

---

# SUPPORTIVE AND DOMINANT TECHNOLOGIES IN HIGHER EDUCATION

Research on Educational Reforms by the Information Revolution

**Rubina G. T. Oliana**

s1293753  
r.g.t.oliana@student.utwente.nl

International Business Administration  
University of Twente

**Michelle E. ten Pas**

s1326813  
m.e.tenpas@student.utwente.nl

Creative Technology  
University of Twente

**Abstract** – *The purpose of this research is to identify a way in which technology can be implemented in the educational system of the University of Twente, in such a way that students can study more effectively. Effectiveness is measured by the students' grades, and 'technology' in this sense is divided into two primary uses, namely 'supportive' and 'dominant'. 'Supportive technology' functions as a tool that stimulates interaction between teachers and students, whereas 'dominant technology' can be seen as a stand-alone service that offers students a complete learning experience without a physical teacher. By means of 4 constructs, that measure study effectiveness, in combination with a survey amongst students of the University of Twente, the perceived effectiveness of both supportive and dominant technology is measured. This is done by asking the students what their experience is with the two types of technology used in education and how they perceived the relation between a certain technology and the 4 constructs. The four constructs used to measure study effectiveness are self-reported grades, teacher clarity, classroom discussion and feedback. From this survey, the use of supportive technology has proven to be perceived as more effective as compared to the use of dominant technology. The University of Twente should consider implementing supportive technology in its educational system and should provide lecturers with workshops and trainings in order to make the use of such technology effective. In addition to that, the University of Twente should not dismiss dominant technology entirely, as it scores high on constructs that supportive technology did not seem to provide.*

## I. INTRODUCTION

This research paper is written in the context of Explore the Void, a study trip to Silicon Valley in July 2014 organized by the study trip committee of study association Proto at the University of Twente. During this study trip, various companies at the west coast of the US were visited to conduct research on the information revolution. This research will in particular focus on educational reforms in the context of the information revolution. The information revolution is

characterized by an easy, fast and global access to information due to the expansion of the Internet. This enables people to share their knowledge and develop new technologies.

Nowadays, one can find more and more technological means that are used in education. "Technology has greatly transformed the dynamics of teaching and learning", however, it has also "depersonalized the whole process," [1]. According to Shah, depersonalization occurs due to the fact that in computer-based education the "teacher and students become virtual entities, with limited human interaction or considerations".

This research paper will examine to what extent these technological means can improve the effectiveness of higher education, in particular at the University of Twente. The specific definition of effectiveness in this research is introduced and explained in the theory section of this paper. To find out what kind of technologies are most effective to provide the best possible education to every individual student, a better understanding of the student's needs is indispensable. The technologies dealt with in this research are websites, mobile applications and similar software or digital material. In line with the university's slogan "High Tech, Human Touch" [2], different possible applications of technology in education will be analyzed. A question that has to be asked is: does the technology have a supporting role, or a dominant role? A supporting technology can be defined as one that assists the teachers in better understanding the needs of individual students and helping them adapt to that student's needs. Whereas, in a dominant role, technology educates and guides the students rather than the teacher. This means that dominant technologies take over the tasks and responsibilities of 'physical' teachers.

In the paper "Critical Issue: Using Technology to Improve Student Achievement", Learning Point Associates of the North Central Regional Educational Laboratory [3] say that "each technology is likely to play a different role in students' learning" and that two roles of technology can be distinguished: "Students can learn "from" computers—where technology used

essentially as tutors and serves to increase students basic skills and knowledge; and can learn "with" computers—where technology is used a tool that can be applied to a variety of goals in the learning process and can serve as a resource to help develop higher order thinking, creativity and research skills". Another distinction of technology roles can be found in the study of Shah [1], where it is divided into technology "as a part of the curriculum, for delivery of teaching contents, as an aid to instructions and as a tool to enrich learning experience".

There is a major shift happening in classrooms at the moment: What used to be a teacher-centered education is changing into an education system where the focus lies on the students. Teachers used to control the learning process, determining the pace and direction of the lesson and students passively retrieved the information [1]. "Multimedia can be crafted to the needs and the cognitive orientation of students," [4].

As described by Evanouski [5], the new student is actively searching for information and the teacher becomes more of a mediator between student and information. Of course, this is dependent on the type of technology that is used. In a dominant role of technology, a physical teacher is not present and the technology might allow for less student-centered education than in a supportive role of technology.

Here, the discussion arises, whether a substitution of a physical teacher has an influence on the effectiveness of learning. In a study about MOOCs, there were no significant differences found in the homework performances between students taking a traditional on-campus course and students following a MOOC [6]. In contrast, you can find many studies that argue that the physical presence of a teacher is essential in the learning process of a student. One of these arguments, found in the paper of Shah [1], is that "technology may work wonders but may not be able to substitute the teacher and his ability to guide the students and equip them with knowledge, skills and values to face the challenges of the real world. While technology is a sharp and powerful tool, its effectiveness depends on the ability of the teacher to determine the needs of the students, design and develop the contents and make strategies to deliver them effectively."

In general, using technology in education has been proven to have many advantages, as also listed in the study of Shah. More interactive learning leads to a greater interest and motivation, which in turn results in an increased retention of information by the student. It also makes it easier to access information and share knowledge with peers. On the teacher side, technology offers "a broad range of tools to collect and analyze data, and richer sets of student data to guide instructional decisions," [3]. Technology in education enables the student to determine his or her own pace in learning and allows repeating exercises and learning material until the student understood it. Also, it has

been proven that "students whose teachers were high level users of technology scored significantly better than did the students whose teachers were low level users of technology in the classroom," [5]. However, to ensure that technologies are implemented and used in the right way, it is important to offer teachers extensive training in educational technologies. With these new skills, teachers can engage their students in a more interactive way, in addition to the intellectual and emotional engagement good teachers should provide their students with.

To summarize, the research questions underlying this research are:

#### KEY QUESTION:

**'How can technology be implemented in the educational system at the University of Twente in such a way that students can study more effectively?'**

#### SUB QUESTIONS:

- a. 'Can a more dominant role of technology, embedded in the educational system of the University of Twente help students study more effectively?'
- b. 'Can a more supportive role of technology, embedded in the educational system of the University of Twente, help students study more effectively?'

The measurement of effectiveness of the different technologies will be based on Hattie's theory of 'Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement' of 2008 [7]. This will be explained in detail in the next section "Theory". After that, the methods, analysis and results of this research will be presented for each of the two sub questions. The results will then be used to come to a final conclusion on the key question. Also, recommendations will be given at the end of the research paper.

## II. THEORY

'Effectiveness' as mentioned in the goal of this research, is defined by the results of the currently used assessment method at the University of Twente, namely a grading system with scores that range from 1 to 10. 'To increase effectiveness' by the use of a dominant or supportive role of technology means that the average scores of students should increase, while other parameters stay the same, because of the use of that technology (*ceteris paribus*).

To measure the effectiveness of implementing a certain role of technology in a higher education system, John Hattie's meta-study is used, in which many factors of teaching and studying have been related to their effect on what is here called 'student

achievement'. Student achievement can be thought of as the same as the concept of effectiveness chosen in this research.

From the list of the top 10 most influential factors on student achievement, as published in John Hattie's *'Visible Learning for teachers'* [8], 4 constructs were chosen, which function as measures of effectiveness that can be compared with both dominant and supportive technology in higher educational systems.

1. Student Self-Reported Grades
2. Piagetian programs
3. Response to intervention
4. Teacher credibility
5. Providing formative evaluation
6. Micro-teaching
7. Classroom discussion
8. Comprehensive interventions for learning disabled students
9. Teacher clarity
10. Feedback

Figure 2.1: Top 10 influences of student achievement as published in *'Visible Learning for teachers'* [8]

Points 2, 3, 4, 6 and 8 in Figure 2.1 do not relate to the use of a supportive or dominant role of technology in higher educational systems, as Piagetian programs, response to intervention (both used in primary school) and comprehensive interventions for learning disabled students do not relate to the chosen target group, namely students at the University of Twente. Teacher credibility related to personal trust between a teacher and the students. Micro-teaching involves a specific method in which student achievement is not directly affected.

The following 4 constructs from the list of the top 10 most influential factors on student achievement, as published in John Hattie's *'Visible Learning for teachers'* [8], function as measures of effectiveness that can be compared with both dominant and supportive technology in higher educational system.

#### A. SELF-REPORTED GRADES / 'STUDENT'S EXPECTATIONS'

The method of questioning students on how they expect to perform on a future test on the current theory. By identifying the expectations of the students, the teacher gets the chance to exceed these expectations by engaging the student in trying to perform better.

