik de Vink
evink@win.tue.nl

Classroom of the Future

Abstract

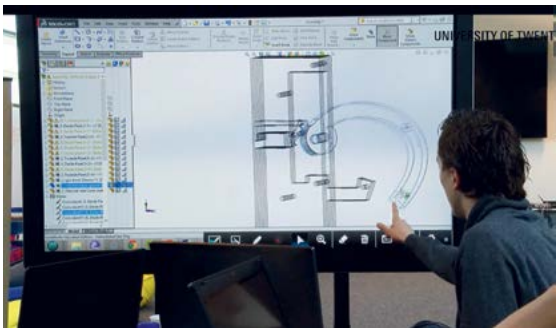
The classroom of the future (CotF) is a new classroom created at the University of Twente with the goal to optimize the usage of modern didactical methods in education. The implementation of the Twente Educational Model (TEM) created a growing need for a classroom which support modern didactical approaches. The CotF is designed to enhance collaboration, project work and create a more student driven learning experience in a very open setting.

Objective

The objective of the CotF is to create a classroom which fully supports modern didactical methods. Multidisciplinary teamwork on a project is a very essential part of a TEM module. A classroom which combines a plenary space for instruction and group working spaces with modern technology really helps in supporting multidisciplinary group work.

The classroom is also flexible in design. It is possible to create groups with the 'walls' in the room. In general the CotF should be an open setting which enhances collaboration between students.

UNIVERSITY OF TWENTE.



Context

The classroom of the future was designed with multiple stakeholders taken into account. Lecturers, students, our IT department and the educational services, all had influence in the creation of the classroom.
Teachers who want to use the CotF need an additional instruction since the education in the CotF differs from general education. The CotF is unsuitable for the traditional 'college'. The role of the teacher changes to that of an coach / facilitator. Therefore it is important to take into account the organizational implementation of such a new room.

Practice

The project was driven by an innovative professor Jos van Hillegersberg.
He was the founder of the CotF. The design is done in close collaboration of multiple disciplines in our University. A video was created from the first pilot group in the CotF (see the image section).

Results

Aspects of the Classroom of the Future:

- Plenary space: Here you can seat students for multiple purposes (short instructions or evaluations). It has possibilities to present on the video wall or use multiple interactive boards (three to four).
- Group spaces: A place for a maximum of six student. Groups can use the interactive boards (also only for presenting) and white boards.
- Interactive boards can be used as normal computers, giant touchpads or as a wireless presentation screen.
- In each section of the Classroom of the Future; the lights, walls and furniture can be adapted to needs.
- The uneven open setup of the room enhances group work and collaboration.

University of Twente
drs. Chris Rouwenhorst
c.rouwenhorst@utwente.nl

Design-Based Learning: Exploring Educational Approaches for Engineering Education

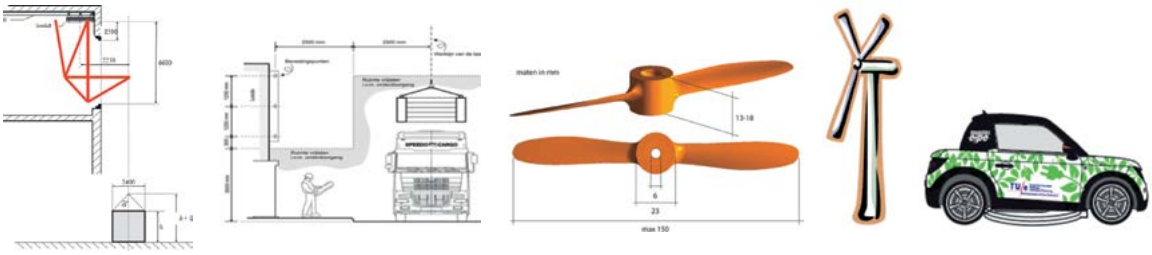
Abstract

The integration of the DBL characteristics (i.e. projects are open-ended, authentic, hands-on and multidisciplinary) in the projects fosters students' ability to solve design problems in gathering and applying knowledge to design artifacts and systems by experimenting in iterations. The role of the teachers and supervisors by enhancing the inquiring process and scaffolding engineering design thinking in solving complex design tasks.

The study the DBL characteristics brings about promising results to apply to engineering projects. Results of DBL classroom practices show that this exploration that open-endedness and authenticity stimulate a hands-on approach and broadens the design scope. This discovery process nurtures the exploration of the problem, searching for alternatives, and building a product in a system component approach.

Objective

- To develop a DBL model for engineering education
- To measure and analyze the effects of the DBL model on teachers and students



Context

Design-based learning is an educational approach to gather and apply disciplinary knowledge while constructing artifacts, designing systems, and creating innovative solutions. Solving engineering design problems requires going through learning cycles of proposing, experimenting, and optimizing the products.

Although DBL is applied in the Eindhoven University of Technology (TU/e) projects, this approach has not been yet explored and its effects on teachers and students' learning has still to be investigated. Studying the benefits of DBL can bring about possibilities for improvement and quality with respect to the implementation of DBL in the curriculum.

Practice

- Literature review on DBL characteristics in engineering education projects in international technical universities
- Develop a DBL model for engineering education
- Analysis of DBL practices in 4 TU/e departments (Mechanical Engineering, Electrical Engineering, Industrial design and Urban Environment)
- Professionalization of DBL teaching staff and supervisors
- Redesign DBL projects, feedback and assessment methods

Research methodology
Quantitative and qualitative methods:
- Likert-scale questionnaires to measure teachers', supervisors' and students' perceptions on DBL
- Protocol analysis
- Analysis of study materials (set-up of projects, assignments, supervision, feedback & assessment tools)
- Member check
- Observations of DBL group meetings
- Verification of findings and interpretation (i.e. analysis of projects and videos) by second researchers
- Interviews with teachers', supervisors' and students'
- Triangulation of research methods to verify results

Research approach:
- Research has been conducted together with the teachers and management of the different departments to improve own classroom practices (ecological validity and evidence-based) to assure sustainability of results.
- Study effects of DBL 'in the classroom'

Results

- A DBL model has been developed to gather and apply knowledge in designing systems, constructing artifacts, and creating innovative solutions
- Students' achievement in quality of designs based on DBL project characteristics, including authentic and real-life scenarios, open-ended, hands-on and multidisciplinary.
- Professionalization strategy for DBL teaching staff and supervisors has been designed.
- Guidelines to design and improve DBL projects to support students to apply theoretical insights in practical design assignments
- Guidelines to supervise and assess students in the process of applying knowledge in the engineering design process (design cycle: proposing, experimenting, and optimizing the products and designs.

Six empirical studies are devoted to investigate DBL and its effects on teachers, supervisors and students. The six studies are published.

