CvB stukken voor agenda Universiteitsraad

Overlegvergadering d.d. : 24 juni 2015
Commissievergadering : 3 juni 2015
Agendapunt : Visie op ICT in het onderwijs
Bijgevoegde stukken : Notitie 'Learning 2020 – Student Driven & Technology Enhanced

Betrokken concerndirectie: S&B paraaf: ____

Secretaris: van Keulen paraaf: ____

Portefeuillehouder: Brinksma paraaf: ____

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1. Status agendapunt:

Rol URaad:
- o Ter informatie
- o Ter advisering
- X Ter instemming
- o Anders:

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2. Eerder behandeld in:

Naam gremium: CvB
Datum behandeling: 19 mei 2015
Naam agendapunt: Visie op ICT in het onderwijs
Conclusie toen: Het College van Bestuur heeft kennis genomen van de Visie op ICT in het Onderwijs en besluit de visie voor te leggen aan de UR.
De decaan onderwijsvernieuwing wordt verzocht om al vast in gesprek te gaan met de directeuren ICTS en CES over effectieve ondersteuning van docenten die ICT-initiatieven in het onderwijs willen ontplooien. Dit dient in nauwe samenspraak met het primair proces te gebeuren. Verder vraagt het College hem om pilots te identificeren die bijdragen aan het nadrukkelijker profileren van de UT; gedragen door opleidingen, groepen of individuen die voorop lopen op dit gebied.

Naam gremium: CvB-D
Datum behandeling: 19 mei 2015
Naam agendapunt: Visie op ICT in het onderwijs
Conclusie toen: De decanen hebben instemmend kennis genomen van de Visie op ICT in het Onderwijs, en benadrukken dat initiatieven zoveel mogelijk bottom-up moeten kunnen ontstaan en goed ingebed moeten zijn in de onderwijsorganisatie. Daarbij moet gericht worden ingezet op het oplossen van problemen; specifiek op gebieden als de verdere ontwikkeling en profilering van het projectonderwijs; toetsing; homologatie; practicumonderwijs. Verder wordt de stelling onderschreven dat de UT zich expliciet moet positioneren met de kwaliteiten van haar campus als fysieke ontmoetingsplaats, waar wel degelijk met high tech middelen wordt gestudeerd.
De rector heeft de decanen uitgenodigd om op korte termijn, samen met enkele door hen aan te wijzen docenten, door te praten over specifieke initiatieven.

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3. Toelichting/samenvatting:

De kwaliteit, efficiëntie en aantrekkelijkheid van het onderwijs aan de UT is middels ICT te versterken. Juist een universiteit als de UT zou zich met haar High Tech Human Touch profiel op dit punt positief

moeten onderscheiden. Zo is ook aangegeven in Vision 2020. Om richting te geven aan initiatieven wil het CvB bijgaande visie vaststellen.

De visie op is geformuleerd in het document *'Learning 2020: Student Driven & Technology Enhanced - ICT and the future of learning at the University of Twente'* (bijlage). Het document is het resultaat van discussies met medewerkers en studenten, ondermeer tijdens een werkbezoek aan Silicon Valley, tijdens OLD-bijeenkomsten, in studentengremia. De UR-commissie OOS heeft op 8 april over de hoofdlijn van de visie gesproken aan de hand van een presentatie. Het was tevens een casus bij het evenement Create Tomorrow, waar ruim 20 studenten- en medewerkersteams input leverden

ENGLISH:

Quality, efficiency and attractiveness of teaching at our university might benefit from new educational technologies. A university like the UT should be a frontrunner in this field, given its profile of High Tech Human Touch. This was also written in Vision 2020.

The document is the result of many events and discussions with staff and students, among which were a study trip to Silicon Valley and sessions with program directors and students. Commissie OOS talked about the main ingredients of the Vision on April 8. It was also a case in the Create Tomorrow Event, where over 20 teams of staff and students delivered ideas.

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4. <u>(Voorgenomen) besluit CvB</u>:

Het CvB stelt de visie als geformuleerd in het document "*Learning 2020: Student Driven & Technology Enhanced - ICT and the future of learning at the University of Twente"* vast om richting te geven aan verdere initiatieven op het gebied van ICT en onderwijs.

GRIFFIE URaad: (door griffie UR in te vullen)
<u>Eerder in URaad aan de orde geweest?</u>

- Nee.
- Ja, op
  Conclusie toen:

<u>Nadere toelichting:</u> (Voor als presidium/griffier vindt dat één van bovengenoemde punten nadere toelichting behoeft)

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LEARNING 2020: STUDENT DRIVEN & TECHNOLOGY ENHANCED

ICT AND THE FUTURE OF LEARNING AT THE UNIVERSITY OF TWENTE

Version 1.2 – May 1, 2015

APPENDICES

1. INTRODUCTION

Classic science fiction stories would have us believe that in the future learning would mean hooking up your brain to a machine through a socket in your body or through a shiny helmet on your head. The machine would pump in all the knowledge you need for your next assignment, or even for the rest of your life. Our view of the future of learning has changed dramatically since then. Hooking up brains had become a theme for dystopias rather than utopias. A positive story about the future will now show the hero being able to easily search and combine databases and do simulations, swiping around screens and objects in a blue-lit 3D environment. The modern hero does not passively absorb information, but is skilled in using technology to navigate through loads of information.

This change in representation reflects how the notion that learning is more than loading information has become more popular. Most of us no longer think of education as the mere transportation of data from one head to the next. It is no longer how we believe highly skilled, creative, self-guiding professionals are trained. And research convincingly shows it is indeed not how brains work.

Nevertheless, many of us hold on to the idea that the main locus of learning is the classroom where the teacher is talking to an audience; that is, conveying information from his or her head to the student's head. Many, if not most of the applications of technology in education also take this model as the gold standard. Take MOOC's. They mostly mimic an average classroom situation.

In 1935, German philosopher Walter Benjamin asked what would happen to works of art, now there were cameras that could make reproductions and take them anywhere (Benjamin, 1963). He was optimistic about the emancipating effect these new technologies would have. Art would become more accessible – especially to those deprived of the privilege to own art or visit museums. It might lead even lead to totally new art forms. Yet at the same time, Benjamin was romantically pessimistic about the demise of the 'aura' art has, because it stems directly from the artist, is unique, and has to be enjoyed in a dedicated environment. And would museums survive? There are many parallels between his writing then, and the discussion about online learning we are having today.