#### B. TEACHER CLARITY

The clarity at which the intentions of the lesson and the success criteria are communicated to the students. Clear learning intentions describe the skills, knowledge, attitudes and values that the student needs to learn. Teachers need to know the goals and success

criteria of their lessons, know how well all students in their class are progressing, and know where to go next.

#### C. CLASSROOM DISCUSSION

Classroom discussion is a teaching-method in which the teacher facilitates time for the students to discuss the material. Classroom discussion helps students better understand the material by discussing their thoughts and questions, whilst the teacher gets the opportunity to better understand the effectiveness of his/her lectures by listening to the students' discussions and evaluating whether the material is understood.

#### D. FEEDBACK AND FORMATIVE EVALUATION

Feedback can be a powerful tool to increase effective studying. Quantitative feedback exists of scores or grades, and is a good indicator of one's understanding of the material. However, this feedback is given in retrospect, and does not influence one's learning process before the assessment. Giving qualitative feedback, or formative feedback, during a project or learning process gives students (and teachers) the possibility to adjust their ways of teaching/studying, which can increase effectiveness during the learning process.

#### DOMINANT ROLE OF TECHNOLOGY

A more dominant role of technology should be thought of as a role in which technology physically can replace the conventional teacher. Technology, in this sense, is used to execute such a teachers' main tasks: Explaining and elaborating on the material, testing the students' knowledge, and assessing their knowledge level.

Dominant technologies in higher educational system such as The University of Twente are used in the form of MOOC's (Massive Open Online Courses). These courses are to be followed on an online platform of some sort, in which the student can for example watch video-recorded lectures and read slides as explanation or elaboration on the material. Tests about these materials are to be handed in online as well. The lack of a commitment to physical space and time, make MOOC's available to a larger pool of potential students at different locations and with different agenda's.

Other sources of dominant technology are online videos or computer programs that provide the student with a complete technology-based learning experience.

#### SUPPORTIVE ROLE OF TECHNOLOGY

A supportive role of technology can be found in tools, websites or applications that offer interaction between the student and teacher via digital communication media. Other than in case of dominant technology, the aim of supportive technology is not to substitute the teacher, but rather to support the teacher in understanding the students' needs. The teacher can

then adapt his or her lecture to specific needs of the students. By using supportive technology, students often experience a more interactive way of learning and participating in class.

Examples of supportive technologies that are used by teachers at the University of Twente are Peerwise [9], Shakespeak [10] and MyLabs+ [11]. All of these three tools facilitate web-based interaction during class and aim for a better understanding of the course material by the student.

### III. METHOD

The aim of this research is to measure the effectiveness of two kinds of technology in education: technologies that have a dominant role and technologies that have a supportive role. The evaluation of this concept, as explained in the section above, is based on four constructs used in the meta-analysis of Hattie. To evaluate the effectiveness, the measure of self-reported grades, teacher clarity, classroom discussions as well as feedback and formative evaluation are tested for both roles of technology separately in one survey. The survey is conducted amongst 50 students of the University of Twente, who are questioned about their educational background and experience with both roles of technology.

After asking which technologies they have used for education, five key questions, based on the four constructs of Hattie and one general rating, are given on a 5-point Likert scale ranging from strongly disagree to strongly agree (cf. Table 3.1). At the end, students are asked to say whether they think dominant or supportive technologies are more effective in education. The complete survey can be found in Appendix A.

Underlying construct	Survey question
General	The technology helped me to study more effectively
Self-reported grades	The technology helped to better estimate my performance/results on a future test
Teacher clarity	The technology helped to make the goals and material of the course more clear
Feedback and formative evaluation	The technology facilitated the possibility to provide feedback during the learning process
Classroom discussion	The technology facilitated classroom discussion on the course material

Table 3.1: Key statements to measure the correspondence of Hattie’s constructs to dominant and supportive technologies in education

Besides the survey, interviews are conducted with employees of the educational services at the University of Twente who work with the implementation of

technology at the university. One interview about how the University of Twente is implementing technology in their educational system is conducted with Wytze Koopal, an expert in ICT and education. Another one is held with the head of the educational services department, Irene Visscher-Voerman. She is interviewed about the recent changes in the educational system with regard to the implementation of technology in class. The full interviews can be found in Appendix B.

During the study trip, several Q&A sessions are held at companies and educational institutions that develop new educational technologies or that use technology in dominant or supportive ways. Answers from these Q&A sessions help to understand the development and changes within the area of this research. Institutions visited in Silicon Valley are Coursera [12], KhanAcademy [13], Stanford University and the USC Institute for Creative Technologies. In Appendix D, the questions and answers of the sessions can be found. With the found results, an analysis is made for both of the technology roles. The results from the survey are used to examine to which extent the four constructs of Hattie match the dominant and supportive roles of technology. Together with the results from interviews and Q&A sessions, this will be analyzed to come to a conclusion whether supportive and dominant are effective in helping students to learn, and, if possible, to say which of the two technologies is more effective. To evaluate the survey results, a 5-step statistical T-test will be conducted using SPSS.

### IV. RESULTS AND ANALYSIS

#### A. RESULTS AND ANALYSIS FOR A DOMINANT ROLE OF TECHNOLOGY

To assess how effective a more dominant role of technology in an educational system can be, the use of such technology, in this case in the form of MOOC’s, should be compared to theory. This is done by analyzing the survey results with respect to the theory of Hattie. Results from the interview with Wytze Koopal and the Q&A session at Coursera are interpreted with respect to the effectiveness of MOOC’s. All the results are then compared and used to come to a final conclusion about the effectiveness of dominant technology.

The survey questions relevant to dominant technology are questions 9 through 13. These had the following results:

Q9 : In total, 13 of 55 (26%) respondents stated to have experience with dominant technology in education.

Q10: Cousera (12%) and KhanAcademy (18%) were the most popular platforms for this group. Question 11 exists out of 5 separate questions related to the overall perceived effectiveness of dominant

technology and the 4 chosen constructs of Hattie:

11.1 : The technology helped me to study more effectively

11.2 : The technology helped to better estimate my performance/results on a future test (related to 'self-reported grades')

11.3 : The technology helped to make the goals and material of the course clearer (related to 'teacher clarity')

11.4 : The technology facilitated the possibility to provide feedback during the learning process (related to formative feedback)

11.5 : The technology facilitated classroom discussion on the course material (related to classroom discussion)

All these questions were answered on a Likert scale ranging from 'Strongly disagree' (1) to 'Strongly agree'(5). Using SPSS, a statistical test can be executed to measure if a certain construct is positively related to dominant technology. The results of the statistical test are shown in Table 4.1.1 and 4.1.2.

#### STEP 1: PARAMETERS

Assume the degree of agreement with the 5 statements about dominant technology presented on a Likert scale is normally distributed with an unknown population mean and unknown standard deviation for all 5 statements. The sample size of the people who answered to have experience with any kind of dominant technology in education is 12 of the 50 students who participated in the survey. The means and standard deviations of survey questions 11.1 until 11.5 are shown in table 4.1.1

	N	Mean	Std. Deviation
11.1	13	3,77	,725
11.2	12	2,75	,754
11.3	12	3,83	,835
11.4	12	2,83	1,193
11.5	12	2,67	1,231
Valid N (listwise)	12		

Table 4.1.1: Mean and standard deviation for all 5 statements about dominant technology

#### STEP 2: HYPOTHESES

For all 5 statements, the hypotheses for population means are:

$H_0 : \mu = 3$  and  $H_a : \mu > 3$ , (with  $\alpha = 0,05$ )

The null-hypothesis is that participants are neutral about the particular statement, i.e. the agreement value is 3. The hypothesis  $H_a$  is that participants rather agree or strongly agree with the statements by having a higher agreement value than 3 (neutral). This will tell whether the participants think that dominant technology helps to study more efficiently and whether or not the constructs of Hattie are present in dominant technology.

#### STEP 3: TEST STATISTIC

The values for t can be found in Table 4.1.2 showing the results of the One-Sample T-Test in SPSS for all 5 statements.

#### STEP 4: P-VALUE

The P-values found in column 'Sig. (2-tailed)' in Table 4.1.2, indicate whether  $H_0$  can be rejected for a certain item:

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
11.1	3,825	12	,002	,769	,33	1,21
11.2	-1,149	11	,275	-,250	-,73	,23
11.3	3,458	11	,005	,833	,30	1,36
11.4	-,484	11	,638	-,167	-,92	,59
11.5	-,938	11	,368	-,333	-1,12	,45

Table 4.1.2: Results from the T-Test in SPSS

#### STEP 5: CONCLUSION

From these P-values it can be concluded that for items 11.2 , 11.4 and 11.5 the null-hypothesis can not be rejected due to a P-value larger than  $\alpha$ , and that for items 11.1 and 11.3 the null-hypothesis can be rejected due to a P-value smaller than  $\alpha$ . Connecting question 11.1 to these results means that there is enough evidence to state that the true mean of the population will be higher than 3 and thus either 'agree' or 'strongly agree' . Connecting the rest of the results to the 4 constructs of Hattie means that:

#### SELF-REPORTED GRADES

There is not enough evidence to state that the true mean of 11.2, related to self-reporting grades, lies above a score of 3. This means that a dominant role of technology does not necessarily help students predict their performance. This makes sense since MOOC's often don't let students report their expected grades in order to adapt the material and emphasize on certain parts of the material in such a way that will engage the student in trying to perform better. The 'massive' part of MOOC means that the courses are equal to each student and are not variable or adaptable to a student's specific progress.