Department of Applied Physics and Electrical Engineering
dr. Sonia Gomez
s.m.gomez.puente@tue.nl

Efficient Creation and Sharing of Educational Content via Internet Media

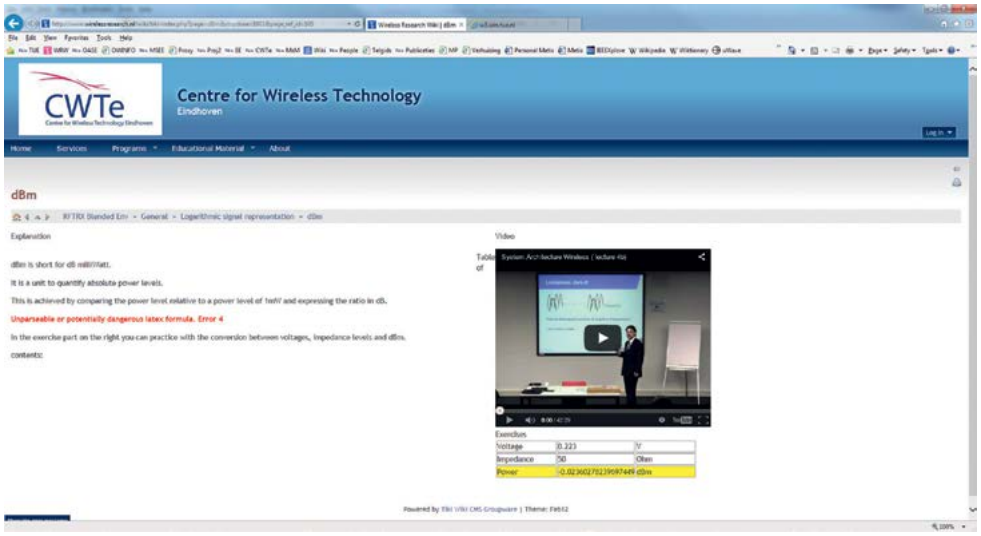
Abstract

The aim of this proposed project is to leverage small team interactions further and extend these to the creation of digital content. In particular, we attempt to build tools and to find a way of working during small-scale interaction that also has spin-off for audio and video material that is suitable dissemination.

Objective

Efficient creation of content for blended learning environment to address:

- Variation in prior knowledge of MSc students
- More interaction during face-to-face for:
  - Critical analysis
  - Creativity
- Flexibility in course content
- Sharing of course content to/from other universities (Singapore, Twente)



Context

- Convinced of value of blended learning
- Current approaches for generating content (esp. audio/video, tests etc.) is high
- Limited available time/effort
- Therefore: need for more efficient content creation methods
- Therefore: need for sharing generated content in very small modules to ensure flexibility and ease of adaptation to local needs

Practice

- First experiment in Jan-April 2015 (5TT40): limited because of too short preparation time, limited SA support
- Next experiment: October-December 2015 (5SFB0) & January-April 2016 (5SFE0)
- Currently upgrading software, hardware, content of web environment
- Integrating real-time student feedback into web environment
- Evaluating possibilities for integrating Big Blue Button in every module

Results

- *Success: student-generated content*
- Web environment prototype ready (needs further development), planning to go live next month
- Method for efficient creation of video content (virtually real-time from existing interaction/lectures/coaching) tested, promising but needs further improvement
- Found simulator that can be integrated in web environment
- Sharing video content with UTwente
- First live test runs of streaming programs

Department of Electrical Engineering
prof.dr.ir. Peter Baltus
P.G.M.Baltus@tue.nl

Department of Electrical Engineering
prof.dr.ir. Jean-Paul Linnartz
J.P.Linnartz@tue.nl

intranet.tue.nl/cee

Learn all about innovations in engineering education at the TU/e Innovation Day

TU/e Technische Universiteit Eindhoven University of Technology

3TU. CENTRE FOR ENGINEERING EDUCATION

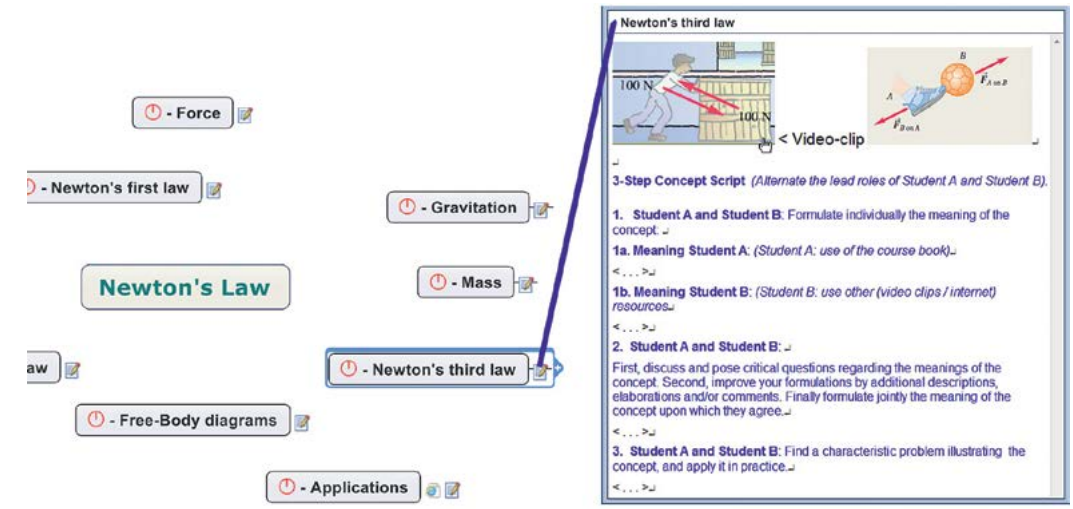
Enriched Skeleton Concept Mapping and Student Feedback

Abstract

In this project we examined the effects of self-regulated learning through scripting students' argumentative interactions during collaborative "multimedia-enriched skeleton concept mapping" on meaningful learning. Each concept in the enriched skeleton concept map (ESCoM) contained annotated multimedia-rich content (pictures, text, animations or video clips) that elaborated on the concept ESCoMS also contain an embedded collaboration script to guide students' interaction. We developed and used rubrics for interim qualitative feedback on the scripts.

Objective

- To foster self-regulated learning through scripting students' argumentative interactions during ESCoM mapping.
- To roll out the ESCoM method to other faculties and courses boxes.
- To foster the peer feedback between students.
- To develop formative interim qualitative feedback on the scripts by means of a rubric.



An example of an attached script to the concept "Newtons's third law" as used within ESCoM "Newton's Law".

Context

With the redesign of the Bachelor at the TU/e, education is provided in larger classes. Some teachers were used to groups of 20 students and are now faced with groups up to 280 students. This brings pedagogical challenges such as giving and organising feedback to students. Enriched Skeleton Concept Mapping (ESCoM) may be a solution to stimulate deeper learning.

To start-up Enriched Skeleton Concept Mapping you need:

1. Subject matter experts to select key concepts they consider essential to understanding the knowledge domain, and to design the ESCoM. They also add multimedia content to the key concepts .
2. The concept mapping software tool Mindjet's MindManager (with the built-in progress indicator).

Practice

The project was conducted in the period November 2014 – February 2015, in the Applied Physical Sciences course of the Bachelor of Industrial Design program. All first-year students took part in this project. The group was divided into dyads of 70 peer groups. During the peer group sessions, the dyads worked together on the ESCoM Applied Physical Sciences under the guidance of the collaboration scripts. The peer groups upload their ESCoM on the LMS on every Friday. Subsequently, 10 student assistants give interim qualitative feedback on the scripts by means of a rubric.

Results

- Scripted collaborative multimedia ESCoM mapping resulted in meaningful understanding of the conceptual structure of the domain and the concepts and their relations.
- The scripts guided and regulated the collaborative learning and feedback process of students engaged in working with the ESCoM.
- The ESCoM method was more efficient in requiring far less teacher guidance.
- The students only moderately used of the possibility of the ESCoMs interim feedback by means of the rubric. This will be a topic of further research.