When we discussed our vision on teaching and learning a few years ago at the University of Twente, technology played a big role. Not only did we look at the effect technology would have on learning, but also at how technology would change the future workplace of our students. From that discussion, we derived a vision on education that, instead of seeing the student as a passive consumer, puts the student at the wheel as much as possible. (Universiteit Twente, 2012)

We wanted a learning model that positively invites students to integrate many different sources of learning into their academic experience. Since then, the amount of resources a student can easily access and use for his or her learning has increased enormously. Many of these resources are of high quality, and the diversity makes it likely there will be something out there to fit any students need; either content-wise or in learning style. The ability to find, judge, combine and use all this information is a critical 21st century skill that students have to train in university.

This model of learning, in which students are trained and stimulated to explore and combine different learning resources under the guidance of coaches and mentors, is what we call Student Driven Learning (SDL).

We want to maximize the use of learning technologies; because we believe they can offer the flexibility needed to better enable students to organize their learning, and because it matches our profile as an institution that combines High Tech and Human Touch. Learning at the University of Twente has to be *Student Driven & Technology Enhanced.*

This white paper tries to answer the question what form education will have a few years form now; looking beyond the hypes that so often surround educational technologies.

Our main conclusion is that a disruption of the higher education system is not likely on a short term. The system will grow and become more diverse, offering many opportunities for a university like the UT. Because there is so much uncertainty, a differentiated strategy, instead of only investing in one field, is most rational. But differentiation is also expensive. When investing in new resources, we have to maximize the possibility that they can be used over a wide array of learning arrangements.

The strategy we propose is that UT distinguishes itself by offering a rich learning experience, that blends the quality of campus learning with the flexibility of online learning, by integrating online learning in our programs. In undergraduate programs, the locus of learning will be mainly on-campus, both for didactical reasons of as well as to give the university a clear position in the market for higher education. Depending on the field and target audience, graduate programs will also integrate distance learning, to offer more flexibility.

READING GUIDE

We have tried to compose a compact and well-readable document. To do so, some of the longer arguments were moved to the appendices. The first section covers the full argumentation but is intentionally brief. Readers who are satisfied with the first section can safely stop there. Readers who like to chew on a specific part a bit longer can refer to the appendices.

In chapter 2 we try to assess in what way higher education may change over the coming years, mainly from the perspective of technology. In chapter 3 we articulate our strategy for the UT with respect to these changes. Chapter 4 sketches the consequences this strategy will have for the organization of services.

2. ARE WE ON THE VERGE OF DISRUPTION?

Information and Communication Technology (ICT) is penetrating and changing more and more parts of society. Yet education, and especially higher education, has not changed a lot under the influence of ICT. This is strange, as information and communication are in large part what education is all about. For sure, there are many computers to be found in our university buildings. But their main role is in planning and administration or as a personal tool for staff and students in word processing or calculation. Classrooms may have been equipped with beamers and smart boards, but mostly they just replaced the overhead projector. What goes on in the classroom hardly changed.

Some three years ago, all of a sudden it appeared as if things where about to change dramatically. A number of so called Massive Open Online Courses (MOOC's – free online courses with no registration or entrance requirements) managed to attract relatively large audiences. Around the same time tablet devices became a commercial success. This combination of content and devices led to visions of large-scale disruption in higher education (eg. Barber, Donnelly, & Rizvi, 2013). Many believed that soon scores of universities would be swept away by providers of online education. But this large-scale disruption of the system has not yet taken place.

2.1. WHAT TECHNOLOGIES ARE WE TALKING ABOUT?

In discussions on ICT in education, at least four categories of concepts or technologies are referred to, without making clear distinctions. This makes many discussions fuzzy at best. So let us try to be clear about what we are talking about.

1. Enriched Classroom technology: technologies aimed at enriching the classroom experience, without fundamentally altering the learning method or course design. Examples are AV-media and interactive quizzes.

2. Flipped learning: students read or watch the relevant content before coming to class, and class time is used to discuss the subject studied.

3. Time and location independent learning: full online courses, including lectures and tests that can be taken at any time in any place.

4. Open Educational Resources: resources - text, audio, video, interactive content, or any combination of these - that are published free for anyone to use.

The distinctions are not always fully clear. To flip a classroom, enriching the classroom experience with different media and other technologies might be a good idea. And students might prepare a flipped class with OER as well as content provided by local teachers.

Some OER are plain content without interactivity. Others may offer features like quizzes at the end of a chapter, for students to test their understanding. And others yet again offer such refined interactivity and such a divers set of media that one can legitimately ask if these are still resources or rather full courses in themself. Khan Academy is an example of what was at first a set of resources – it started as a YouTube channel – but has become very rich through the overlaying interface that was later developed. It offers tests, scorecards, portfolio management-tools etc, of such quality that is has become a full independent learning environment. Some OER are close to MOOC's and some MOOC's are mere video books.

2.2. IS HIGHER EDUCATION RELUCTANT TO CHANGE?

Those who believe in technology as the main driver of change, tend to think that higher education is either actively resisting innovation or just incapable to move. Our analysis takes a different angle.

Predictions of a coming revolution are mostly grounded on naive assumptions about both teaching and the functioning of universities. A high quality academic program is much more than a sequence of lectures and tests. If anything, MOOC's show that it is extremely hard to learn without the context and community of a school. Only a few percent of the students who enroll in a MOOC manage to finish a course. These are mostly the ones that already have a degree – the trained learners. Besides, much of the learning that takes place on a campus, takes place outside the lecture hall.

The business model for large-scale online education is at best incomplete. For one thing, there is no direct revenue generator. Attempts to have students pay for certificates, sell data on learning behavior or liaise talented students and employers have so far not raised enough money. But perhaps even more important: there is no sustainable organization model to generate content for the courses. In traditional universities, there is a system of co-creation of research, teaching and spinoff. To make this system function, universities are both regionally embedded as well as connected in international knowledge networks. To produce relevant teaching, you need the whole system. Universities can make MOOC's because they also do a lot of other things.

