

# **Active Learning and ICT in TEM**

**(IJCLEE/ALE' 2015)**

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## **Abstract**

The University of Twente is a young and dynamic research university in the Netherlands where the development of new and relevant technological knowledge is at the forefront in research and education. The UT radically redesigned all the bachelor's programmes in the academic year 2013-2014. All new bachelor's programmes are designed according to our own Twente Educational Model (TEM). The TEM principles are (1) modular education, (2) active learning - project based work, (3) personal responsibility, (4) learning together and (5) quick and correct fit to get students in the most suitable degree programme. In the last two years several pilots focusing on active learning and ICT have been carried out within the TEM curriculum. These pilots include a peer feedback project, a peer instruction project and a digital portfolio system. All pilots are done in collaboration with faculty staff. They supply useful information for other Faculties. In this paper we focus in particular on peer feedback.

## **1 University of Twente**

The University of Twente is a young and dynamic research university in the Netherlands where the development of new and relevant technological knowledge is at the forefront. UT stands for "High Tech, Human Touch", which means that we approach technology in the context of the life sciences, management sciences and social sciences. In addition the UT boasts the spirit of entrepreneurship.

Our students are not only trained to become skilled researchers, they are also educated to become designers and organizers. (Naar een Twents Onderwijsmodel, 2013). These ambitious characteristics are the true profile of the University of Twente. To maintain this profile, we ensure that we constantly (re)develop our degree programmes and to keep pace with a rapidly changing society and an even more diverse student population with different educational needs than their predecessors. Students nowadays have different educational demands and lifestyles and they handle information in other ways than those of previous generations.

Universities are no longer the only source of knowledge. In a time when all kind of courses can be found and followed via the internet, it is all the more important for a university to be able to provide relevant and outstanding education.

The highly educated no longer assume they will practice the same profession throughout their lives. Many contemporary occupations did not exist 20 years ago. Therefore it is not possible to predict what our students will be doing 20 years from now. According to Oskam (2009) 'Engineers are concerned it is no longer sufficient to be simply a good project manager, researcher or engineer. In a field of work in which innovation is gaining increasing attention and where more and more work is being done in interdisciplinary teams in an open innovation environment, different requirements are now being set for the knowledge, skills and attitude of the young technical professional'. Highly educated professional engineers should therefore become more of a so-called T-shaped professional, a concept that was introduced by IDEA, an American design agency (Kelley & Littman, 2005). The University of Twente embraces the idea of the T-shaped professional and wants to educate students to develop in depth knowledge of their field (the vertical leg of the T), and, in collaboration with society and other disciplines, apply their knowledge more widely. They should be able to venture off the beaten path (the horizontal leg of the T).

With this in mind, the UT is since the academic year 2014-2015 in the process of radically redesigning all the bachelor programmes, to provide our students with an unique and relevant educational experience. All of the bachelor's programmes are designed according to our own Twente Educational Model (Naar een Twents Onderwijsmodel, 2013)

## **2 Twente Educational Model**

The Twente Educational Model (TEM) has five principles. These principles are (1) modular education, (2) active learning - project based work, (3) personal responsibility, (4) students learn together and (5) quick and correct fit to get students fast in the most suitable study programme. (Tom Principles, 2015). We use 1 quartile modules, each module consists of a project and several relevant courses.

At the University of Twente we want our students to study actively. Participating in a programme is regarded as a full time occupation (40 hours a week). This way students can complete their bachelor studies within three years. Therefore, it is important that education is attractive and that students are motivated to become future academics who represent the UT profile. Besides the project work (the core of TEM) other teaching methods are deployed when certain subjects lend themselves more to a different approach. Examples of different teaching methods include formal lectures and seminars, practical's, tutorials, practical exercises and video lectures. Because of TEM education at the UT is focused on active and attractive instructional methods. A number of teachers and Educational Support employees have carried out projects on active learning: peer feedback, peer instruction, flipping the classroom and the classroom of the future. In this paper we focus on active learning – peer feedback projects-. They are described below.

## **3 Peer Feedback**

### *3.1 Feedback*

Regarding feedback as a gift is the historically dominant paradigm (Askew & Lodge, 2000). Feedback was given by the teacher to the student and students were relatively passive recipients receiving the feedback. In TEM students have to play a more active part in their learning process. For two reasons students are more involved in giving and receiving feedback. First, peer feedback enables students to take an active role in the management of their own learning (Liu & Carless, 2006). Providing feedback to peers can fill the gap between what students know and what students have to know and therefore it stimulates students to reflect on their own performance which enhances 'deep learning'. The second reason is that development of the skill 'giving and receiving feedback' is very important to constant learning in everyday life and work (Boud & Falchikov, 2006).