Eindhoven School of Education
dr.ir.ing. Ton Marée
a.j.maree@tue.nl

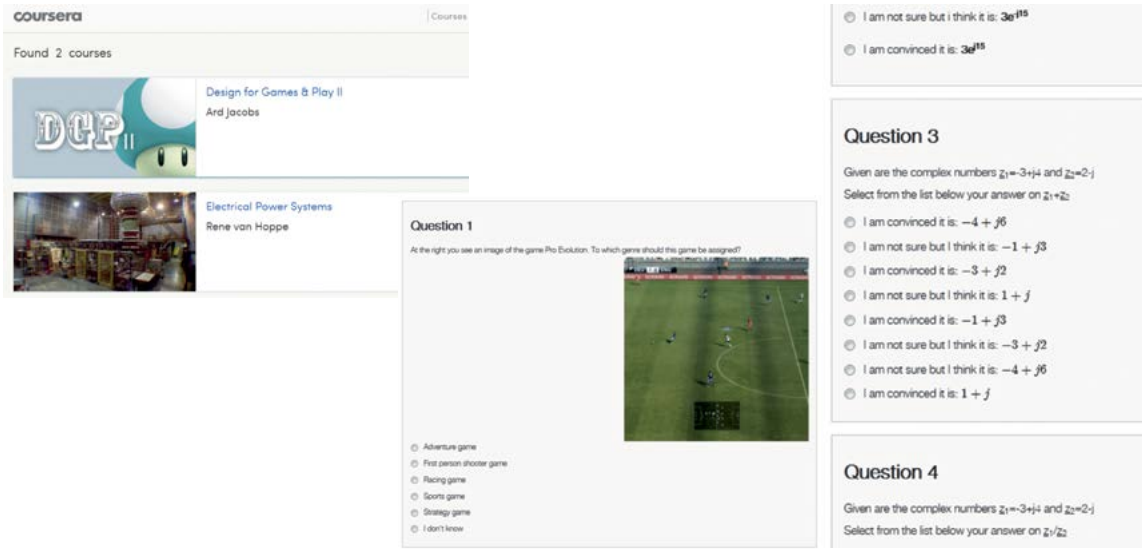
Getting a Heads Up on Prior Knowledge

Abstract

This project entails a pilot within two courses. In the pilot students can test their prior knowledge and skills before they start the course. Based on their results they're offered links to (open) educational resources to study so they can attain the needed entry level before they start the course.

Objective

Within this project we want to pilot the use of pre-tests and additional (open) educational resources in preparation of two courses. We want to evaluate if this helps to get students on the same entry level. The project should give us insight in to the requirements and guidelines that apply when developing a pre-test to achieve this goal.



Context

Within certain elective courses the student population is very divers.
The students come from different faculties and do not necessarily have the same knowledge and skills before they start the course.
Now the necessary prior knowledge is strictly described in the terms of entire courses to be followed, while in reality it often is not the entire course that is relevant but specific learning outcomes that are.

Students either have taken the course or not and the only solution to an expected lack in prior knowledge is to take an entire course. The choice to take the elective course is solely based on that information.

Practice

The core of this project is the pre-test. Two lecturers have been developing a high-quality pre-test for their course. They had to get from the general course description and (sometimes unclear) learning objectives to the actual test.
An educational specialist helped them define proper learning goals and establish the needed prior-knowledge and skills to successfully finish the course, while an assessment specialist helped translate the prior-knowledge into assessment criteria and the actual questions.
After the tests were constructed the lecturers have been selecting educational resources for each question to offer the students, based on their test results.

Results

So far the tests for the two courses have been developed and the additional (open) educational resources have been selected. The tests and materials have been placed in the online learning platform from Coursera. A link to the Coursera website was e-mailed to the students who have enrolled the course. Students have taken the test and we've evaluated the process.

Students appreciated the prior knowledge test, not only the ones who weren't sure about their prior knowledge. But also the once who knew they have learned the topics before, just so they could 'freshen up' on that prior knowledge. In general they felt better prepared.

Education and Student Service Center
Bianca van der Aalst
b.v.d.aalst@tue.nl

Giving Effective Feedback to Students

Abstract

This project focused on how teachers can be supported in providing effective feedback in educational settings. Based on a literature exploration and interviews with departments, we developed and evaluated tools for professional development, and incorporated these in the TU/e professional development offer.

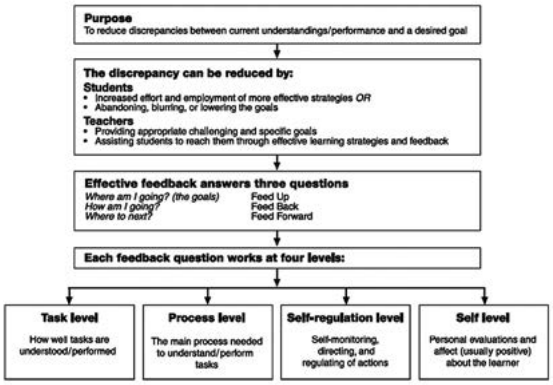
Objective

Overall goal was to improve the quality of education by supporting teachers in giving effective feedback to improve students' learning results.
Sub goals were to:

- Increase awareness about the value of effective feedback.
- Create guidelines for giving effective feedback specific to certain educational settings.
- Develop a method and materials to support professional development of teachers.
- Incorporate this within TU/e professional development for teachers.
- Make the materials available to all teachers for independent use.

Context

Nowadays, teachers in higher education more and more encounter larger groups of students which are more diverse. Simultaneously the goal of education is shifting towards preparing students for life-long learning. Teachers therefore need to shift their teaching style from a more teacher-centered style to a more student-centered style. This is often a more coaching-based style in which feedback skills are essential. Feedback is found to be one of the most important influences on learning. However, providing effective feedback (i.e., reinforcing learning) is not easy, and giving feedback does not always result in learning.
Against this background several teacher trainers and researchers of the TU/e started a project funded by the TU/e Bachelor College.



Theoretical background Figure 1: model of Hattie and Timperley (2007, p. 87)

	Person directed at the student himself; it rarely contains relevant task-information is and therefore hardly effective. Teacher praises without specifying the behavior the praise is about.	Task feedback about how well the task is being accomplished or performed, feedback on content of assignments, i.e. right/wrong calculations, right/wrong understanding of definitions.	Process feedback specific to the processes underlying the tasks, providing deeper understanding. Teacher provides feedback on thinking activities (how to apply, how to analyze)	Self-regulation feedback to the way students monitor, direct and regulate actions towards the learning objective. It involves interplay between commitment, confidence and control to achieve the learning outcomes. The teacher provides feedback on how the student manages himself to find the right answers, how many help he needs in this process and how he can do this independently next time.
Where is the student going?				
How is the student doing?				
What to do next?				

Figure 2: Levels and questions of effective feedback, as part of the (self-)assessment form and manual for giving effective feedback.

Practice

The project consisted of four phases:

1. Literature review and needs analysis by means of interviews with teachers and directors of education.
2. Formulating the implications for the method and tools for professional development for teachers.
3. Design and development of method and tools.
4. Trying, evaluating, adjusting and implementing of the method and tools.

Results

The interviews showed that most teachers view learning from a more behavioristic and cognitivistic perspective, whereby the learning is mainly teacher-centered with the student as an active participant. The interviewees could describe aspects of effective feedback, but also stated the importance and need for further developing feedback skills. Based on the literature review and the interviews, several implications were formulated, such as that professional development on this subject should contain a combination of theory and practice and should be closely related to the teachers education.

These implications were translated into our offer of the following five products:

1. Training component on feedback skills
2. Guide for coaching on feedback skills
3. Manual giving effective feedback
4. (Self-)assessment instrument
5. Practical article that describes the project

http://feedbackesoe.wikispaces.com/Feedback+bevorderen

Service Personnel and Organization
drs. Carry van Weert
c.j.w.v.weert@tue.nl

Improving Students' Writing Skills through Effective Small-group Peer Feedback

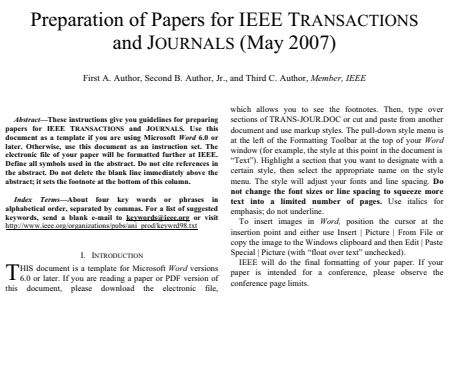
Abstract

The Electrical Engineering (EE) department has pursued efforts to innovate the existing study programs both at bachelor and master level. One of the major challenges is the growing number of students. In addition, one of the major problems identified by the teaching staff is the quality of writing skills.