#### TEACHER CLARITY

There is enough evidence to state that the true mean of 11.3, related to teacher clarity, lies above a score of 3. This means that a dominant role of technology can still be very clear on the intentions of the course, and its success criteria. In general MOOC platforms offer the room to its creators to create and, if needed, adapt the content to the mass of its users. This means that it is up

to the creator to make the intentions of the course, and its success criteria clear to all students.

#### (FORMATIVE) FEEDBACK

There is not enough evidence to state that the true mean of 11.4, related to formative feedback, lies above a score of 3. This means that dominant technology does not necessarily help students to get feedback during or a certain learning process. Again, this makes sense, since MOOC's are massive, and personal feedback is often impossible due to the amount of students. Peer feedback is a common way to deal with this problem.

#### CLASSROOM DISCUSSION

There is not enough evidence to state that the true mean of 11.5, related to classroom discussion, lies above a score of 3. This means that dominant technology does not necessarily facilitate room for good discussion on the material. However, class-specified forums can help to facilitate this.

#### INTERVIEW : WYTZE KOOPAL

This section presents the results of an interview with Wytze Koopal, project leader and advisor on the intersection between education and IT, at the University of Twente. He gave more insight into the intentions of the University of Twente to develop its first MOOC.

The University of Twente is only just starting to introduce MOOC's to its services. Wytze Koopal says that "introducing MOOC's is mainly a strategic move. A large portion of the potential target group of the University of Twente is employed. Commercial operators such as 'LOI', and 'NCOI' already cater to this group by offering flexible and (partially) digital education programs. The University of Twente is now starting to implement more flexible and digital programs in order to attract this potential group." However, he says: "The university exists because of its human touch. By offering project oriented education, group projects and interactive lectures we hope to attract students to come to the UT. Lecturers use technology more often during their lectures to make them more interactive."

#### Q&A : COURSERA

The following text is based on an Q&A session with Coursera, provided by Emma Starks and Jacob Samuelson:

Coursera is a MOOC platform that offers free MOOC's from universities from around the world. Around 60% of its users have a Bsc or Msc degree and take courses in developing fields. These courses (can) stand completely apart from the university you are registered at. Once a course is successfully finished, a certificate can be bought for as less as 35\$. The following questions were asked in relation to the effectiveness of MOOC's:

- Is Coursera seeking to become an educational institution on its own?

"Coursera can not replace the campus experience, and is not seeking to become competition for conventional universities"

- How do companies (employers) react to certificates and degrees gained from MOOC's?

"At the moment certificates are used to show competences, but it takes time to be fully trusted by companies. Coursera is trying to build relationships with companies in order to build this trust."

- What makes MOOC's more effective than conventional lectures?

"Coursera uses MOOC's to 'flip the classroom', this means that learning becomes more interactive and all the material is handled in tutorial style. Students teach themselves by doing and practicing, rather than listening to a lecturer."

## B. RESULTS AND ANALYSIS FOR A SUPPORTIVE ROLE OF TECHNOLOGY

To find out whether a supportive role of technology helps students to study more effectively, the results of the survey are analyzed together with findings from interviews and Q&A sessions at KhanAcademy in Silicon Valley. The relevant survey questions that have to be examined are questions 6 to 8 and 12 to 13. The other questions are not relevant to this sub-question, since they are either only general or related to dominant technologies. A summary of the results of the survey can be found in Appendix C.

#### SURVEY RESULTS

To begin with, of the 50 participants, 22 answered to have experience with using supportive technology. That equals a percentage of 44%. From the different examples of supportive technology listed in the survey question 7, Peerwise was the one that was used by most of the participants. It is a tool that lets students submit questions that other students can rate, comment and answer. The teacher can select the best question based on the rating and difficulty to create a multiple-choice exam. It "can help to establish a learning community in your class incorporating collaborative learning and peer tutoring," (Peerwise). Other supportive technology tools used by students that participated in the survey indicated to have used are MyLabs+, Shakespeak and others. All of these tools increase the engagement of the students with the lesson.

Next, a statistical analysis will be made to test if the outcomes of question 8 are also applicable to the general population.

#### STATISTIC T-TEST

In this test, the degree to which the participants agreed with the 5 different statements based on constructs of Hattie is examined for the case of supportive technology. The 5 statements are presented on a Likert

scale and are rated as follows: Strongly disagree will get a value of 1, disagree will be valued as 2, neutral as 3, agree as 4 and strongly agree as 5.

**Statements:**

**S1:** The technology helped me to study more effectively

**S2:** The technology helped to better estimate my performance/results on a future test

**S3:** The technology helped to make the goals and material of the course clearer

**S4:** The technology facilitated the possibility to provide feedback during the learning process

**S5:** The technology facilitated classroom discussion on the course material

**STEP 1: PARAMETERS**

Assume the degree of agreement with the 5 statements about supportive technology presented on a likert scale is normally distributed with unknown population mean  $\mu$  and unknown standard deviation  $\sigma$  for all 5 statements. The sample size of the people who answered to have experience with any kind of supportive technology in education is  $n=22$  of the 50 students who participated in the survey. The sample means for the different statements and the sample standard deviations are can be found in Table 4.2.1 below.

	N	Mean	Std. Deviation
S1	22	3,41	,959
S2	22	3,73	1,120
S3	22	3,28	1,077
S4	22	4,05	,785
S5	22	3,59	,908

Table 4.2.1: Statistics of the statement samples calculated in SPSS

**STEP 2: HYPOTHESES**

For all 5 statements, the hypotheses for population means  $\mu_{S1}, \mu_{S2}, \mu_{S3}, \mu_{S4}$  and  $\mu_{S5}$  are

$H_0: \mu = 3$  and  $H_a: \mu > 3$  with  $\alpha = 5\%$ .

The null-hypothesis is that participants are neutral about the particular statement, i.e. the agreement value is 3. The hypothesis  $H_a$  is that participants rather agree or strongly agree with the statements by having a higher agreement value than 3 (neutral). The significance level of this test will be 5%.

This will tell whether the participants think that supportive technology helps to study more efficiently and whether or not the constructs of Hattie are present in supportive technology.

**STEP 3: TEST STATISTIC**

Using the One-Sample T-Test in SPSS for all 5 statements (cf. Table 4.2.3), the values for t can be found.

**STEP 4: P-VALUE**

Table 4.2.3 also shows the p-values for the different statements.

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
S1	2,001	21	,059	,409	-,02	,83
S2	3,044	21	,006	,727	,23	1,22
S3	1,188	21	,248	,273	-,20	,75
S4	6,243	21	,000	1,045	,70	1,39
S5	3,052	21	,006	,591	,19	,99

Table 4.2.3: T-test results of the statement samples calculated in SPSS

**STEP 5: CONCLUSION**

Hypothesis  $H_0$  can be rejected if the p-value  $\leq \alpha$ , with  $\alpha = 0,05$ .

Testing this for the different statements, the following conclusions can be drawn:

S1:  $0,059 > 0,05$

S2:  $0,006 < 0,05$

S3:  $0,248 > 0,05$

S4:  $0,000 < 0,05$

S5:  $0,006 < 0,05$ .

For S1, the p-value 0,059 is slightly larger than the significance level of 0,05. This means that for the first statement  $H_0$  cannot be rejected. With a significance of 5%, it cannot be said that everyone would agree or strongly agree with the statement that supportive technology helps to study more efficiently. Rather, people tend to be neutral about this statement.

For the second statement S2, the p-value of 0,006 is significantly smaller than the significance level 0,05. Therefore,  $H_0$  can be rejected and the conclusion can be drawn that at a significance level of 5%, supportive technology helps to better estimate performances and results on a future test.

The third statement S3 has a p-value that is significantly larger than the significance level. Thus,  $H_0$  cannot be rejected. The conclusion can be drawn that at a significance level of 5%, people are rather neutral about the statement that supportive technology makes the course goals and material clearer than that they would agree or strongly agree.