Then there is the conviction that the changed expectations of modern youth will force change. These young people are seen as 'digital natives' of an online world in which they are so capable of maneuvering, that they will no longer accept intellectual authority. Research shows that, although being online certainly is part of the world of young people, their knowledge of this world and their capacity to navigate it, is often grossly overestimated. Young people today are hardly better at muti-tasking, or rather multi-channeling, than older people – at least when working with more complex information. Their skills online are mostly concentrated in the area of using social media. In other fields they are not particularly well equipped at all. And searching and assessing online sources is something young people are even rather bad at.

Belief in revolution also often is hope for revolution. There is a sense of optimism in the expectations about an online revolution in education. There is hope that as more and more course are available to more and more people, the result will be that everybody will learn more. This democratizing effect of the internet is also highly overrated, as research by our own university shows. The highly educated use the internet to learn and to collect information that could help them professionally. Low skilled people hardly use the internet in this way. Online education might deepen the education divide, rather than bridging it, research suggests. The statistics for MOOC's also point in a similar direction. Most students enrolled with EdX or Coursera already have a degree.

2.3. TECHNOLOGY PUSH ...

The technology behind most of what is available in the world of education technology is not particularly new or innovative. It's mostly video, quizzes and discussion boards. What has changed is the affordability and the speed of the network on which these technologies depend. High media quality content is available almost anywhere now.

What this model of video, quiz and board is good at, is simulating a classroom situation in which there is not much interaction. So it can do a good job at replacing this sort of teaching. While this might be the standard in some learning institutions, good universities

strive to do better. For sure, classroom instruction is one of the forms used in our university as well, but there is a lot more going on.

Most online learning technology is not very high tech. But technology is moving on. Two fields of technology that do hold promise for a shift in the balance are close to entering the consumer market. These are Virtual and Augmented Reality (V/AR), and Artificial Intelligence (AI). Fairly primitive forms of both of these have been applied in consumer products for quite some time already, but recently the technology has come a lot closer to maturity.

Virtual and Augmented Reality (V/AR) devices like the Oculus Rift and Microsofts HoloLens will soon be available to consumers at relatively low prices. They can make an educational experience significantly more immersive. Moreover they open options for skills and lab training on any location, and when virtualization software gets better, at any time. For Microsoft, this is a market they are specifically aiming at.

Artificial Intelligence research at IBM's Project Watson meanwhile is also looking at the education sector. Their goal is to design virtual tutors, who can give high quality feedback tot students in massive online learning environments, and answer complex questions from students.

Combined, these technologies can make online education significantly more immersive and responsive, at a price point that can be highly competitive. The disruptive potential of current technologies in higher education may not be very big; but that might very well be about to change. However, to asses what impact these technologies might have, it is wise to not only look at the technology but also look at the problem this technology wants to solve.

2.4. ... OR DEMAND PULL?

The growth in demand for higher education in Europe is decreasing. From 2020 total demand will even start to shrink. In the developing economies of the world, we see a rapid growth of the middle class, and thus of the demand for higher education. The growth curve is so steep, that demand can not be met by local providers. Universities simply cannot grow at that rate, unless they have the resources to recruit foreign teaching staff.

Given the shrinking market in Europe and the rapidly growing market in Asia and Africa, it is not a difficult question where new providers of education will try to find their customers. The main problem for Euopean institutions meanwhile is not how to keep new providers of their tail, but rather how to compensate for their shrinking home market.

The up-to-now biggest economy in the world, the US, shows trends that run in an opposite direction. There, campus-based education has been increasing in price at a steady level, well above inflation, over the last decennia. Prices are now at a point that young people are seriously wondering if it is worth the money. A degree in the US can cost up to $200.000, most of which is taken out in a loan. To compare: in the Netherlands students on average enter the labor market with a debt of €14.000. In business terms, there is no market for higher education in the Netherlands, or in Europe at large. In the US however, there certainly is.

New technology-driven education startups have successfully nocked on the door of venture capitalists in the US. Existing universities are trying to change their strategies, and the first respected liberal arts college has closed its doors. It is this development that has led to much of the MOOC-hype of some years back. Many of the articles that appeared in the US-press back then where readily copied in Europe, although they were hardly relevant for the European situation.

What is relevant, is that the situation is the US is starting to push students away from full degree programs and towards portfolios of individual courses as labor market credential. What we see if is a process that can be seen in other markets as well when digital disruptors turn up: 'debundling' or 'decoupling', meaning the breaking of links between services of products that traditionally have been offered together (Teixeira & Jamieson, 2014). The different parts of a traditional academic program can increasingly be obtained from different parties, in many cases at a fraction of the cost. The student can put together his or her own program from these elements. These elements are not just the courses, but also the guidance and even the certification. The market is responding by providing platforms for the recognition and validation of credentials – like openbadges.com – that might in time make the classic degree superfluous.

2.5. A PRELIMINARY CONCLUSION

The technological revolution that has often been predicted for higher education over the last few years has not yet materialized. This is partly because the technology and the didactics are simply not good enough to be serious competition for the institutions.

There are technologies on the horizon that may change this situation. Given the rapid growth of the market for affordable higher education in developing economies, mostly in Asia and Africa, but even in the US – albeit for totally different reasons and at a very different price point – it is not likely that these technologies will rapidly shift the balances is Europe. Our problem is rather how to compensate for the shrinking local market.

Technology might help us solve the challenges that lay ahead for Europe: attracting talent from abroad, and making our education more efficient and more attractive to our local students. A university like ours that prides itself in combining HightTech and Human Touch should be a frontrunner in this respect. So how will we do that?

3. THE UT-STRATEGY

Teaching technologies can certainly help the quality and efficiency of teaching and learning at our University and may also open up new markets. But the field is wide and unstructured. Our choices and investments will have to be guided by clear goals and a clear vision on teaching. It is easy to burn a lot of resources on these technologies. Implementing the ones that can really help our mission may proof to be more difficult.

Our vision of teaching - *Student Driven Learning* – can be a guiding principle for our portfolio of undergraduate and graduate programs, but also to integrate new learning technologies.