Giving feedback to students' reports and paying attention to individual need to be strengthened. Peer review and peer feedback in a small group setting has become an alternative to improve writing skills. These, together with the feedback by expert teachers and supervisors, and with the use of appropriate feedback instruments such as rubrics or criteria lists, are suitable methods to enhance peer feedback.

Objective

- To develop an educational strategy to provide effective small-group peer feedback that can be used within the department in BEP projects but also in other courses at bachelor and master level.
- To improve students' writing skills through effective peer feedback.
- To create an IT online platform for the students to provide feedback during external internships.



Preparation of Papers for IEEE TRANSACTIONS and JOURNALS (May 2007)

First A. Author, Second B. Author, Jr., and Third C. Author, *Member, IEEE*

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I. INTRODUCTION

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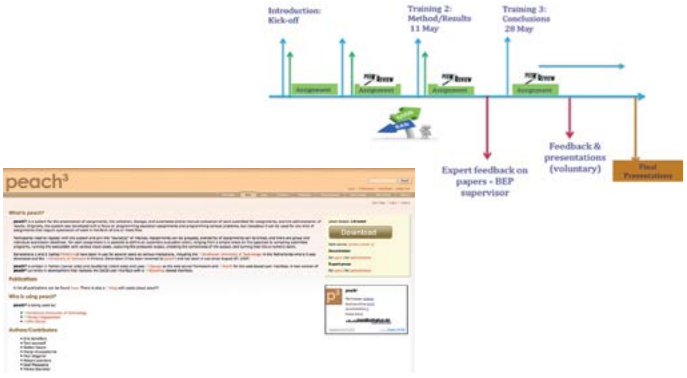


Context

The EE department is keen on looking for suitable educational methods that can bring about potential solutions for the development of academic writing skills. Furthermore, to optimize feedback and relieve the teachers' and supervisor's burden, potential effective educational options to explore is peer feedback in small-groups.

Within the EE department, there is special interest to work on new educational methods that can allow effective supervision by researching possibilities to organize feedback. These methods will be used and explored in order to identify the most suitable one(s) to supply the need for feed-back, feed-up and feed-forward to guarantee that students' writing skills are at the level of the end qualifications of a Bachelor engineer and a Master graduate.

Practice

Improving writing skills in EE courses through peer feedback.
Pilot 1 (finished) – Improving writing skills in Bachelor End Projects (BEP) through peer-to-peer review and feedback
Pilot 2 (in progress) – Integrating writing skills within two master courses and using peer-to-peer review and feedback in an online platform (PEACH)

Peer feedback strategy
Training students in
- Writing skills
- Peer feedback methods

Feedback by
- Peers
- Trainers
- Expert teachers & supervisors

Educational supervision methods
- Evaluation rubrics of Academic writing following IEEE guidelines
- Criteria lists for IEEE papers
- Before: Self-assessment instrument: diagnostic test level in writing skills
- After: Self-assessment instrument: Exit test level

Results of the first pilot

- 11 BEP Smart Sustainable Society students were trained in peer feedback and peer assessment methods.
- Teachers/supervisors have learned and use coaching methods to provide feedback.
- An educational and effective strategy grounded on peer feedback that can be easily adopted in other EE bachelor and master courses.
- Training materials and feedback instruments were developed and piloted to be used in all kinds of courses and settings.
- The quality of students' reports has been improved.

Department of Electrical Engineering
dr. Sonia Gomez
s.m.gomez.puente@tue.nl

Eindhoven School of Education
dr. Marieke Thurlings
m.c.g.thurlings@tue.nl

intranet.tue.nl/cee

Learn all about innovations in engineering education at the TU/e Innovation Day

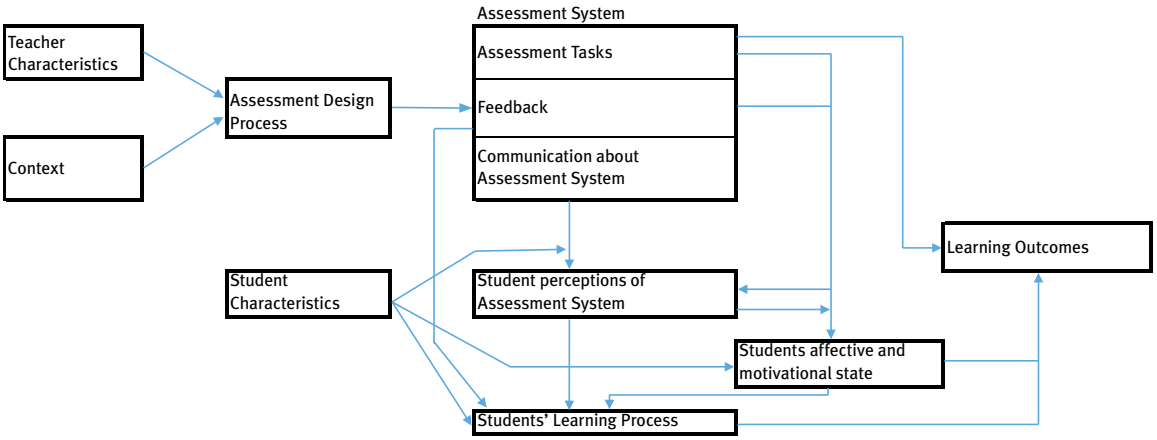
TU/e Technische Universiteit Eindhoven University of Technology

3TU. CENTRE FOR ENGINEERING EDUCATION

In-Between Testing in Technical Higher Education

Objective

The goal of the project is to better understand how in-between testing, and everything that is connected to it, influences students' learning processes and learning outcomes. This understanding can be used to formulate best practices that fit well with certain learning goals, which can be used to improve the overall use of in-between testing on the university.



Context

In-Between testing was part of the Bachelor College innovation at the Eindhoven University of Technology of 2012. Many courses were redesigned, and it became obligated to provide students with at least 2 in-between tests, that count for at least 30% of the final grade. The goal of these in-between test is to teach students the value of regular study, and to provide them regularly with useful feedback on their learning. However, the implementation of these tests differ widely across courses and the effects and best-practices of these in-between tests are unclear.

Practice

This PhD project was started to investigate the effects of the different implementations of the in-between tests on students learning outcome. A research model has been developed that describes the process from the design of assessment within a course, trough students' learning processes to students' learning outcomes. Four research projects will be performed to turn the research model into a theoretical model, and use it to design an intervention/innovation aimed at improving the design and implementation of the in-between. This innovation will then be evaluated according to the theoretical model.

Results

A pilot study was conducted to investigate some of the aspects of students' perception of the in-between tests and to find out how these perceptions are related to students learning outcomes, their intrinsic motivation, and course evaluations. The following factors of students' perceptions of the in-between tests were found:

- Value of the in-between tests.
- Learning function of in-between tests.
- Negative consequences from in-between tests (stress, anxiety).
- Positive consequences from in-between tests (self-confidence, less stress).

The positive and negative consequences contributed to students' grades, and value contributed to course-evaluation.
Intrinsic motivation for the course was related (reversed) to negative consequences and intrinsic motivation for studying in general was related to the learning function.

Eindhoven School of Education
msc. Bram Vaessen
b.e.vaessen@tue.nl

Instructing the Right Study Effort in 0SEUB0 'Patents, Design Rights and Standards' and Other USE Courses

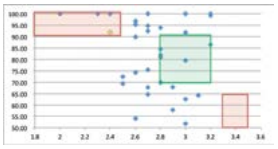
Abstract

TU/e provides User-Society-Enterprise education to prepare its engineers for solving societal problems. Students give good individual course evaluations, but ask for more overall relevance and rigor. First, the introductory course 'Patents, Design Rights and Standards' is analyzed and discussed with an expert group. The assessment plan is adapted. Clicker questions are higher order and guess correction optimized; the essay is elaborated and the final exam has a more rigorous format. In the last phase, the results of the course redesign will be studied and extrapolated to other USE courses.