With the lowest p-value of all statements,  $H_0$  of the fourth statement can be rejected. This means that with a significance level of 5%, people agree or strongly agree that supportive technology facilitates the possibility to give feedback through technology during the learning process.

For the last statement S5, the p-value of 0,006 is again significantly smaller than the significance level of 0,05. The null-hypothesis can be rejected and at a significance level of 5%, the conclusion can be made that people agree or strongly agree with the fact that supportive technology facilitates classroom discussions on the course material.

#### RELATION BETWEEN SURVEY FINDINGS CONCERNING SUPPORTIVE TECHNOLOGY AND HATTIE'S THEORY

Now, the findings from the survey can be related to the theory of Hattie.

#### SELF-REPORTED GRADES:

A supportive role of technology can help students to predict their performance of a future test. This can be facilitated through mini tests or quizzes that students can choose to do or just statistics that show their work progress so far.

#### TEACHER CLARITY:

It is not significantly proven the clarity of the course material imparted by the teacher is enhanced through a supportive role of technology. However, in the survey results most of the participants agreed that supportive technology helped to better understand the course material and intentions of the teacher.

#### FEEDBACK AND FORMATIVE EVALUATION:

According to the test results, supportive technology helps students to get feedback and formative evaluation during, not only after, a project. As proven by Hattie, this increases the effectiveness during the learning process.

#### CLASSROOM DISCUSSION:

Supportive technology facilitates classroom discussions where the students can discuss the material with the teacher in an interactive way. Classroom discussions, in turn, also helps teachers to better understand the needs of their students. Therefore, they can tailor their lectures to individual needs and students can study more effectively.

Summarizing, it can be found that three of Hattie's constructs, namely self-reported grades, feedback/formative evaluation and classroom discussions, are facilitated in supportive technologies such as Peerwise, MyLabs+ and Shakespeak. Only the construct of teacher clarity cannot be significantly proven. Also the general statement that supportive technology helps to study more effectively cannot be proven by the statistical t-test. However, taking these results of the survey together with findings from interviews with members of the educational services at the University of Twente and answers from a Q&A session at KhanAcademy in Silicon Valley, there are more arguments for the fact that supportive technology

facilitates higher effectiveness in studying compared to dominant technology.

#### INTERVIEWS

In the interviews with Wytze Koopal and Irene Visscher (Appendix B), both working at the educational services of the University of Twente, it became clear that "a lot of teachers at the University of Twente are already using supportive technologies in class," (Appendix B, Koopal, 2014). Many of them use supportive technology tools like Peerwise to make the course more interactive and engage the students more with the class and course material.

Teachers can choose to take courses on how to implement technologies in class offered by the educational services of the UT. However, "these trainings are on a voluntary basis, so the initiative has to come from the teacher himself," (Appendix B, Koopal, 2014). Of course, not every teacher knows how to implement supportive technology in his or her lectures. For some courses this might also just be very hard due to the subject he or she is teaching. It is probably easier for younger teachers to learn how to use technology in class than for older teachers who might have problems with catching up with all the new technologies that are being developed. The UT is now developing their first MOOC. Teachers who are involved in this process "can gain more experience with digital teaching," (Appendix B, Koopal, 2014). This might even encourage teachers to work more with supportive technologies during class.

#### Q&A KHANACADEMY

Unexpectedly, during a Q&A session at KhanAcademy located at the Google Campus in Silicon Valley, it became clear that, with regard to the chosen definitions for supportive and dominant technologies, the services of KhanAcademy should be seen as a supportive technology rather than a dominant one as it was assumed at the beginning of this research. In the survey it was listed as an example for dominant technology, because it offers short video lectures and it can be used as a substitute for a teacher.

As it turned out, KhanAcademy does not want to substitute teachers in the classroom, but rather give students a tool to practice course material. Therefore, the answers, as to be found in Appendix D, given by Salman Khan and Ben Komalo as representatives of the company will be analyzed in this section about supportive technologies.

According to Salman Khan, although it is often used in high schools, "KhanAcademy can also be used at universities; especially in the context of competency based education," (Appendix C, KhanAcademy, 2014). Within the platform of KhanAcademy, teachers can create a dashboard for their classroom. This gives them an overview of the students' progress and allows the teacher to tailor their lecture to the individual needs of the students. The individual approach in turn, can help students learn more effectively, since the teachers

know which parts of the course material the student needs help with. Through gamification, the platform allows the teacher to offer an interactive lesson to the students and the digital dashboard provides teachers as well as students with feedback on the students' achievements. This feedback, as also proven in the statistical test above, helps students to study more effectively according to Hattie.

The service of KhanAcademy is also offered respecting two different learning styles: textual and visual. The students can choose either to watch the videos or read the explanations. Yet, according to KhanAcademy, their "focus is not on different learning styles", since each student should decide for himself/herself how he or she wants to learn. The student can then find the perfect learning speed and choose to have a break whenever he feels that he needs more time to digest the course material.

In the future, KhanAcademy will focus even more on providing individual feedback features and creating personal tracks that are adapted to the students needs and goals. After all, "KhanAcademy does not want to interfere too much with the lesson," it is an effective supportive technology for both, students and teachers.

### C. COMPARISON OF THE SURVEY RESULTS OF SUPPORTIVE AND DOMINANT TECHNOLOGY

Looking at the results of question 12 of the survey, the following percentages can be found:

- 3 of 13 (23%) respondents that had actual experience with dominant technology chose dominant technology over supportive technology.
- 11 of 22 (50%) respondents that had actual experience with supportive technology chose supportive technology over dominant technology.

This shows that participants perceive supportive technology in education as more effective than dominant technology.

In question 13, some participants gave explanations for their choice in question 12. Here are some of the reasons participants gave for a supportive role of technology:

- "I think it's still useful to have some personal contact with the teacher. Therefore it is also important that this supportive technology does not introduce extra distance between the teacher and the student. On the other hand, dominant technology can be used to reach more students and to get more people interested in studying, and it's much cheaper. But for me personally supportive technology is better."
- "It provides an opportunity to directly apply knowledge and receive feedback."
- "I think that technology should not replace the real interaction between student and teacher. It should supplement it."

After statistically testing for both technologies whether the results can be applied to the general population, it becomes clear that for a supportive role of technology, there is enough evidence that self-reported grades, classroom discussions and formative evaluation/feedback are facilitated. Interestingly, these are exactly the constructs that are not proven to be effective for dominant technologies, where only classroom discussions and the general perception of being effective give enough evidence. Therefore, a supportive role of technology can be evaluated as being slightly more effective than a dominant one. Table 5.1 provides an overview of the findings comparing dominant and supportive technologies. The "✓" marks the constructs that have enough evidence to be seen as effective for the according technology. "✗" means that the effectiveness of that construct cannot be proven statistically.

Constructs	Dominant Technology	Supportive Technology
General effectiveness	✓	✗
Self-reported grades	✗	✓
Teacher clarity	✓	✗
Classroom discussion	✗	✓
(Formative) Feedback	✗	✓

Table 5.1: Overview of the statistically tested effectiveness of Hattie's constructs

A possible explanation for this outcome is that dominant technologies such as MOOCs are too big to allow customization to individual needs, including feedback for example. MOOCs are made for "massive" groups of students, offering the same service for everyone. With supportive technologies, the focus lies more on the individual learning processes. If teachers better understand their students' needs, they can adapt their lecture to these specific needs. This is impossible on big platforms like MOOCs, since the goal is to reach as many students as possible, rather than facilitating individualized education.

The fact that dominant technologies show enough evidence to say that teacher clarity is facilitated compared to a negative proof with supportive technologies could be explained with the aspect that supportive technologies make the class more interactive and might distract the students from the real goal of the lecture the teacher wants to reach [14].

Table 5.2 summarizes the most important results of this research. Unexpectedly, there seems to be a contradiction when looking at the results of survey questions 7.1, 11.1 and 12. Where most respondents ranked dominant technology higher in general effectiveness than supportive technology in questions

7.1 and 11.1, just 23% of respondents with experience in dominant technology actually chose dominant technology over supportive technology, and 50% of respondents with experience with supportive technology chose supportive technology over dominant technology in question 12. Even though general effectiveness is rated higher for dominant technology, respondents still preferred supportive technology to dominant technology. A possible reason for this contradiction could be that there are other factors besides the four constructs that influence the effectiveness of the different technologies.