3.1. STUDENT DRIVEN LEARNING (SDL)

SDL wants to maximize student engagement in learning and in the campus community. In undergraduate education, this is done through the Twente Education Model (TEM), in groups of students working on projects or realistic problems. To take away obstacles to this mode of learning, the curriculum structure for undergraduate education was changed into a model of 10-week fulltime modules. The idea is that teaching does not have to take the form of 10-week lecture based courses that run parallel to each other. The modules should give room to spend a number of days to work fulltime on a certain subject, either in classes or through online resources. Using online sources may also help delivering the knowledge a student needs at the time it is needed instead of when the schedule permits. A more flexible mode of content delivery will help the further development of TEM.

With TEM as the model for undergraduate programs, the university has positioned the undergraduate programs as campus based programs with a strong – physical - learning community aspect. When looking at the adoption of learning technologies in TEM, the goal will not be to introduce distance learning. The focus of innovation will instead be to solve two main problems in TEM: flexibility for the student and efficiency for the teacher. Flexibility for the student is needed for both the learning experience - making it student driven - but also helps the campus experience, as students will be better equipped to integrate sports and culture into their daily program if their schedule offers more flexibility.

Efficiency for the teacher should be reached mainly by spending less time on preparing and delivering classroom teaching by reusing recorded material – which will only be efficient after some time, given the initial investment - and making use of resources produced by others. Testing is a second field where ICT can create some air.

Not just bachelors, but also some masters programs are likely to remain primarily campus based. This may be the case because they require specific infrastructure, like in many engineering programs. Or because they are in a domain where there is not much student mobility, either because the undergraduate degree does not give sufficient access to the labor market or because the differences between the providers are not very big. Again, this is true for many engineering programs.

Some programs for degree-seeking grad-students will blend on-line and on-campus learning to meet students demand for flexibility, e.g. a program in which student spend a day a week on campus, allowing them to live and work in other parts of the wider region. The other option is the model the faculty ITC has developed; in which periods of several weeks to months are spend on-campus during the course of the program.

Blends of working and studying are most likely to be applied in fields that are under financial pressure. This may be true in the future for some masters programs, most likely in social sciences and humanities, and is already true in capacity building programs.

Programs may increasingly enroll students with very diverse backgrounds, who may also bring a portfolio of courses they have already taken elsewhere. These students may already have – partially - met some graduation requirements for the degree. They will take a limited number of courses, or take very specific courses to match their portfolio.

Highly specialized content may be a reason for students all over the world to come to Enschede for a semester or a full program, but it may also be a reason to only take a limited number of courses without making the trip. These students may be enrolled in a program elsewhere, perhaps at a foreign partner institution, either on undergraduate or postgraduate level, including PhD-students. Or they may be professionals or even hobbyists, not necessarily looking for a degree.

Fully online degree programs that can meet Dutch accreditation standards would require very large investments. Entering this (potential) market can be further investigated. Yet here we have to keep in mind that stopping just short off the investment a high quality and highly visible program would require, will mean burning a lot of resources with limited to no result.

3.2. THE LEARNING STORE

One aim of Student Driven Learning is training students is collecting, assessing and combining information relevant to a complex question or problem. If this is something students have to learn, then it is rational to have them work not only on prescribed sources, but to stimulate them as much as possible to go out and find sources. Yet, as was mentioned before, it is easy to be too naïve about how easy this is and how good students are at it. Finding and assessing high quality, complex information is a skill one has to train. This can be very time consuming.

The UT will be a producer of resources as well. To store these, a UT-wide repository will be developed. But we want to take an extra step. The repository can be integrated with the library system and a system to browse for external source in ons seamless system, that we dub the Learning Store, This store for online learning will combine three kinds of sources:

- material published in online scientific magazines, available through university library subscriptions,
- OER and other sources suggested by staff and students, like – parts of – MOOC's, video's, texts, pen casts, simulations, etc.
- (learning) materials produced by UT-staff and students, including for example graduate papers and other assignments

The question how the UT should respond to online learning was also offered as a case to the Create Tomorrow think tank – a huge campus event by our Student Union, involving over 1.000 students and this year for the first time also around 50 staff members. Their ideas have been integrated in this paper.

Quite a few groups came up with online platforms where learning materials can be exchanged and reviewed, to integrate them in on-campus learning. Often connections were sought with industry and academic partners.

A second recurring theme was flexibility. Many groups came up with systems to enable students to plan learning activities independently; either at course level or in the full curriculum.

So the sources can be any format, plain text to highly interactive. All these sources have gone through some sort of assessment by definition. The Learning Store would however also add an extra feature: continuous user feedback, both through ratings and comments, and through intelligent open learning analytics.

Ratings and comments are a well-known phenomenon to any online shopper. Comments and ratings in the Learning Store can be more advanced than mere stars or short texts. There are systems that also permit comments that are added 'in' the source, for example as comments in a text or as ratings for a specific part of a video.

Experienced online shoppers will also have encountered user analytics. Think of the '*customers who bought this item also looked at …*' lists. Learning analytics tools can do the same things, but can also quite a lot further. They can for example show the average amount of time other users have spend reading a document online, and even which sections where stopped at mostly. Student data can also be connected in other ways. The system could for example suggest sources preferred by top-tier students, or give information like 'students who passed course X with above average results, used these sources …'. Of course these systems will have to respect student privacy to the maximum – as is also required by law.

Data from Learning Analytics tools will be open to our students. This is what we mean by Open Learning Analytics. From the perspective of our business model however, it might very well be information that is explicitly positioned as added value we offer to registered students only, as opposed to anonymous users of our Learning Store. Which other services we want to offer only to registered users and how the systems can combine servicing registered and free users will have to be further examined. Other options to consider are offering guest and alumni accounts and adding 'sharing' options like 'notify students in my group', etc.

If well designed and managed, the Learning Store can be a largely self-organizing and self-sustaining system. The main challenge will likely be to feed it with enough new material to keep it from recycling outdated knowledge. And to organize an efficient way to make a first assessment of a new source, check it for copyright status, and attach relevant search labels to it.

CURATED ENVIRONMENTS

The competition between music and video streaming services is not so much on collection and price. A service like *Spotify* tries to set itself apart from other providers on the quality of its playlists. *Curation* is what this is called; much like the way museums make expositions from their archives. The Learning Store will have curated environments as well; where a selection of sources are presented in a grouping or order that make them more accessible or allows the users to gain more understanding from their content.