Objective

The project will optimize the study effort and success rate, without lowering the students' general course evaluation. In a first phase, this will be applied to 0SEUB0. In a second phase, this will be applied to other USE courses.

Very good results for course evaluation, fun and design



USE courses 2014 Q4-Q1-Q2 and 2015 Q3 with success rate (y) w.r.t. "Study Effort vs ECTS" (x)

Context

TU/e's educational vision: 'Engineers of the future must be professionals capable of thinking critically and independently [...] able to contribute to solving societal problems'[1]
USE education: user, society and enterprise
Basic course + 10 course sequences
Challenge:

- Students generally report good individual USE course evaluations.
- USE education as whole can improve on relevance and rigour[2].

Practice

Analysis of introductory course: 'Patents, Design Rights and Standards' as pilot. Topic: Understanding, awareness and moral consequences of patents, design rights and standards.

Assessment plan: 10% in between clicker test, 20% Essay and role playing game, 70% written exam.

Expert Meeting discussed:

- students indicate problems with examination style
  - expect 'exact engineering' questions
  - questions on Multiple-choice
- students less enthusiast about role model game

Wide variation in evaluation guest speakers

Challenge for 'study effort vs ECTS' and Success Rate

	Respons	# enq	Course evaluation	Design	Organisation	Study guide	Study effort vs ECTS	Fun	Success rate
13-14	30%	32	7.5(1.5)	4.1(0.9)	4.0(0.6)	4.4(0.7)	2.7(0.5)	4.1(0.9)	89%
14-15	41%	46	7.0(1.9)	3.8(1.2)	3.7(1.3)	4.2(0.9)	2.4(0.8)	4.0(1.2)	94%

Table 1: Results of student questionnaire on 0SEUB0

Results

Phase 2: Adaptation course and analysis evaluation 15-16

- Clicker questions: higher order questions, guess correction optimized, more profound feedback
- Essay and role playing game elaborated
- Final exam, new format. Eight lectures, eight topics, also eight 'parts'. Every part 2 MC-questions, 1 question to answer in 10 words and 1 open question (insight, analysis, application).

Phase 3

- Analysis of 15-16 Q1 and further adaptation for 16-17 (After Q1)
- Extrapolation to other USE courses (Start September)

Department of Industrial Engineering & Innovation Sciences
dr. Gunter Bombaerts
g.bombaerts@tue.nl

1 MEIJERS, A., & Brok, P. den (2013) Engineers for the future: an essay on education at TU/e in 2030. Eindhoven: Eindhoven University of Technology, 11.

2 Graham R. (2015) Bachelor College evaluation and impact study. Report. Eindhoven: Eindhoven University of Technology.

Integrating Blended Learning in Physics Courses

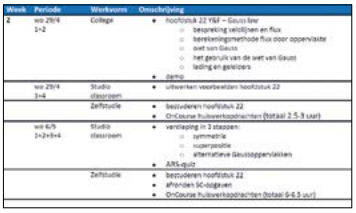
Abstract

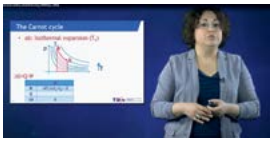
The AP department is interested in enhancing the quality of education and looking at possibilities to optimize, for instance, self-study time. Likewise, with the use of ICT tools the teacher-student contact time will be optimized as lectures will be used to focus on examples, additional and supervision as the direct contact will be effectively used to tackle main solving problems.

The lectures will be therefore used to present examples, to deepen in the content and focus on students' problems with the content.
Blended learning can be a suitable approach to meet different learning styles, to consider diversity and to address individual needs both in teaching and in supervision.

Objective

- Develop an educational strategy for the integration of blended-learning in AP courses.
- Improve teaching practices by optimizing contact hours, improving self-study time and providing feedback through the use of blended-learning.
- Pay attention to differences of students in learning styles, prior knowledge, etc., by introducing blended-learning in courses.





Context

The current developments at the TU/e bring about challenges in education. These developments have also an influence in education at the Applied Physics (AP) department. The classroom composition is more heterogeneous. This means that students come from different disciplines and have different backgrounds, interests differ, learning styles varies, and prior knowledge is not the same. In addition, with the growth in number of students the classroom composition are large. Within this context it becomes also important to pay attention to students' differentiation in learning. In order to make education more efficient, there is a need to experiment with blended-learning and integrate ICT methods in education.

Practice

The project implementation has focused on:

- Training in Oncourse, as an educational platform for feedback and assessment
- Training in weblectures, pencasts & screencasts
- Educational advice to analyze educational context and explore possibilities for improvements (i.e. flipping the classroom)

Results

- Integrated blended-learning in the Electromagnetics course
- Integrated blended-learning in three to four AP courses:
  - Weblectures - Condensed matter; Physics of new energy; Theoretic classic mechanics;
  - Oncourse - Computational and mathematics physics; and enhanced this tool in Experimental physics 3.
- Professionalize teachers and support teachers to introduce educational innovations.
- The 'good practices' are disseminated among AP deparment staff.

Department of Applied Physics
dr. Sonia Gomez
s.m.gomez.puente@tue.nl

Investigating Interdisciplinary Engineering Education

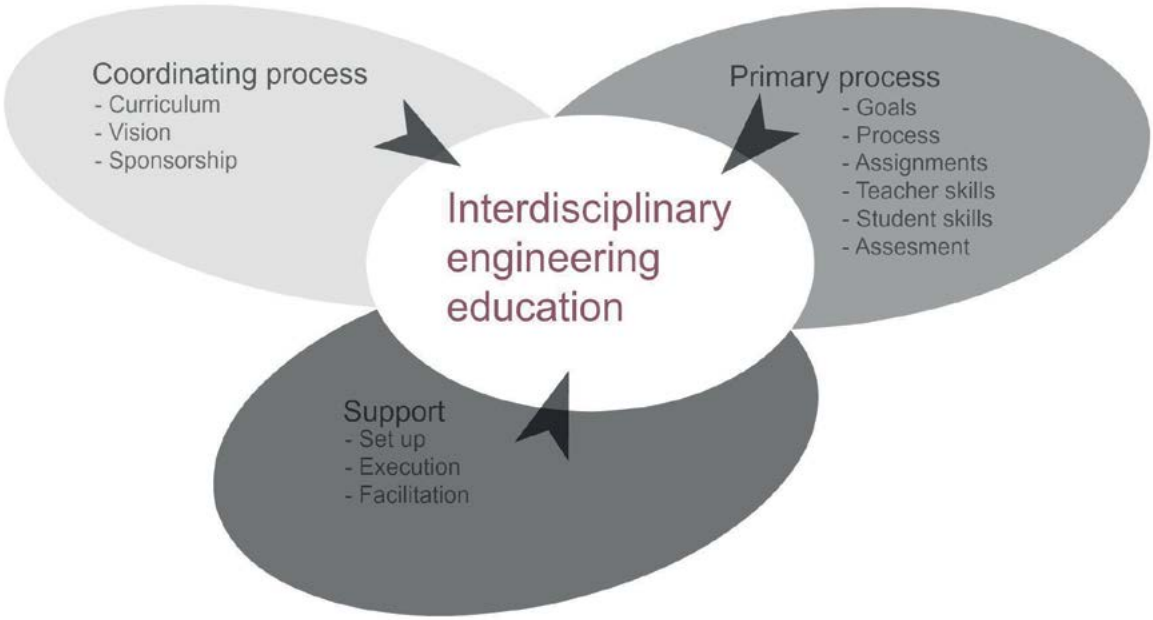
Abstract

This study maps and compares current examples of interdisciplinary engineering education at the 3 Universities of Technology, both at the bachelor as well as at the master level.