	Dominant Technology	Supportive Technology
Example	Coursera (MOOCs)	KhanAcademy
Implemented at the University of Twente?	Currently developing a MOOC	Used by some teachers, Voluntary trainings offered
Experience of students with technology	26%	42%
Significantly effective constructs	General effectiveness, Teacher clarity	Self-reported grades, Feedback, Classroom discussion
Students with experience who think this technology is most effective	23%	71%
Reasons	<ul style="list-style-type: none"> <li>- Easily accessible</li> <li>- Cheaper</li> <li>- Reaches more students</li> <li>- More independency</li> </ul>	<ul style="list-style-type: none"> <li>- Personal contact with teacher and other students</li> <li>- More interactive</li> <li>- Facilitates feedback</li> <li>- More tailored to individual needs</li> </ul>

Table 5.2: Summary of the research findings

## V. CONCLUSION

Looking back at the research questions that were posed in the beginning of this paper, it can now be concluded how and to what extent these questions can be answered.

### KEY QUESTION:

**‘How can technology be implemented in the educational system at the University of Twente in such a way that students can study more effectively?’**

Taking into account the results of the survey, students at the University of Twente prefer a learning environment where technology supports the role of the teacher and by stimulating interaction. Therefore, the focus of the University of Twente should lie on implementing more supportive technologies in order to

achieve that students can study more effectively. This can be done by training more teachers about the use of such technologies and motivating them to implement them. Moreover, since dominant technologies facilitate some constructs that supportive technologies do not facilitate, students should also be given the chance to use dominant technology in addition to supportive technology in class.

This key question is only answered for a specific measurement of study effectiveness. It only takes into account four constructs that are proven to be effective in learning, but it could be useful to measure it for more constructs.

### SUB QUESTIONS:

a. ‘Can a more dominant role of technology, embedded in the educational system of the University of Twente help students study more effectively?’

According to the research results, dominant technologies only show limited study effectiveness when compared to supportive technologies. In general, dominant technology is perceived as generally helping the students to study more effectively and to make the course goals, communicated by the teacher, clearer. Therefore, it helps students to study more effectively, only to a limited extent.

Furthermore, this question is answered only in comparison to supportive technology. It could be interesting to find out if dominant technologies show more study effectiveness as compared to a situation without any technology.

b. ‘Can a more supportive role of technology, embedded in the educational system of the University of Twente, help students study more effectively?’

The findings in this research show that the implementation of supportive technologies at the University of Twente can help students to study more effectively, especially when compared to the use of dominant technology. The reason for this high study effectiveness is that supportive technologies score high on facilitating self-reported grades, classroom discussion and (formative) feedback.

As applies for the subquestion a, this question is answered only in comparison to another role of technology and neglects a situation where no technology is used at all.

Now, a summarizing conclusion can be drawn.

In general, it can be found that the line between supportive and dominant technologies can be unclear sometimes, since some technologies like KhanAcademy can be used in different ways.

In the search for the most effective technology to help students learning at the University of Twente, a supportive role of technology can be found to be more effective than a dominant role of technology, due to the fact that supportive technologies facilitate

individual feedback and adaptations. Dominant technologies are more focused on reaching a massive group of students than on making the learning process more effective. Since dominant technologies turn out to be effective in the points where supportive technologies are not, an implementation combining dominant and supportive technologies could increase the study effectiveness of students at the University of Twente. Thus, the decision of the UT to develop a MOOC and offer teachers trainings in new technological tools for class are a good way to stimulate technology integration.

Yet, the focus should not be too much on dominant technologies, since supportive technologies seem to be more effective than dominant ones.

## VI. DISCUSSION AND RECOMMENDATIONS

In the course of this research some problems arised, one of them being the fact that we categorized KhanAcademy as a dominant technology at the beginning of the study. It wasn't until the actual visit at KhanAcademy that it was realized that it is meant to be more of a supportive technology. This had implications for the survey, in which we listed KhanAcademy as an example of a dominant technology. Since it was listed with platforms that worked in a similar way (education through video lessons/lectures), it was decided to still use the results of the survey, assuming the participants used it in a dominant way, namely using video lectures to further educate themselves.

Another point of interest is the use of theory. Hattie's study includes many constructs that are proven to be effective. Using more of these constructs could have had a positive influence on the strength of our research.

Other points of improvement are the fact that more students could have been contacted to fill in the survey. Most participants came from one faculty. It could have been interesting to see if there would be a difference if more students from other faculties would have participated., and the amount of Q&A's could have been increased. Of the companies visited in Silicon Valley, only Coursera and KhanAcademy were of value for this research. It would have been interesting to hear the vision and mission of other dominant and supportive technology companies too.

We recommend the University of Twente to systematically implement more supportive technology into its educational system, possibly by making trainings about supportive technologies compulsory for teachers. This could be handled as part of the new Twente Education Model (TOM) where there is a stronger focus on project-based education. However, dominant technology should not be dismissed entirely, as it scores higher on two constructs that supportive technology did not seem to provide. Therefore, the development of MOOC's provide good prospects for the University of Twente, and should certainly be continued.

## REFERENCES

- [1] S.A. Shah, *Making the Teacher Relevant and Effective in a Technology-Led Teaching and Learning Environment*. Procedia - Social and Behavioral Sciences, vol. 103, pp. 612-620, 2013.
- [2] University of Twente. *High Tech Human Touch*. 2014. <http://www.utwente.nl/touch/>. (Accessed: 25-06-2014).
- [3] Learning Point Associates. *Critical Issue: Using Technology to Improve Student Achievement*. North Central Regional Educational Laboratory (NCREL), 2005. <http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm>. (Accessed: 16-10-2014).
- [4] Neo, T.-K. and Teoh, B.S.P. *Innovative Teaching: Using Multimedia To Engage Students In Interactive Learning In Higher Education*. Information Technology Based Higher Education and Training, pp. 329-337, 2006.
- [5] Evanouski, L. *The Impact of Technology in Education. A Synthesis Paper on Technology in Education*. 2009. <http://www.slideshare.net/loraevanouski/impact-of-technology-in-education>. (Accessed: 16-10-2014).
- [6] Colvin, K.F., Champaign, J., Liu A., Zhou Q., Fredericks, C., Pritchard, D.E. *Learning in an Introductory Physics MOOC: All Cohorts Learn Equally, Including an On-Campus Class*. The International Review of Research in Open and Distance Learning, vol. 15, (4), pp. 263-282, 2014. <http://www.irrodl.org/index.php/irrodl/article/view/1902/3009>. (Accessed: 16-10-2014).
- [7] Hattie, J. *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. NY: Routledge, 2008.
- [8] Waack, S. *Glossary of Hattie's Influences On Student Achievement*. 2014. <http://visible-learning.org/glossary/>. (Accessed: 25-06-2014).
- [9] Peerwise. 2014. <https://peerwise.cs.auckland.ac.nz>. (Accessed: 25-06-2014).
- [10] Shakespeak. 2014. <http://www.shakespeak.com>. (Accessed: 25-06-2014).
- [11] MyLabsPlus. 2014. <http://www.pearsonhighered.com/mylabsplus/>. (Accessed: 25-06-2014).
- [12] Coursera. 2014. <https://www.coursera.org>. (Accessed: 25-06-2014).
- [13] KhanAcademy. 2014. [www.khanacademy.org](http://www.khanacademy.org). (Accessed: 25-06-2014).
- [14] Jenvey, N. *New Technologies – Tools of Learning or Distraction?*. University World News, (290), 2013. <http://www.universityworldnews.com/article.php?story=20131002164421350>. (Accessed: 25-06-2014).

# APPENDICES

## APPENDIX A – SURVEY

### Survey: Technology in education

In our research question, we are looking at how technology is implemented in higher education, in particular at the University of Twente, in such a way that students can study more effectively. We are specifically distinguishing between dominant and supportive technologies.

With a supporting role, we mean that technology assists the teachers in better understanding the needs of individual students and adapting to these needs. Whereas, with a dominant role, we mean that the technology's primary role is to educate and guide the students. This means that technology in a more dominant role takes over the tasks and responsibilities of 'physical' teachers.