The obvious organizing principle for curated environments is a course or a module, or perhaps a full major or minor program. Teachers can make a selection of sources they think are relevant and use feedback and learning analytics to update the environment at given intervals. The link to this course environment can easily be made from the learning management system (LMS; BlackBoard in our case). Here again, the question is whether this is a service for registered students or something we want to (partially) open up to the world, for example for student recruitment purposes.

3.3. OER@UT: AN OPEN ACCESS STRATEGY FOR LEARNING

Many universities have started publishing recordings of their lectures some years ago. The reasons where mostly idealistic; sharing the knowledge they have accumulated – in many cases through public funding – for the greater good of humanity. But there were

also more mundane reasons; mostly building a reputation, and increasing quality. The quality argument perhaps needs some explanation. The idea is that teachers will invest more effort in a lecture if they know it will be published to the world. It is hard to proof this is true. Fact is that teachers who participate in video lectures are more likely to follow training. The question of course is what the direction of the causality is here.

OER can be video's, complete MOOC's or just plain online text or sheets. Sometimes these are edited by teachers who collaborating under a public license; very much like the model we know from software-development. In this case, the aim of the OER is explicitly to offer high quality learning materials at a low, or even at no price.

If we want students to take charge of their own education as much as possible, opening up many different learning sources is a logical step. If we only rely on material from publishers, it will also be a very expensive step. OER are out there, so lets see how we can use them. And with their use comes the social responsibility to also give back the material we produce to the OER community.

Parallel to open access in research publishing, the University of Twente should commit itself to Open Educational Resources in education. This means using open resources as much as possible in education, and opening up our own educational productions to the outside world.

COPYRIGHT AND CREATIVE COMMONS

Open is not the same as free for anyone to use in any way. There is a copyright system for open access publishing, called Creative Commons (CC). It allows for producers of content to clarify the copyright status of their work - who can use it and under which conditions - through standardized pictograms. The pictogram on the front of this document for example, grants users the right to use this document whole or in part, as long as the producer is mentioned. There are a number of combinations one can choose from (see https://creativecommons.org/licenses/). Adopting this system for our publications - either video, text or any other medium – will be necessary.

The system to implement Creative Commons in our university should pose as little effort for teaching staff as possible. Some training or information will be unavoidable, but a system that simply asks the contributor which license he or she wants to use as part of the upload procedure to the campus repository should be possible. And of course 'not open' can be one of the options, for example if the material will also be published through a publisher that does not allow open publishing, or if the material is part of a research contract that does not – yet – allow publishing.

Copyright is an issue in one more respect. We all like to use pictures and other material in our presentations, and since we only show them to a limited audience, we mostly do not worry much about copyrights on these materials. When we publish to the world, this changes. We have to be sure the material we use in our productions is free of copyright or is also copyrighted under Creative Commons. This is easier said than done. Those who frequently browse the Internet for a nice picture to support an argument will have noticed that copyright restrictions are rarely very clear and that finding good material that is free to use can be very time consuming. That is why an open access strategy will not only require awareness, but also facilities to help use and re-use appropriate content.

3.4. ASSESSMENT

Eric Mazur, Dutch born physics professor at Harvard and an avid innovator of teaching, nicely points out how summative testing – testing for a grade, as apposed to formative

testing for feedback - is a motivation killer.[1] The more a student is tested, the less he or she will wander of the beaten path. This is not a problem technology can solve – or at least, not yet. But there are some tools that can help.

Formative self-tests are tests that students can take to see how well they understand what they read or watch. These tests are not very difficult to make and might well become a more integral part of our course designs. Interesting experiments have been done using learning analytics to add gaming elements to these tests; showing students how they do as compared to their peers, either individually, as a project group, or as a year group (see a tool like Youtopia.com).

A second way to go is to use peer-feedback in testing. Students are very well capable of telling each other how they are doing. The problem mostly is not that they are easy on each other, but that they are actually too harsh, especially if they can give their comments anonymously. So using peer-feedback effectively is not easy, but there are experiments and tools used already on campus. WebPA for feedback in project groups is a example, as is PeerWise. A program to further investigate the application of tools like these is certainly relevant to our SDL vision.

Also in classic testing, technology can help increase efficiency. Multiple choice tests on computers are obvious. The problem here lies mostly in allowing student to use their own device, and making sure the student is actually tested and not somebody outside the classroom. Test with open questions can also be taken more efficiently on computers, experiments in Utrecht and Groningen show. Not having the problem of deciphering handwriting and distributing answers over multiple correctors makes the process significantly more agile. We need to further investigate which software and training can help in this effort, and what hardware requirements there are. Bring Your Own Device (BYOD) is a cost-efficient approach, but has obvious disadvantages. Having learning facilities that can double as test facilities might also be feasible.

In distance learning, secure testing is a problem that does not yet have a convincing fix. How do you know for sure it is the student actually doing the test? Camera checks and even typing-rhythm tests (apparently your typing rhythm is fairly unique) can be fooled. Physical test centers around the world, used by several institutions, might in time fill this gap. This could be an argument for collaboration with partner institutions.

3.5. CAMPUS AND ONLINE INFRASTRUCTURE: COMPLEMENTING BY COMPETING

Campus life adds distinctive elements to the learning experience of students. It offers community elements that are important to the social development of students. The campus experience can be enhanced with all sorts of learning technologies. But what makes students come to campus when all this technology can be experienced online, at home or anywhere else? Do we want students to be on campus for the things they cannot do online only?

The campus experience has to complement the online experience. Paradoxically, the way to do that might be to compete with it. If campus project rooms offer facilities for online meetings cannot offer, this is a reason to go

The winning student concept at Create Tomorrow was a European system of connected classrooms, called "PORTAL'. Universities would use these classrooms for joined courses, in which students could work together or follow classes. Next to a screen, these portals would have augmented reality tools that enable students to work together on physical objects

[1] https://www.youtube.com/watch?v=8sh6wsUFQT0

there. That is why experiments like the classrooms of the future are important. There is the risk however, that we enter in a very expensive competition to constantly bring unique technology but very expensive technology to the campus.

The winning staff team at Create Tomorrow presented a concept in which courses are designed as games that are played online as well as on campus. The gaming approach can work very well for learning specific skills and is shown by research to be highly motivating.