Interdisciplinary learning is one of the central characteristics of contemporary engineering education and of design-based education. In addition a review study provides a framework to evaluate current practices.

Objective

- To find evidence for interdisciplinary practices that work.
- Provide suggestions and support for the improvement of interdisciplinary educational practices.
- Framework to evaluate interdisciplinary practices.



Context

- Educating future-engineers
- Increasing technical and societal complexity
- Increasing pace of (technological) developments

Practice

- Literature review
- Interviews with stakeholders
- Development of framework
- Evaluating educational practice

Results

- Framework for evaluation of courses
- Guide for education (re)design

Eindhoven School of Education
dr. Antoine van den Beemt
a.a.j.v.d.beemt@tue.nl

Multi-Disciplinary Course Assessment with Multiple Assessors

Abstract

Many programs in higher education design multi-disciplinary courses, in which students have to apply theories and concepts from different academic disciplines.
Although multi-disciplinary courses are desirable, safeguarding their educational and assessment quality is difficult. Many staff members are specialist in one discipline and lack expertise to grade the students' multi-disciplinary work. This may impair the reliability and validity of the assessment, which may lead to unsound grading decisions.
The goal of this project is to investigate the requirements and design of multi-disciplinary assessment within the current multi-disciplinary course "IE Quick Scan", within the program of the bachelor Industrial Engineering.

Objective

- Gaining insight into the value and the design of multi-disciplinary assessments.
- Gaining insight into the degree to which different assessment methods meet evaluation criteria such as grading accuracy, time efficiency, administrative feasibility, and assessor confidence and satisfaction.
- Proving a framework for benchmarking the appropriateness of other assessment methods applied in other courses, at IE&IS, at TU/e, or at other universities.

Context

The Industrial Engineering (IE) bachelor program offers a course "IE Quick Scan", in which students have to analyse and describe their internship company using multiple frameworks they have learned during their major. IE Quick Scan is an integrative course, in which students have to apply theories and concepts from five different academic fields and perspectives: Accounting and Finance, Human Performance Management, Information Management, Operations Management, and Innovation Management. However, many staff members are specialist in one field only. Thus, although multidisciplinarity is a promising design feature of this course, it puts challenges on assuring assessment quality.

Practice

We investigate the challenges of assessing multi-disciplinary assignments given specific boundary conditions, such as staff expertise and availability. The following research questions are addressed:

1. What is multi-disciplinary assessment and how can it support student learning?
2. To what extent does the current assessment procedure meet the requirements of reliability and validity of grading?
3. What are criteria to evaluate available assessment methods?
4. Which method is preferred for the IE Quick Scan course?

A literature review outlines the requirements for multi-disciplinary assessment and identifies alternative methods. A quasi-experiment investigates which method is most suitable for multi-disciplinary integrative assignments.

Results

The results should provide information about:

- multi-disciplinary assessment methods and their implementation
- the role and responsibilities of the involved actors
- conditions (e.g. criteria, experience, combination of peer review and multi-disciplinary assessment, practical implementation issues)
- various tools and their effectiveness
- the extent to which multi-disciplinary assessment contributes to students' learning and assessment processes
- criteria to evaluate multi-disciplinary assessment methods.

The main result of this project is an advice on how multi-disciplinary assessments can be implemented and conducted to enhance student learning. Final results are expected in April 2016.

Department of Industrial Engineering & Innovation Sciences
dr. Kelly Meusen-Beekman
k.d.meusen-beekman@tue.nl

Department of Industrial Engineering & Innovation Sciences
dr. Jeroen Schepers
j.j.l.schepers@tue.nl

Department of Industrial Engineering & Innovation Sciences
dr.ir. Ad Kleingeld
p.a.m.kleingeld@tue.nl

Realizing Personal Education within an Increasing Student Population:

Scaling up High-quality Feedback and Assessment in Industrial Design and the Bachelor College

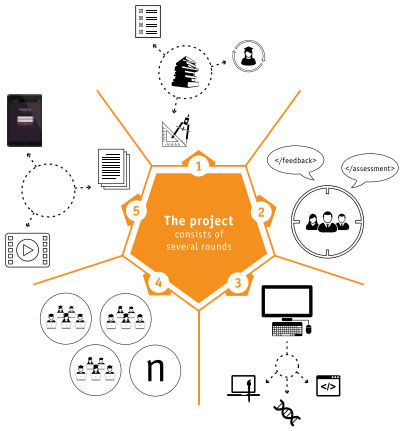
Abstract

In this project the tool **feedback camp 1.0** is redesigned and integrated in the education program of Industrial Design at a larger scale. Based on a literature study on summative and formative assessment and personal development planning, and condensed insights from focus group meetings with teachers and students several key functionalities will be developed in this project: facilitate structuring, automation and personalization of feedback are in the focus of research and will help maintain the quality of education even with growing student numbers and imposed efficiency measures. The finalized tool will be piloted in 2015 in several key learning activities.

Objective

Design: Extending the existing feedback tool with formative and summative assessment tools; that make the feedback and assessment more efficient, structured, transparent, and consistent (e.g. rubrics).

Implementation: Piloting and integrating feedback camp 2.0 on a larger scale. Attending to high degree of automation, structural conformance, good integration with educational processes and strong incentives for teachers to join and leverage novel feedback tools.



1. Studying literature on formative and summative assessment, personal development planning and feedback tools.
2. Focus group meetings with teachers of Industrial Design to explicate and develop the content of feedback functionalities, personal development planning functionalities, and assessment functionalities.
3. Developing feedback camp 2.0 web app.
4. Piloting the tool with > 100 students, >5 teachers, and >3 learning activities.
5. Extensive dissemination activities.

Context

Industrial Design (TU/e) has a tradition of in-depth coaching and personal education with a major role for high-quality individual feedback. This requires a large effort for teachers since student numbers are growing and the staff-student ratio is decreasing. To ensure the quality of the feedback and assessment practice in the future the tool, **feedback camp 1.0**, was developed and tested [1, 2]. The tool was appreciated by students and teachers, and as a logical follow up, we aim now at integrating the education program of Industrial Design at a larger scale and design functionalities that facilitate structuring, automation and personalization of feedback.

Practice

This project consists of several rounds:

1. Studying literature on formative and summative assessment, personal development planning and feedback tools.
2. Focus group meetings with teachers of Industrial Design to explicate and develop the content of feedback functionalities, personal development planning functionalities, and assessment functionalities.
3. Developing feedback camp 2.0.
4. Piloting the tool with > 100 students, > 5 teachers and > 3 learning activities.
5. Extensive dissemination activities.

Results

The expected outcome of this project is an elaboration of the existing tool of **feedback.camp** with improved feedback functionalities, personal development planning functionalities, and assessment functionalities. Further we plan to create functionalities for integrating the tool on a larger scale within Industrial Design and the Bachelor College. We believe **feedback.camp 2.0** can be useful for future learning activities within both the BC and the GS. We expect the following deliverables:

- web app feedback.camp 2.0
- professionally produced introduction movie
- scientific paper
- practical paper (“white paper”)
- “how to” guides for formative assessment and personal development planning

Department of Industrial Design
dr. Migchiel van Diggelen
m.v.diggelen@tue.nl

Department of Industrial Design
dr. Mathias Funk
m.funk@tue.nl

Department of Industrial Design
dr.ir. Miguel Bruns
m.bruns@tue.nl

Research Projects in a “Studio Setting”

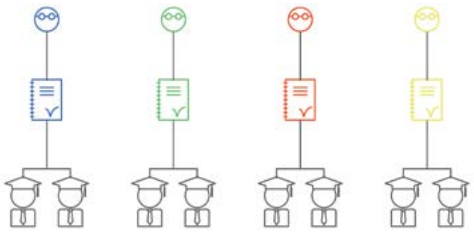
Abstract

Projects in a studio setting stimulate students more towards self-activating and collaborating education. Students will first communicate with peers and try to find answers before meeting the supervisors. This leads to more progress between the meetings, a better preparation and in-depth discussions during the meetings.