**\* Required**

**1. What is your age? \***

- 17-20
- 21-24
- 25 or older

**2. At what university did you study this year? \***

- University of Twente
- Other:

**3. What is your occupation? \***

What degree are you working on at the moment

- Bsc
- Msc
- PhD

**4. To which faculty does your study belong? \***

- "Dutch/English"
- EW/EEMCS
  - MB/SMG
  - CTW
  - CTI
  - GW/BS
  - TNW

**5. Did your study participate in the TOM/TEM model this year? \***

- yes
- no
- I don't know

**6. Do you have direct experience with supportive technology in education? \***

Supportive technology can help teachers by making lessons more interactive or by testing students and analyzing the results. (e.g. Peerwise, Shakespeak, MyLabs+)

- Yes
- No (Continue with question 9)

**7. If you answered yes, which supportive technologies did you use?**

- Peerwise
- Shakespeak
- Socrative
- MyLabs+
- Other:

**8. Please fill in the following questions according to your agreement with the statement.**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The technology helped me to study more effectively	<input type="radio"/>				
The technology helped to better estimate my performance/results on a future test	<input type="radio"/>				
The technology helped to make the goals and material of the course more clear	<input type="radio"/>				
The technology facilitated the possibility to provide feedback during the learning process	<input type="radio"/>				
The technology facilitated classroom discussion on the course material	<input type="radio"/>				

**9. Do you have direct experience with dominant technology in education? \***

Dominant technology functions as the main source of information, material and assessment. (E.g Kahn Academy, Coursera, LOI)

- Yes
- No (Continue with question 12)

**10. If you answered yes, which dominant technology did you use?**

- Coursera
- Khan Academy
- EdX
- LOI
- Other:

**11. Please fill in the following questions according to your agreement with the statement.**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The technology helped me to study more effectively	<input type="radio"/>				
The technology helped to better estimate my performance/results on a future test	<input type="radio"/>				
The technology helped to make the goals and material of the course more clear	<input type="radio"/>				
The technology facilitated the possibility to provide feedback during the learning process	<input type="radio"/>				
The technology facilitated classroom discussion on the course material	<input type="radio"/>				

**12. Which role of technology do you think helps you to study most effectively? \***

- Supportive technology
- Dominant technology
- There's no difference
- None
- I don't know

**13. Why?**

Never submit passwords through Google Forms.

Powered by

This form was created inside of University of Twente.

[Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

Het doel van deze interviews is om het huidige systeem beter te begrijpen, en te praten over huidige ontwikkelingen in het onderwijs die relevant zijn voor ons onderzoeksthema. ( Manier van lesgeven, en technologie in het onderwijs)

### **Interview, Donderdag 26. Juni 2014: Wytze Koopal**

(Onderwijskundige Dienst, UT; kennis over E-learning/Web2.0/technologie in onderwijs/MOOCs)

#### **Is er al onderzoek gedaan naar onze vraag?**

“Er zijn vaak casestudies gedaan naar de effectiviteit van technologie in het onderwijs. Helaas zijn er vaak geen controle groepen. EdX, een organisatie die MOOCs aanbiedt, heeft onderzoek gedaan naar de ideale kijktijd van educatieve videos. Echter zijn er veel discussies over en het onderzoek is niet altijd definitief, aangezien er geen echt bewijs voor is dat de resultaten algemeen toepasbaar zijn. Daarom is het belangrijk om rekening te houden met de context van onderzoeken. De onderscheiding van technologie in “ondersteunend” en “dominant” ben ik zo nog niet tegengekomen. Als jullie een onderzoek vinden dat gerelateerd is aan jullie onderzoek, bekijk dan vooral de context. John Hattie heeft met zijn meta-analyse uitgebreid onderzoek gedaan naar effectiviteit in het onderwijs. Dat zouden jullie in jullie onderzoek kunnen verwerken, als de context klopt. Hattie heeft bijvoorbeeld uitgevonden dat feedback in onderwijs de effectiviteit van het leren bevordert en huiswerk of lange schoolvakanties juist niet.”

#### **Heeft u ervaring met deze onderscheiding van technologie (“ondersteunend” en “dominant”)?**

“Zoals gezegd heb ik geen directe ervaring met jullie onderscheiding. Misschien zou het zelfs zinvoller zijn om de technologie te onderscheiden in het ondersteunen van de onderwijsgevende en het faciliteren van het leerproces. Dus eigenlijk een onderscheiding tussen technologie voor studenten en technologie voor docenten. Het onderwijsleerproces bestaat uit een constante wisselwerking tussen docent en studenten in de klas. De vraag is hoe dat wordt beïnvloed door technologie. MOOCs ondersteunen bijvoorbeeld het leerproces aan de kant van de studenten.

Momenteel wordt het steeds gemakkelijker om onafhankelijk van plaats, tijd en docent te studeren door middel van nieuwe technologieën. Dit is het zogenaamde e-learning. Informatie en educatie is altijd en overal beschikbaar als je internet hebt, maar het is niet altijd betrouwbaar. De juistheid van de informatie in Wikipedia is gelijk aan dat van encyclopedieën. De informatie is beschikbaar, maar sommige vaardigheden leer je alleen door te doen. Daarom kunnen docenten niet zomaar vervangen worden door technologie.”

#### **Wat is volgens u de definitie van effectief studeren?**

“Met zo weinig mogelijk geld en tijd zoveel mogelijk kennis en vaardigheden opdoen is voor mij de definitie van effectief studeren. Dit kan gemeten worden met cijfers en resultaten van de studenten. Ook kan naar de tevredenheid van de studenten gekeken worden of naar de arbeidsmarkt. Tegenwoordig worden individuele talenten en vaardigheden steeds vaker geanalyseerd en gemeten door middel van technologie. Individueel toegepast onderwijs is dus steeds meer mogelijk. Gebaseerd op de vaardigheid van studenten creëren programma's een individueel leerpad naar het einddoel.

In het nieuwe TOM onderwijs op de UT is het doel dat studenten opgeleid worden voor functies op de arbeidsmarkt. De laatste jaren is de arbeidsmarkt steeds meer veranderd en bedrijven zoeken multidisciplinair opgeleide studenten. Door middel van veel projectonderwijs en multidisciplinaire studies proberen wij hierop in te spelen.”

#### **Hoe kan technologie volgens u bijdragen aan het zo effectief mogelijk studeren?**

“Het analyseren en daardoor individueel kunnen aanbieden van leerpaden is mogelijk d.m.v technologie en kan bijdragen aan het zo effectief mogelijk studeren.”

#### **Welke rol (ondersteunend of dominant) is volgens u het meest effectief, en waarom?**

“Mijn verwachting is dat educatie steeds makkelijker beschikbaar wordt, vaak in digitaal. Er wordt steeds meer educatie aangeboden die onafhankelijk is van docenten en experts. Ik zie een toekomst in MOOCs, wat jullie als dominante technologie beschouwen. Helaas is er wel een risico: hoge kosten. Het is interessant om te weten wat het business model van bedrijven zoals Coursera is. Hoe krijgen zij genoeg geld binnen om MOOCs te ontwikkelen? Zijn investeerders geïnteresseerd in bedrijven die bezig zijn met onderwijs technologieën? Veel mensen in Silicon Valley wisselen regelmatig van baan; hoe betrokken zijn zij dan met het bedrijf? Silicon Valley is een wereld apart. Vaak gaat het daar alleen maar om geld en zo veel mogelijk winst. Het sociale systeem in Amerika is heel anders als in Nederland. Het is goed dat er in Nederland nog een gemeenschapszin is, en betaalbare publieke universiteiten van goed niveau. “

#### **Welke ontwikkelingen omtrent het gebruik van technologie in educatie zou u aanraden aan de UT om in te voeren?**

“Wij zijn op dit moment al bezig met het ontwikkelen van een MOOC op de UT. Maar daarnaast wordt er door docenten ook steeds vaker technologie gebruikt om de les interactiever te maken.”

Denkt u dat als er steeds meer MOOCs komen dat universiteiten gaan veranderen? Bijvoorbeeld komen er dan geen colleges meer? Wat zijn de grote veranderingen volgens u?

“De UT bestaat vanwege de menselijke interactie, persoonlijke begeleiding en het grote netwerk. Het onderwijs is aan het veranderen en de UT moet aantrekkelijk blijven. Dit proberen we door veel project onderwijs, groepswork en multidisciplinaire studies aan te bieden. De hoorcolleges moeten amuseren en interessant blijven, zodat studenten niet thuis blijven maar enthousiast naar hun hoorcollege gaan. Een goede docent is een entertainer. De UT bestaat ook omdat zij diploma's mogen afgeven. De concurrentie zijn de commerciële aanbieders zoals LOI. De grootste potentiële doelgroep is al werkzaam, dus de UT moet goed onderwijs aanbieden aan de 25+er. Initiatieven om deze mensen aan te trekken zijn bijvoorbeeld kortere trajecten, MOOCs en Professional Learning and Development (PLD). PLD gaat meer opties aanbieden voor de werkende doelgroep. Ik zie het gebeuren dat bedrijven hun werknemers korte opleidingen of cursussen laten doen op de UT. De UT heeft immers de meest actuele kennis, kunde en faciliteiten. Op dit moment ligt de focus van ons onderzoek op “Smart Cities”. Dus hoe organiseer je een grote stad zo dat mensen nog goed kunnen leven? Vision2020 van de UT gaat over verschillende gebieden in het kader van “Smart Cities”, van vervoer tot gezondheid.”