In recent years, the process of peer feedback is being facilitated by the use of educational software. Online peer feedback can considerably simplify the logistics of peer assessment. Online peer feedback can support didactical aspects as well as face to face feedback. As mentioned by Gehringer (2001) and Trahasch (2004), it allows higher degrees of interactivity between students and offers teachers better possibilities to monitor and guide this interactive process.

There are several ways in which elements of peer feedback can be categorized. At our university we make a distinction between (1) feedback on teamwork, (2) feedback on a written report and (3) feedback to process the learning materials. We will discuss pilots with computer based tooling on all three distinctive forms.

### 3.2 *Optimizing teamwork with WebPA*

A tool used for optimizing group work is WebPA<sup>1</sup>. This is an open source online automated tool that enables every project member to score individual contributions to group work directly into the WebPA system. So WebPA helps students to reflect on their own work and assess the contribution of other project members.

WebPA is mainly used to give and collect feedback on students teamwork skills and afterwards discuss the results in the project group. It results in formulating recommendations for the individual students and for the team. In the first year bachelor modules are multiple pilots running with WebPA. We did a pilot in the degree programme of Creative Technology, of Industrial Engineering and Management and of applied Mathematics. These three pilots will be outlined below.

In the three pilot modules students have the possibility to attend lectures and tutorials and to study books and online materials, these are the instructional methods used in the courses. In the project the students work together, make a project plan, divide tasks, brainstorm and discuss ideas, evaluate results, write a report and present the outcomes of the project.

#### 3.2.1. *Creative Technology*

In the project of the module *Art Impact and Technology* students design and realize an interactive installation for GOGBOT 2014<sup>2</sup>, using and integrating methods and techniques from previous Creative Technology projects. The primary design criterium is to have high impact on the spectator/participant of the installation, irrespective of its practical application, utility or deployment. The students have to explain (the creation of) their installation, both visually and textually and relate it to the context of application, for a variety of audiences. During the project “Have Fun and Play!” students will be asked to reflect on their functioning as a team and to assess their peers on their collaboration skills. All this is intended to become familiar with each other capacities and to apply their capacities in such a manner that the whole group benefits and that the performances of the whole group is improved.

#### 3.2.2. *Industrial Engineering and management*

In the project of the module *Business Intelligence and IT* students design a database, design and implement a Balanced Scorecard Dashboard for a given business company and develop a web application. Students work in a mixed group of six students from two degree programs. The project work (group mark) contributes 40% of the final grade for the module. The group mark makes it worthwhile to spend attention on the individual contribution of each student to the group process. Halfway through the project students are asked to fill out the WebPA system about the contribution of their group members. Questions concern for example the quality of

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<sup>1</sup> <http://webpaproject.lboro.ac.uk/>

<sup>2</sup> <http://en.wikipedia.org/wiki/GOGBOT>

the work, the way of communication, the effort the team member is putting in the group process, etc. The outcomes will be (anonymous) discussed in the project group, this gives students the chance to improve their behaviour during the remainder of the module. At the end of the module students were asked to fill out the WebPA system again. This time it may influence the end mark of the individual student for the project.

### 3.2.3. *Applied Mathematics*

In the project in the module *Certain and Uncertain information* the students work together in a group of five students. They have to work on the following question: *Can you predict what period of the day tomorrow, after tomorrow and next week the water level is above 1.50 meters relative to NAP in the bend of the river Walsoorden in the Netherlands. And can you say something about the quality of your predictions?* Students also used WebPA to evaluate the contribution of the group members.

### 3.3 *Stimulate better understanding with PeerWise*

Peerwise<sup>3</sup> is a tool to stimulate better understanding of the learning materials. Peerwise is a web based online tool where students can create and present multiple choice questions with regard to the learning materials in a repository for their peers. Students can answer questions, give comments and communicate about the questions and answers with other students.

The pilot was executed in the module 'Living and Working Tomorrow' in the degree program Creative Technology. Students were asked to submit at least one question each week about the content of the indicated videos for that particular week. 5% of the final grade was determined by submitting the question on time. In addition to the question, students were encouraged to post as many questions as they liked, at any time, either about the videos, or about explanations given by the instructor during the class meetings. The students had to formulate their questions in line with the criteria for high quality multiple choice questions.