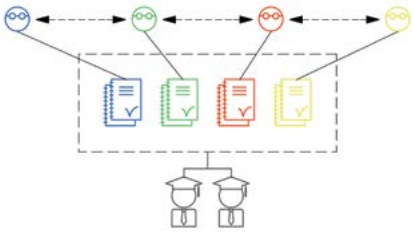
Studio’s focus on a certain topic. The collaboration between students directly leads to a higher more extend level of output. Students compare each other’s progress and that way better monitor their own progress.
To quantify this new approach a monitoring period is started. Students and supervisors will be asked to give feedback on working in studios.

Objective

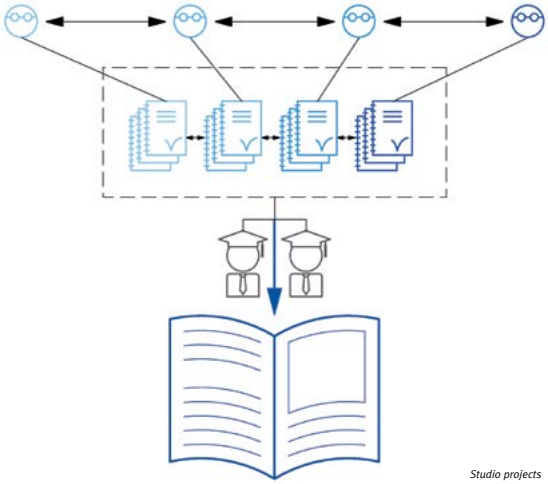
A new organization for master research and graduation projects will be implemented. In studio based projects students will work in a studio on one topic on individual assignments.
By presenting their work to each other on a weekly basis, they can learn more intense how to summarize and present their work to others and compare their progress. They give each other feedback, and collaborate during but also between meetings. This results into more progress, higher output level, more opportunities to publications and time reduction for supervision.



Individual projects



Combined projects



Studio projects

Context

Till now the unit Structural Design at the department of the Built Environment is organizing master research projects and master graduation projects where one student is guided individual by more than one supervisor. Supervisors explain topic multiple times, students have limited guidance resulting in relative low level of output. These inefficient and laborious practices cannot stay unchanged because the level of output is the driver for a University and larger groups of students enroll and/or a decrease of staff members will occur. How to improve the learning curve, the level of output and time efficiency?

Practice

An inventory has been made of all existing research, design and graduation projects that could be helpful for information about collaboration, peer coaching and self-activating education. Students and supervisors of these projects are surveyed and/or interviewed. The collected information will be analyzed and compared. In such way findings towards working in studio settings can be quantified and qualified. It should become clear if studios stimulate self-activating and collaborating education towards a higher learning curve for students and a more efficient workload of the supervisors.

Results

The project is not yet complete, therefore only some first indicative response can be given.

- Collaboration of students between the meetings will improve their progress. Things are solved sooner.
- Dividing work and learn from each other will increase the output.
- It is not always easy to find moments in the agenda to meet each other.
- Judging the individual quality of students seems more difficult. Does the grading become more average?
- Supervisors do ask other students to explain subjects after the meeting, making the meetings more efficient.

Department of
Built Environment
ir. Arjan Habraken
a.p.h.w.habraken@tue.nl

Strategies for Teaching Academic Competencies, for Teaching Large Groups, and for Differentiated Instruction

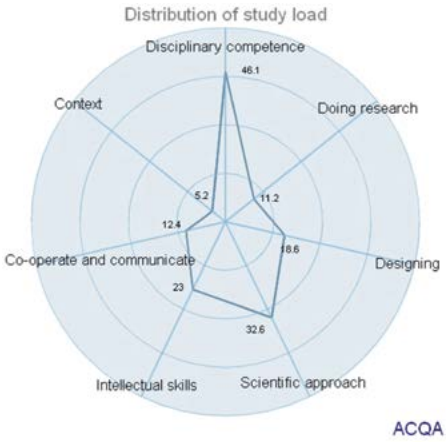
Abstract

The Academic Competencies and Quality Assurance group (ACQA) built a Wiki with tips for academic competence teaching; the Eindhoven School of Education (ESoE) and Teaching Support for TU/e Staff (TEACH) added strategies for teaching large groups and differentiated instruction. The aim was to support teachers in the new educational situation caused by the implementation of the Bachelor College, and the earlier introduction of competence-based quality assurance.

Teachers are invited to consult the Wiki aimed at improving their own educational practice. Furthermore they might suggest new strategies from their own best-practice. See http://tactics.ieis.tue.nl/wiki/index.php?title=Main_Page and contact m.c.g.thurlings@tue.nl or v.a.j.borghuis@tue.nl.

Objective

The aim of the projects was to build a support system for teachers in various new educational situations: when confronted with large groups, or differentiated groups or when trying to strengthen specific academic competences in their courses. The system should be user friendly and extendable.



Context

The Bachelor College brought larger, and more differentiated, student groups. Therefore tailor-made educational strategies are needed to handle this new situation in TU/e bachelor education.
Earlier, as a consequence of the introduction of the Bachelor-Master structure, the ACQA framework (Academic Competencies and Quality Assurance), also called 'the Criteria', has been developed and applied at the TU/e. Profiles of courses and programs in terms of study time divided over the competencies were constructed. Actual profiles often asked for strengthening of specific competencies in courses or programs. So, again, tailor-made educational strategies were needed.

Practice

Evidence-based strategies were constructed by use of two sources: educational research literature and best-practices of experienced TU/e-teachers. First, a Wiki was built for strategies concerning competencies by the ACQA group (called "Tips for Academic Competence Teaching Inspired by the Criteria" (TACTICs)). Second, strategies for large or differentiated groups, with separate attention to the use of ICT, were added by the Eindhoven School of Education (ESoE) in cooperation with the group Teaching Support for TU/e Staff (TEACH).

Results

A set of more than 100 strategies was developed; about 60 for teaching academic competencies, about 30 for teaching large groups, and about 10 for differentiated instruction. The strategies are characterized by a standard format comprising information such as a contents description, the educational background, preliminaries, conditions for using, and the author's name.

TEACH uses the Wiki in teacher training and also individual teachers consult it.
Conform the Wiki-approach, the set might be extended or individual strategies might be improved. Please visit the Wiki at http://tactics.ieis.tue.nl/wiki/index.php?title=Main_Page and contact us for questions or potential contributions.

Eindhoven School of Education
dr. Marieke Thurlings
m.c.g.thurlings@tue.nl

Department of Industrial Engineering & Innovation Sciences
dr. Tijn Borghuis
v.a.j.borghuis@tue.nl

Student Engagement at Mechanical Engineering

Abstract

Introduction to Technological Research (ITO) is a 3rd year bachelor course at Mechanical Engineering. To improve both student appreciation as well as image of research amongst students, the course was redesigned according to guidelines from motivational theory.
Students were able to choose their assignment and write their own research plan (*autonomy*). The assignment was done in pairs. Explicit attention was paid to professional practice and societal impact (*relatedness / purpose*). Regular feedback was provided by the research group and the peer review partners (*competence*). Evaluation results were positive and several students remained involved in research after the course.

Objective

The course 'Introduction to Technological Research' (ITO) was doing very poorly in the course evaluations. Students were complaining about the course. As a result of this, the image of research as a potential career was negatively influenced.