**Word er momenteel gebruik gemaakt van ondersteunende technologie (apps, software, leg uit!) die studenten helpt de stof beter te begrijpen? En zo ja, Krijgen docenten instructies/trainingen voor deze technologieën? Hoe worden docenten begeleid in de implementatie van de technologieën?**

“Docenten zijn niet altijd goed met het gebruik van technologie in hun les. De UT biedt trainingen aan en cursussen, maar niet alle docenten zijn er goed in. Het primaire doel van vele docenten is onderzoek, onderwijs is vaak een bijzaak. Onderwijs geven is veranderd: docenten moeten een goed hoorcollege geven, goed met technologie kunnen omgaan, en kunnen amuseren. Docenten hebben dus meer op hun bordje dan vroeger. De deelname aan trainingen is vrijwillig, dus het initiatief moet van de docent komen. Ook is er een afspraak met het ministerie, de zogenaamde Basis Kwalificatie Onderwijs (BKI). Dit houdt in dat docenten een bepaald percentage diploma's in bezit moeten hebben. Sommige docenten krijgen een vrijstelling, maar nieuwe docenten gaan een traject in om het certificaat te halen. Met dit certificaat kunnen de docenten hun competenties aantonen. Er zijn steeds meer docenten, die ondersteunende technologie in de klas gebruiken.”

**Op welke manier hoopt de UT dat MOOC's bij kunnen dragen aan beter onderwijs?**

“Betrokken docenten kunnen met MOOCs ervaring opdoen met digitaal lesgeven. De UT hoopt dat die ervaringen voor verbetering zorgt in het regulier onderwijs. MOOC's zorgen ervoor dat grote groepen inschrijvingen komen, hoe ga je daar dan nog in de begeleidende sfeer mee om?”

---

## **Interview, Tuesday 1st July 2014: Irene Visscher-Voerman**

**Has there been other research related to our research question?**

“Yes, there is a lot of research done on education. There are several magazines that are engaged in the subject.  
- Journal of ETRND educational technology of research and development  
- Educational Technology magazine → academicus  
- Innovations in Education and Teaching International magazine volume 43 nr.1 “

**Which points, in comparison with the old educational system at the University of Twente, have changed in the model?**

“In general: subjects have been merged into coherent modules.”

**Why did that have to change?**

“There are several reasons and several goals. The curricula of all studies had to be more coherent, so student can understand the importance and the relation of all subjects. We also implemented more projects. Universities have to make sure more students finish earlier. Students have to stop with the attitude that subjects can be finished later on. We think that students who are serious about their study will be able to make it. We want that our studies can connect to future jobs (that don't exist yet). We aim to do that by offering more project work, and a research-driven attitude. Creativity is also an important part. “

**Which results were expected from the TOM-model?**

“We expect more students to be done earlier, and we expect them to be better prepared for the professional life. Furthermore, modules are cheaper than separate subjects, so we expect a return of costs of 10%.”

**Did the TOM-model already return some of these results?**

“We were surprised on some fronts: more than 70% made it to the 3rd quartile of the year.”

However we did not see the return on costs yet.

Modules / project-oriented education -> dominant technology (teacher creates educational platform and only functions as support.)

The UT was front-runner with the use of technology in education. When we started to fall behind we hired Wytze Koopal, he introduced the flipped classroom, E-learning and helped to create vision2020. Many teachers still don't see the usefulness of technology in education."

**There has been a lot of critique on the TOM-model this year, which complaints do you get most frequently?**

"Complaints go straight to the study, so we do not hear every complaint. However we have noticed that there are a lot of complaints about the unclear organization of the modules and about the study load created by many tests. In general, students say that many things are unclear, and they feel like they are laboratory-bunny's. Of course, that is not true. Many teachers do not show their support enough, they also blame the TOM-model instead of trying to think of a solution.

Some students are skeptical about 3 years of projects: how do you handle free riders? But many students are enthusiastic about project-based education.

Students seem to work very hard on projects. The workload is very high due to the interrelated subjects plus a project."

**On which points could the TOM model be improved?**

"We could better integrate the subjects within the modules and the projects."

Think about the learning triangle or pyramid by Bethel and Maine.

Pencast: short videoclip in which you explain the basics of a concept

**Does the UT pay special attention to technological developments within education (like the increasing availability of information on the internet), and how does the UT handle that?**

"Yes, the UT responds to those developments by creating an ICT portfolio, digital tests, letting teacher try out new technologies and by creating MOOC's.

I wonder if MOOC's are the future, some people think they are already starting to get outdated."

(Dominant technology):

**We heard that the UT offers MOOC's. Why did you choose to offer these online courses?**

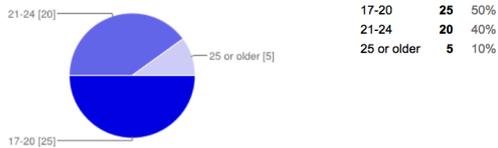
"We wanted to put the UT on the map and attract new groups of students (mostly older students that are interested in a master degree). It functions as a marketing tool for the UT."

# 50 responses

[View all responses](#) [Publish analytics](#)

## Summary

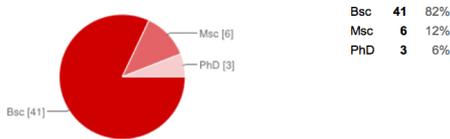
### 1. What is your age?



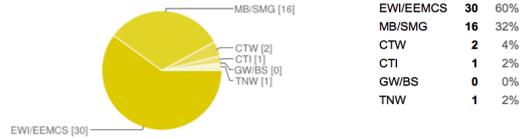
### 2. At what university did you study this year?



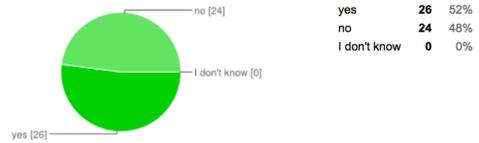
### 3. What is your occupation?



### 4. To which faculty does your study belong?



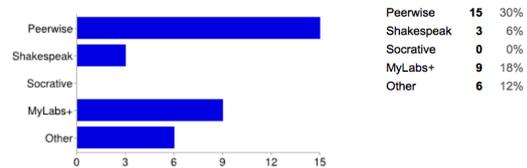
### 5. Did your study participate in the TOM/TEM model this year?



### 6. Do you have direct experience with supportive technology in education?

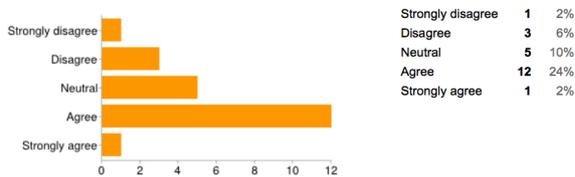


### 7. If you answered yes, which supportive technologies did you use?

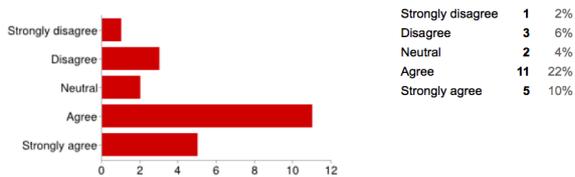


(Note: The values in the diagram of question 6 should be Yes:22 and No: 28)

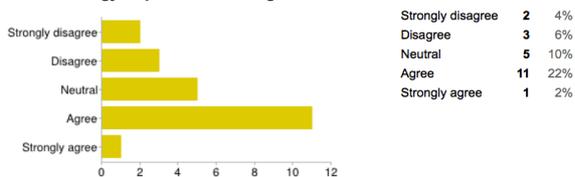
### The technology helped me to study more effectively [8. Please fill in the following questions according to your agreement with the statement.]



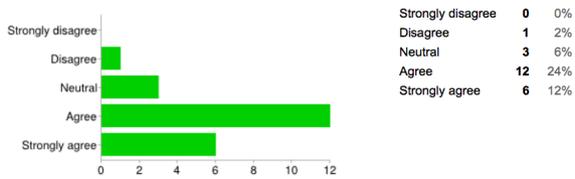
### The technology helped to better estimate my performance/results on a future test [8. Please fill in the following questions according to your agreement with the statement.]



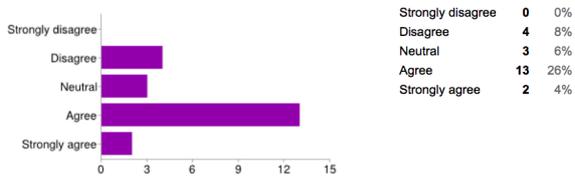
### The technology helped to make the goals and material of the course more clear [8. Please fill in the following questions according to your agreement with the statement.]



The technology facilitated the possibility to provide feedback during the learning process [8. Please fill in the following questions according to your agreement with the statement.]



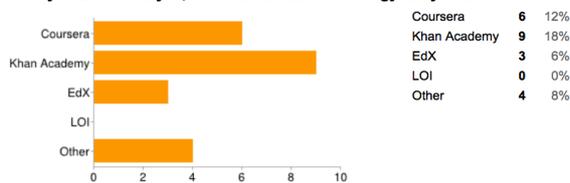
The technology facilitated classroom discussion on the course material [8. Please fill in the following questions according to your agreement with the statement.]