Leaping less far there is still a lot to do: the big dissatisfier in classroom use of learning technology is that the quality is still not good enough to fully rely on it and/or the interfaces are to challenging for many teachers. We will have to fix this first.

What is the kind op learning experience that keeps students coming to campus? This extends beyond the direct learning technologies. It also refers to quality-of-life aspects: the coffee shop, sports, culture, the general atmosphere ... And here, the point for flexibility can be made again: for a rich campus life, it is also important students are flexible in their program; when to meet their project group, when to watch that lecture, and when to do that test.

The paradoxical conclusion might be that to be a university that blends learning technology with on-campus learning, investing in the campus might be just as important as investing in learning technology. This holds for fulltime campus programs, as well as for part-time and joint degree programs. These programs will require students to be on campus for shorter periods with larger intervals. Flexible short stay arrangements will be needed tot accommodate these students.

3.6. MAKING MOOC'S

Where MOOC's – as stand-alone online courses - are going is unclear. There is much ado about MOOC's and this in itself is reason to be present in the market. And as was said before: the future is too unsure to choose only one strategy. They are not the main focus of our strategy, but there are good reasons to stay connected to international developments. One is the opportunity MOOC's give to showcase the university internationally.

There is much ado about MOOC's and this in itself is reason to be present in the market. And as was said before: the future is too unsure to choose only one strategy.

The University of Twente has chosen FutureLearn, a spin off of Open University UK, as its partner for two pilot projects. FutureLearn is a European platform, which offers advantages with respect to legal issues around copyrights and privacy. More important, FutureLearn is a platform that is less focused on the model of video lectures and tests, but also seeks to develop other more constructivist didactical models for online learning.

If our MOOC's are to showcase the university though, they should not only show its strength or focal points in research, but also give a taste of its approach to learning. Experiments with so-called cMOOC's, which involve students in collective endeavors like peer reviewing papers and tests and working on projects, are still in a stage of infancy. It might be one of the fields were the University of Twente can make a difference.

4. ORGANISATION AND SUPPORT PRINCIPLES

The UT- strategy for the use of ICT in education does not focus on a single technology or field of application, but is relatively broad. The organizing principle is a vision on teaching and learning. As a consequence, we do not design generic blueprints of what our teaching programmes should look like. Rather, we will need to stimulate a community of skilled and motivated staff - faculty and support – and students who innovate through local initiative.

Support for these initiatives will be organized accordingly, through a support program named Technology Enhanced Learning and Teaching (TELT).[2] The following principles will form the basis to work on:

- Create a one-stop-shop for support
- Work together and in partnership with users (students and teachers) and suppliers
- Experiment with new technologies, but not widely implement unproven ones.
- Ensure we are designing sustainable services
- Develop own services for trademark services; possibly outsourcing common ones when economically feasible
- Have ease of use, flexibility, privacy, security and reliability top of mind.
- Reduce bureaucracy whenever possible
- Centralize & save money when feasible, but have an open mind to legitimate local needs

Furthermore, the following factors will be crucial for success:

- Engage the University community
- Integrate production and evaluation of online resources in the normal workflow of degree programs
- Provide ways for teaching staff to develop specific skill sets
- Align with University plans
- Have a clear governance structure for the TELT-program, which can:
    - Ensure and allocate sufficient resources to achieve relevant aspirations
    - Balance spending realism and custom solutions for individual programs
    - Manage risk and comply with regulation

Some of these Critical Success Factors create the need to make choices in what we will and will not do. The full service portfolio will need to be analyzed and re-prioritized to find possibilities to free up support staff. Temporary increases in support staff will be unavoidable, but will be limited as much as possible.

[2] This name is already being used for a smaller program. This program will be integrated.

APPENDICES

1. A TYPOLOGY OF THE USES OF ICT IN EDUCATION

E-learning is a concept so broad, that it is hardly useful. There is almost nothing in higher education that is not done through a computing device; from a PowerPoint presentation in a lecture, to registering for a course, through to reading an e-reader or doing an online test. So which of those are E-learning and which are not?

In discussions on E-Learning, at least four categories of concepts or technologies are referred to. This makes many discussions fuzzy at best. So let's start with trying to clarify the categories. They are:

1. Enriched Classroom technology

These are technologies aimed at enriching the classroom experience, without fundamentally altering the learning method or course design. Well known examples are of course the almost classic PowerPoint presentations and the more recent smart boards. Arguably, interactive quizzes and the like, for example using clickers or platforms like ShakeSpeak also fall in this category, as they are mostly an advanced form of the classic show-of-hands.

2. Flipped learning

The idea of flipped learning, or 'flipping the classroom' as it is also called, is that students have read of watched the relevant content before coming to class, and class time is used to discuss the subject studied. This is of course not a revolutionary concept. It is what many teachers have been doing, or trying to do, perhaps since the advent of the printing press.

Advocates of flipped learning say that the reason many students do not prepare classes is that the material is not inviting enough and/or that the added value of class in relation to the material is not clear or not sufficient. Enriching the material could help. For example by using video in stead of plain text; effectively having the student watch the lecture the teacher would have given, had the student come to class unprepared. So, basically 'flipped learning' means having students do before class what they do in most classes - sit and listen -, and then make class more involving.

3. Time and location independent learning

These are technologies and concepts seeking to deliver learning experiences independent of time and/or location. MOOC's are an example of location independence, although they are often only relatively time independent, either because they start at a given date, or have fixed deadlines for test or to hand in material. Online seminars are also location independent, but obviously do require participants to log in at a given moment in time. Time and location independent learning of course does not just relate to content. Tests, either formative or summative, and platforms for student-to-student or student-to-staff interaction also belong in this category.

4. Open Educational Resources

OER are resources - text, audio, video, interactive content, or any combination of these - that are published free for anyone to use. In most cases they are produced for a specific use by an institution and published online. In some cases they are actual collective open source projects, aimed to build an affordable resource for use in many classroom situations. OER are published by universities or through platforms like OpenStax, which publishes free peer reviewed online textbooks for a number of disciplines.

Some OER deliver content without interactivity. Others may involve some simple quizzes at the end of a chapter, for students to test their understanding. And others yet again offer

such refined interactivity and such a divers set of media that one can legitimately ask if these are still resources or rather full courses in themself. We have mentioned Khan Academy before as an example of a set of resources – it started as a YouTube channel – that has become so rich through the overlaying interface that is now available, offering tests, scorecards and private curriculum management, that is has become a full independent learning environment.