Goal of the innovation is to improve student appreciation for the ITO course and for research as a possible job perspective. We want students to experience that doing research can be a fun and creative activity and an important condition for innovation.

UNIVERSITY OF TWENTE.

Context

For other teachers or course designers who would like to raise student engagement, I found the Self Determination Theory (Deci & Ryan, 2000) very helpful. This theory states that conditions supporting the individual's experience of autonomy, competence, and relatedness during the learning process will stimulate intrinsic motivation and engagement for activities, leading to enhanced performance and creativity.

Practice

Based on the principles of motivational theories, the course was redesigned. During the course, students work in pairs on research assignments at one of the research groups. Students choose their own assignment from a large list of options. In the first quartile, a research proposal is written, followed by lab experiments and a journal paper in the second quartile. The course is concluded with a small conference where students present and discuss their papers. Both products are peer reviewed by another pair of students doing a similar assignment.
Inspirational lectures are added about ethics, societal impact and professional practice.

Results

Evaluation results show that the appreciation of the course was raised considerably. Students liked the research assignments and the peer review method is also appreciated very much. Several students have been actively involved in other research activities of the research groups as a result of the ITO course.

University of Twente
drs. Lisa Gommer
E.M.Gommer@utwente.nl

Taste Your Future

Abstract

In this project 3 digital modules (SPOC's: Small Online Private Courses) will be developed. In the future we would like to create a SPOC for all TU/e Bachelor Programs.
The modules contain representative educational experiences of first-year education for upper-level secondary school (VWO) students who are interested in science and technology.
The modules help to compare the images that students have received from information activities (e.g. TU/e open days) with reality.
Participation would provide students with insight into the match between image and reality in terms of interests, capacities and study attitudes.

Objective

- To offer incoming students the opportunity to verify their view on their provisionally program choices.
- To increase graduation rates among first-year Bachelor College students.

Context

The introduction of the Bachelor College changed the character of the information campaign for new students. The focus has changed into experiential aspects instead of real student life.
Students tend to fail in their first year because (among others) the image they have of what studying at TU/e is, is not right.
By participation these SPOC's the choice they can make for studying at TU/e will be more realistic.
Furthermore, the students can do this SPOC in their own chosen time and place. Independent of TU/e and Eindhoven as location.

Practice

At this moment we are working on the development of 3 digital modules (Industrial Engineering and Management Sciences, Electrical Engineering and Applied Physics).
Oncourse is the platform we're using for this project. After filling this platform with the developed content we can test the different modules (upper-level secondary school students and first year Bachelor College students).
After that we want to develop new modules for other Bachelor Programs.
In order to do this, we'll make a didactical design.

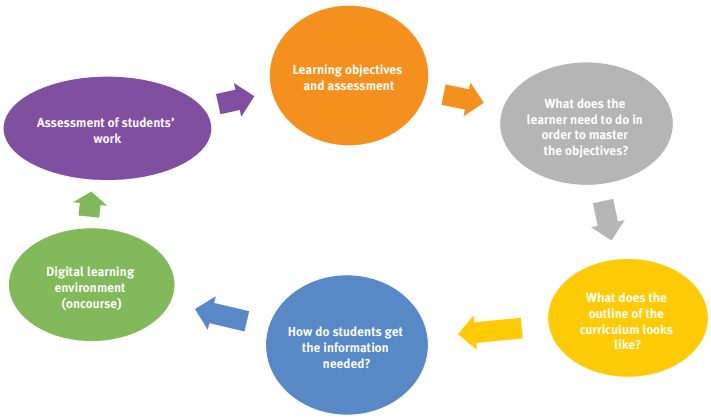
Results

Work in progress...

Education and Student Service Center
Jolanda Vogelsangs
J.vogelsangs@tue.nl

Technology Entrepreneurship

Practice



Results

Outline of the (redesigned) course

Monday	Wednesday	Friday
Weblectures	In-Class Lecture & Case Assignments	In-Class Workshops

Skills: teamwork, analysing, presenting, professional writing.

Web Lectures

Workshops

Oncourse

A learning environment that supports the students

Case Assignments

UBER

Uber cases distributed by the case centre (thecasecentre.org) on pricing & marketing, regulation & growth in combination with own synthesis of web information.

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Department of Industrial Engineering
dr. Myriam Cloodt
m.m.a.h.cloodt@tue.nl

TU/e SkillsLab
Scalable Skills Development & Education

Objective

Design a suitable infrastructure for learning, designed to fit the learning outcomes, the content that will be taught and the individual nature of the student.

- Students in control of their own education[1].
- Education tailored to individual student needs, engineering profiles, learning styles, and labor market requirements[2].
- Cater to diversity of students and student needs (i.e. time and place independent learning)[1].
- Learning how to learn, supporting life long learning[1].
- Improve quality of feedback and opportunity for differentiation in professional skills education[3].

Practice

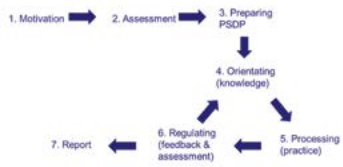
	On	Outcomes
Pilot 1	Bachelor College: A. Self Assessments B. Content & Tools C. Functionalities D. Learning support	• Good starting point for improving skills; Automate assessments. • Quality of content is good; Selection is too big; Use Topic Guides; More tools and exercises. • Interactive functionalities were hardly used; Online environment needs good search functionalities. • Integrate the communication in education program communication; engage the labor market; point out student ambassadors for integration with education programs.
Pilot 2	Graduate School: A. Self Assessments B. Content & Tools	• Self Assessments were hardly used (“I know my failures”). • Content was used by 50%; needs better search options; Students want STU guarantee.
Pilot 3	Graduate School: A. Diagnostic Test of Professional Skills	• Assessment was perceived as too long; Students need external motivation to take the assessments.
Start Sept 2015	Graduate School: A. Diagnostic Test of Professional Skills B. Content & Tools C. Functionalities adjusted online environment D. Learning support	• Assessment time is reduced; Self-assessments are automated; Integrated TU/e SkillsLab Assessment website. • Topic guides for each skill; Number of tools and exercises is extended; Integration of online & offline content. • New online platform without interactive functionalities; Extended search & find modules. • Student Ambassadors for each education program; Skill related information from labor market; Emphasis on “Why Skills?”.

Results

Skill Learning Cycle[4]

TU/e students can:

- Determine their own level using the TU/e SkillsLab assessments (http://educationguide.tue.nl/skills-assessment)
- Develop and practice their professional skills using the online content and tools (http://educationguide.tue.nl/skillslab)



Recommendations

- Engage labor market to address the question “Why skills?”.
- Integrate skills development & education in education programs by Student Ambassadors.
- Blended learning: Integrate online learning and development with off-line activities.

1 A. Meijers & Brok, P. den (2013). Ingenieurs voor de Toekomst
2 Position paper 'Revision of Graduate School Master's programs' Adopted by the Executive Board on April 3, 2014
3 Enquête Afsluiting eerste jaar Bachelor College 2013, 2014
4 Duisterwinkel, H., van der Aalst, B. & P. den Brok. Towards a learning-centered frame work for Blended learning

Education and Student Service Center
ir. Larisa Camfferman
l.camfferman@tue.nl

intranet.tue.nl/cee

Learn all about innovations in engineering education at the TU/e Innovation Day

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3TU. CENTRE FOR ENGINEERING EDUCATION

Contact

Perry den Brok
Executive Board Leader Eindhoven 3TU.CEE
e-mail p.j.d.brok@tue.nl
phone 040 247 47 02

Chantal Brans
Project Coordinator Eindhoven 3TU.CEE
e-mail c.brans@tue.nl
phone 040 247 27 05

intranet.tue.nl/cee

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