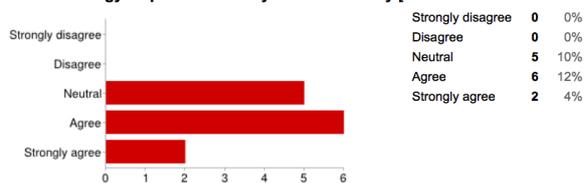
9. Do you have direct experience with dominant technology in education?



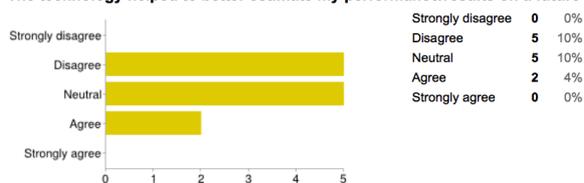
10. If you answered yes, which dominant technology did you use?



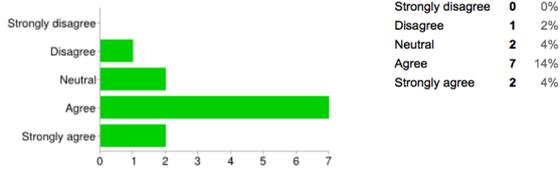
The technology helped me to study more effectively [11. Please fill in the following questions according to your agreement with the statement.]



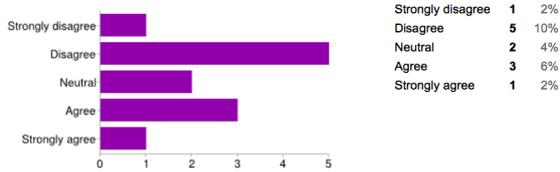
The technology helped to better estimate my performance/results on a future test [11. Please fill in the following questions according to your agreement with the statement.]



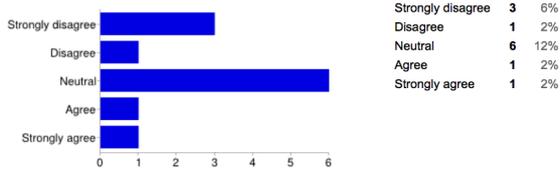
The technology helped to make the goals and material of the course more clear [11. Please fill in the following questions according to your agreement with the statement.]



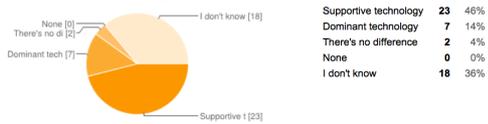
The technology facilitated the possibility to provide feedback during the learning process [11. Please fill in the following questions according to your agreement with the statement.]



The technology facilitated classroom discussion on the course material [11. Please fill in the following questions according to your agreement with the statement.]



12. Which role of technology do you think helps you to study most effectively?



13. Why?

Omdat als je veel van met een computer werk, ik last van mijn ogen krijg. Je werkt al veel met computers, maak het niet meer.  
 I simply have no experience with such technologies.  
 I like kahn academy because it's a way for students to sift through instruction and pick out what they need to learn more about. For each video you can skip parts, pause it when you want to and re-watch them if necessary. Supportive technology like MyLabs plus is often just an annoying way to have to do practice problems. I often find I'd rather just work on a problem with a pen and paper instead of on the computer. Although it is helpful that you get to know if your answer is correct or not right away.  
 The best way to help someone learn is to support him in the process at the steps that are difficult for someone. This is where technology should support someone.  
 I like doing stuff in my own time. Give me an assignment that should be finished by the end of the week and it will be. But don't give me specific working hours (for homework ofc, practicals is something different)  
 I only worked with supportive technology, so my opinion is slightly biased and not based on experience. Dominant technology like a complete study online would take out some of the fun extra experiences out of studying like socializing with your classmates.  
 I think personal feedback is still highly appreciated and needed. I think the interaction and guidelines of teachers can help a lot, but personally I also watch some online (YouTube) lectures while preparing for exams.

## **Q&A Coursera with Emma Webb and Jake Sanderson**

MOOC-platform (2011): 3 online courses at Stanford became popular

Main topic : Computer Science

Coursera does not create content, but content is delivered by partners.

MOOC's offer:

Interactive learning: video stops to ask relevant questions on the topics

Exact grading: auto-grading (multiple choice)

Feedback: computer gives unlimited feedback

Project grading: peer-grading, creates comparison and inspiration amongst students.

Coursera tries to reach everyone, but not everyone has access to the Internet. That is why they have partnerships with community centers, libraries etc.

70% of Coursera's users are older than 30 years, and come from developing countries.

60% of Bsc and Msc take courses in developing fields.

Coursera is looking into offering bigger units of learning, for example full specializations instead of just one course. Maybe in the far future, Coursera can offer full degree programs.

Q : Why do universities partner with Coursera?

A : Universities use Coursera to increase their visibility and reach. People can find the university easily through Coursera's Google links. Also, Universities get access to big data. The large amounts of students that apply can help universities to analyze this data and increase the quality of their courses. Lastly, by offering online courses, students often get higher grades (through the flipped classroom) and they engage in (inter)active learning.

Coursera makes money through the sale of certificates at the end of each course.

Coursera knows that they can't replace the 'campus experience'. They have no interest in being rivals to existing universities. They have friendly partnerships with them.

Q : How do companies react to certificates gained through Coursera?

A : The certificates are used to show competencies, but Coursera knows that it takes time to be fully trusted by companies. That is why we try to partner up with companies, too.

Securing of quality: Universities put their best courses on Coursera to represent the university. The board needs to accept the courses as well. If there is something that needs to be improved, content is easy to update.

## **Q&A KhanAcademy with Ben Komalo and Salman Khan**

Q: What is KhanAcademy? How would you describe its purpose?

A: KhanAcademy offers a platform for interactive lessons. It is a tool for students to practise course material, but it is not meant to take over physical schools. The platform hosts videos that explain different topics from many different subjects ranging from simple maths to complicated economic theories. On the platform students can see their progress and choose what kind of topics they want to work on. Teachers can also see these progresses and tailor their lessons to the specific needs of the students.

Q: How do you promote KhanAcademy:

A: We promote our product mainly to teachers, so they can integrate the system into their lessons. It enables teachers to make their class more interactive and motivate students to practice what they learned in an interactive and fun way.

Q: What does KhanAcademy offer in terms of education?

A: Our product offers progressive education. Its focus lies on multidisciplinary and creative skills combined with classic skills. The learning process at KhanAcademy is very creative and flexible. In many cases nowadays, your portfolio matters more than a degree. Students have to convince employers with their skills and work they have done rather with a paper confirming that they have collected enough credits during their study.

Q: What is the business model of KhanAcademy? How do you make money?

A: We are a not-for-profit organization, so we are dependent on donations and partnerships. By try to build our brand by partners that market our brand.

Q: Who are the teachers behind the videos on your platform? Are they external teachers or are they employees at KhanAcademy?

A: Most of the exercises and explanatory videos are made by employees of KhanAcademy. Sometimes, if the content has to be very specific, we work together with partners. We do not want to crowd-source teaching, instead we have a limited amount of lecturers on specific topics. This is needed to build trust, which in turn is necessary to learn effectively.

Q: Is KhanAcademy also used in higher education?

A: Yes, KhanAcademy can be blended in to universities, especially in competency-based education.

Q: What does an interactive exercise using KhanAcademy look like?

A: Teachers can create virtual “classrooms” on the platform and provide students with interactive exercises. Students can then practise on the platform and the teacher will then see the students’ performances on a digital dashboard with analytics. Through gamification, we try to make learning more fun for students.

Q: How do you incorporate different learning styles of students (think of visual, audio, text)?

A: At KhanAcademy, we provide two very different ways to get help: on the one hand video and on the other hand text. We are conscious of the different learning styles, but it is not our focus. The balance is something that should be found on the side of the students. They can decide how much time they want to spend on what kind of material. Some people need more time to digest learning than others.

Q: What are the future plans for KhanAcademy?

A: At the moment, KhanAcademy is already accessible to a large range of people. Of course we want to expand this to even more people. Also we will focus more on feedback and the creation of personal tracks in the future. Personal tracks could guide the student into a specific direction that is tailored to his or her needs.

Q: Will KhanAcademy one day substitute teachers?

A: No, we want to function as a supportive tool for teachers rather than substituting them. We do not want to interfere too much with the lesson of a teacher, e.g. by pushing students into another direction. It is not our intention to interfere with the teaching tracks and feedback of the teachers. We just want to help students to understand why it is important what they learn.