Are these independent categories?

The categories discussed above are not fully independent. To flip a classroom, enriching the classroom experience with different media and other technologies might be a good idea. And students might prepare a flipped class with OER as well as content provided by local teachers. How OER and time and location independent learning overlap has already been discussed in the paragraph about OER above. Some OER are close to MOOC's and some programs use MOOC's as books. Which brings us a final remark: time and location independent learning tools can very well be part of an on-campus learning experience. In fact, as we shall discuss below, this might very well be crucial to delivering a modern Student Driven Learning-experience.

2. A TYPOLOGY OF PROGRAMS

It may help our thinking to look at the form programs may have in the future from the perspective of the main goal of their organizational set up. This leads us to three types:

A. campus experience
B. flexible arrangement
C. distance learning

These types are not mutually exclusive. It is possible to blend their forms and goals. But there are logical relations between these types and a number of other characteristics.

A. Campus Experience

With TEM as the model for undergraduate programs, the university has positioned the undergraduate programs as campus based programs with a strong – physical - learning community aspect. When looking at the adoption of learning technologies in TEM, the goal will not be to introduce distance learning. The focus of innovation will instead be to solve two main problems in TEM: flexibility for the student and efficiency for the teacher. Flexibility for the student is needed for both the learning experience - making it student driven - but also helps the campus experience, as students will be better equipped to integrate sports and culture into their daily program if their schedule offers more flexibility.

Efficiency for the teacher should be reached mainly by spending less time on preparing and delivering classroom teaching by reusing recorded material – which will only be efficient after some time, given the initial investment - and making use of resources produced by others. Testing is a second field where ICT can create some air.

Not just bachelors, but also some masters programs are likely to remain primarily campus based. This may be the case because they require specific infrastructure, like in many engineering programs. Or because they are in a domain where there is not much student mobility, either because the undergraduate degree does not give sufficient access to the labor market or because the differences between the providers are not very big. Again, this is true for many engineering programs.

B. Flexible arrangement

In the flexible arrangement, programs for degree-seeking students will blend on-line and on-campus learning to meet students demand for flexibility – in time; match with previous education, or even preferred learning style.

Flexibility in time can take the form of a program in which student spend e.g. a day a week on campus, allowing them to live and work in other parts of the wider region. The other option is the model the faculty ITC has developed; in which periods of several weeks to months are spend on-campus during the course of the program.

Blends of working and studying are most likely to be applied in fields that are under financial pressure. This may be true in the future for some masters programs, most likely in social sciences and humanities, and is already true in capacity building programs.

Programs may increasingly enroll students with very diverse backgrounds, who may also bring a portfolio of courses they have already taken elsewhere. These students may already have – partially - met some graduation requirements for the degree. They will take a limited number of courses, or take very specific courses to match their portfolio.

C. Distance learning

Highly specialized content may be a reason for students all over the world to come to Enschede for a semester or a full program, but it may also be a reason to only take a limited number of courses without making the trip. These students may be enrolled in a program elsewhere, perhaps at a foreign partner institution, either on undergraduate or postgraduate level, including PhD-students. Or they may be professionals or even hobbyists, not necessarily looking for a degree.

Fully online degree programs require very large investments. Entering this (potential) market can be further investigated. Yet here we have to keep in mind that stopping just short off the full investment a high quality and highly visible program would require, will mean still burning a lot of resources, with limited to no result.

3. ABOUT MOOC'S

MOOC's are online courses distributed through new brands like EdX, Coursera, Udacity or FutureLearn. Many of these started as platforms to use a common technology and structure to deliver courses, making it easy for students to find, subscribe to, and attend the courses. Some have changed into brands in their own right, providing smaller and less well-known institutions with a global stage. Lately, big brand universities like Stanford are pulling out of platforms like EdX as a brand and only using the technology - Open EdX - to offer content from their own website. They don't need the EdX brand anymore.

Business models

There is still no sustainable business model for MOOC's. Universities that are among the believers, like TU Delft and Leiden, stress the spin off for their campuses: attracting students and getting teachers to critically asses their teaching before it goes to the big stage. Coursera uses roughly the same arguments when trying to attract new partners.

None of the platforms has made any profit so far. So the search for viable business model goes on. The main sources of revenue that are looked at now are selling certificates to students and selling support to universities, either is setting up online education or in providing content. Before, the hope was on selling information distilled from the large community of users, like learning analytics - what's the best way to teach a given subject), or spotting talents for recruiters. The models for MOOC's are also getting more diverse, ranging form smaller personal courses (SPOC's) to models that require students to interact on assignments or form groups around projects (cMOOC's). Udacity, the third platform that started the MOOC trend, has chosen a different road and fully turned from higher education to professional in-company training.

Technology

A recent report about the use of online learning technologies in higher education in Europe, commissioned by the EUA, was surprised to find universities have been working on ICT applications in education since decades (Gaebel, Kupriyanova, Morais, & Colucci, 2014). This is certainly the case for our university, which has long been a front-runner in this field.

So, has technology changed so drastically recently, as to account for this sudden new interest in ICT? Not really. Much if not all of the technology necessary for MOOC's etc. has been around for years. What has changed is the affordability, and thus the penetration, and the speed of the networks on which these technologies depend. A platform like BlackBoard was explicitly designed to be useful in low bandwidth situations. This is what makes the platform look and feel outdated now. Media-rich content is accessible from almost any place; whether it is the home, the campus or the cafe, and whether it is in Europe or in Africa.

Innovation

This content is now mostly video - talking people, pen casts, etc. -, text, and interactive content such as quizzes and discussion boards. It is reasonable to expect that media types and technologies that still require too much bandwidth and calculation power, like Virtual Reality, speech recognition, etc., will be added to the repertoire soon. It will be interesting to see if these technologies will actually influence the dominant didactical model of teaching of learning.

From a didactical point of view, what these technologies do, mostly relates to the mode and model of delivery but not necessarily to a different way of learning or teaching. There

are beautiful lecture productions that come close to full documentary series on an academic level. And there are impressively interactive; even adaptive textbooks that can be used on tablet computers. Intelligent quizzes can give formative feedback tailored to the profile and progress of the student. In grading the final tests, teachers can get support from tools that can detect cheating and that help fair assessment. But it is still mostly the stuff we have always used: lectures, readings, some guidance, and tests.