### 3.4 *Feedback on a written report with Digital Portfolio*

At the UT we developed our own Digital Portfolio System (DPS). Since the implementation of TEM the need for a system that incorporates the newly needed functionalities with regard to TEM increased. One of these functionalities of the digital portfolio is the function to ask for feedback. In the TEM modules students deal with many different roles, and all of them can give valuable feedback. The digital portfolio system has options to facilitate 360 degrees feedback. All kind of stakeholders can provide the student with relevant feedback. This means that a teacher, tutor, the project members or friends from a student committee can provide feedback. In the DPS students can send a feedback request. In the request the student uploads his product file and may add an existing feedback form (predefined by a so called coordinator), the student can also add an empty feedback form and add his own items. The evaluator (the person who gives the feedback) fills out the form in the digital form and sends it back. The DPS collects all the feedback and products in the digital portfolio of the student

The degree programme Industrial Engineering and Management started with the DPS as a pilot in 2013. In this programme the portfolio is used to monitor the development of academic and

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<sup>3</sup> <https://peerwise.cs.auckland.ac.nz/>

professional skills during the bachelor. Because of the success the system became a University-wide-system since February 2015. It is likely that more functionalities will be added in the near future.

## 4 Results

All pilots with computer based tooling were executed as standalone pilots. In this chapter we show preliminary conclusions. As a follow up we would like to set up pilots which give insight in the effects of the tools on the learning of the students and the time investment of the lecturers.

### 4.1 WebPA

In all pilots the teachers were enthusiastic using the new tool for enhanced learning. Unfortunately teachers were not impressed with the results. The first teacher using WebPA was not satisfied with the contributions of the students because students found it difficult to discuss the feedback they had given and received. It seems the students do not feel safe enough to discuss the feedback. Because of this attention should be paid to the influence students have on the assessment criteria and conditions. In future pilots students will be made part of the process to set up the assessment criteria. Some interesting student quotes include: *'Students should have the opportunity to opt out of peer assessments if it's not anonymous'*. Almost all students wanted future peer feedback to be anonymous.

Other students remarks include: *What's wrong with paper peer assignments? Why does every single thing that we do, need to be electronic?* This remark might be due to the fact that the pilot was executed in a very small group. The practical advantages of computer based tooling will be more evident when used in large groups. One could argue that you should only use computer based tooling in small group sizes when there is a clear pedagogical advantage.

### 4.2 PeerWise

In the PeerWise pilot the teacher concluded that the tool worked all right. Unfortunately the teacher was disappointed with the results, the multiple choice questions the students formulated were of poor quality. The implementation of the skill 'giving and receiving feedback' is hard. Students have to learn how to give and receive feedback, how to deal with feedback and how to discuss feedback to ensure the feeling of security amongst them. One solution is to pay more attention to the introduction of peer feedback by discussing good and bad examples of the multiple choice questions in PeerWise during the course and by focusing more on the fact that giving and receiving feedback is an important skill for the future.

### 4.3 Digital Portfolio

In the pilot the Digital Portfolio was used for academic and professional skills. The teachers and students are satisfied with the fact that there is a place where students can submit their products, ask for feedback and where teachers can monitor the student during the bachelor programme. Other programmes from the faculty Behavioural Management and Social sciences, Engineering Technology and Electrical Engineering, Mathematics and Computer Science became enthusiastic to use the same portfolio system.

On the downside it is still difficult to motivate students for academic and professional skills. Students know the importance of developing their professional skills, but don't give it priority in their study. The digital portfolio and the use of rubrics is just a facility. The curriculum and motivation of the students influences the usage of the portfolio system.

## **5 Discussion of the results and recommendations for interested parties**

The number of peer feedback pilots is limited. Therefore we can only draw tentative conclusions. More empirical research is necessary to make strong scientific conclusions. Nevertheless we have formulated a few recommendations based upon the results of the pilots. These recommendations are of interest to other parties who would like to implement similar tools to activate students and to enable learning.

### *WebPA (feedback on the group process)*

- Students should have influence on the assessment criteria to make the results more relevant
- Some students like anonymous feedback over not-anonymous, however not-anonymous feedback gives the discussion about the results more focus.
- Especially during the first year the lecturer/tutor should have the role of coach, monitor and process keeper to ensure an appropriate debate about the peer feedback results of the project members.

### *PeerWise (feedback on the professional skills and content)*

- The lecturer has to give a clear introduction of the learning objectives of the use of this tool
- It's very important to motivate students, for example by giving bonus points
- The lecturer should explain more than once bad and good examples of multiple choice questions in PeerWise.
- Appointing a moderator in PeerWise might work as well.

### *Digital Portfolio (feedback on written work)*

- It's useful to work with rubrics. Rubrics will help students to better understand the feedback and to get insight in what went well and not so well.
- Students have to learn how to give and receive feedback and have to be aware of the importance of feedback.
- The lecture/tutor should have the role of coach, monitor and process keeper.
- Working on a portfolio has to be an integrated part of the curriculum

We are glad to be able to conclude that these pilots gave a good introduction of computer based peer feedback tooling at our University. There is a growing interest in the system WebPA and the number of users of the Digital Portfolio system is increasing rapidly. Within the next year of TEM modules we are going to set up following pilots which give insight in the learning effects on the students in relation to the use of computer based peer feedback systems.

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