Underlying all the innovation, there is hardly any innovation in the mode or model of instruction. This raises the question if these technologies are suitable for all kinds of learning. Training skills, either for the lab, the workplace, or the discussion table, might very well need other modes of learning.

What's more; because these technologies make education cheap to distribute but expensive to design and support, these courses require very large numbers of students to break even. This, of course, has a direct consequence for universities offering programs with small student numbers.

4. DEVELOPMENTS IN THE MARKET FOR HIGHER EDUCATION

Many societies in the world see an enormous growth of their middle classes. These are mostly connected to the rapidly developing economies in Asia, Africa and South-America. For political stability in these regions, this is good news. A consequence of this growth of middle class will be an enormous growth in demand for higher education. The growth rate is expected to vastly exceed the rate in which these societies will be able to build institutions for learning and research, leaving a large surplus in demand of, according to some estimates, up to 200 million places in 10 years.

This trend holds both an opportunity and a threat. Obviously, there is huge potential of talented young people to attract to our university. There is an even larger group however that will not be able to get a quality education if we, as a sector, do not come up with ways to deliver good education at low cost.

In parts of Europe and even more in the US, we see a different trend: higher education is becoming too expensive. In countries with limited of no public funding for higher education, like the US, we see the effect in tuition rates that are rising beyond what the middle class is able to pay. As a consequence, economists are warning for the effect of the loans people take on for a college education. The UK has also seen a steep rise in tuition fees some years ago. In the Netherlands, discussions have started over the funding of, specifically, graduate programs.

What both developing and developed economies have in common as a result, is an increasing demand for affordable education. To meet this demand, many are looking towards Open Educational Resources (OER) and Massive Open Online Courses (MOOC's). There are good reasons for the University of Twente to join in this effort. First; there is the aspect of visibility of our institution in these places, which might steer talented students in the direction of our campus. And then of course, there is our social responsibility as a publicly funded institution for learning.

Joining the effort can be done on any number of scales. The most limited is to open up resources - video's of lectures, instructional texts, simulations, etc. - to external users. The most extensive is to focus a substantial amount of resources on developing a full service package exclusively for these new student populations; either online, on-campus, or combining the two.[3]

[3] There is one even more radical option, and that is to steer the full effort of the university towards this emerging market. The consequence of this move however, would be stepping out of the Dutch system of public universities. That is not an option we will investigate here.

5. IDENTIFYING THE COMPETITION – AND THE PARTNERS

Higher education has never been a domain exclusive to universities. We are used to other - private - providers, some of which are marginal and some with considerable size. IEEE for example is the worlds biggest post-graduate trainer of engineers by far. But with new modes of delivery come new deliverers. With all attention turned to MOOC's, it is easy to overlook all the other new players that are joining the education game. Two groups stand out. First there are the initiatives that try to radically reinvent the model of a higher education program; and not by only moving it to the Internet.

An example is the Minerva project, which aims at developing a blend of online education and campus experience. It is a college with a dorm, but with no lecture halls. Students attend intensive seminars through an online interface. Both teachers and students can check in form any location that has broadband Internet. So students do not follow classes in the same room, but they *do* live together and join in co- and extra-curricular activities. The added value of the technology is not just that it is very much cheaper than supporting lecture halls and flying in teachers. It also enriches the interaction with a host of tools for monitoring student participation, testing, etc.

The second group consists of companies that are looking to provide extra services to students, next to or prior to the programs they are enrolled in - either on-line or off-line -. Perhaps best known is Khan Academy. Starting as a YouTube channel some years ago, they have evolved to a full learning platform that is a great tool for individual learners, but can also help primary and secondary school teachers and/or parents to track the learning of their pupils.

Khan is a not-for-profit aiming primarily at individuals and institutions with limited resources. Yet, one can also see uses in university, specifically for foundational courses in math. And it is also a great tool for students who want to independently work on their math foundation, for example in bridging programs to obtain the requirements for admission to a university.

Similar services are increasingly offered by textbook publishers as well, as part of their strategy not to be innovated out of business by new, cheap or even free online providers. Their aim is increasingly to keep their foothold within the institutions by expanding their pack of services well behind the classical textbook. Similar to the way in which the open access movement is shaking up research publishing, it is reasonable to expect a shake-up of the teaching-publishing market by open educational resources. This is definitely something to keep in mind when entering collaborations with publishing houses.

A final mention for interesting new players in this second group is for all the 'sharing economy'-inspired platforms that aim at matching students with questions to students with answers and/or build up knowledge bases of FAQ's, wiki-like article's, ratings of online content, etc. Examples are Openstudy.Org or the Dutch FeedBackFruits.

6. DO THE DIGITAL NATIVES OF ONLINE UTOPIA EXIST?

Many people in higher education claim to see a change in the way students learn. The model in which information is transferred primarily through the lecturer and the reading he or she prescribed, appears to be becoming less relevant. Students show up less and less in the lecture hall, and when they do, they appear to invest most of their time and attention in catching up on Facebook.

Education's center of gravity seems to be moving out of the classroom. Around a given course a web of interactions between students will appear, in which students point each other to other sources that convey similar information; either at a higher pace, with a lower threshold, or at a more convenient moment. Meanwhile, the main question to be answered in the lecture hall is increasingly 'what do you want us to know?' instead of 'can you explain?'.

Hard data on the question if this really is the case is not easy to come by and there are many popular beliefs about the reasons for this trend. Three myths that are frequently used as an explanation need to be debunked:

Myth 1: Young people today have different hard wiring

It is a widely held belief that kids growing up in a world full of smartphones and other devices have a neural hardwiring that is different from kids from earlier generations or from technologically less saturated environments. They are thought to be less good at staying concentrated for longer periods; while at the same time being better at simultaneously using different media and information sources or working under distraction.

There is no research to support these beliefs. In validated tests, kids who are heavy tech and/or social media users show no significant difference in complex multitasking capabilities or other high-level cognitive functions. What tests of multitasking during complex cognitive activities do show is that it does not necessarily have a positive effect on understanding or retention.[4]

So, if more students are less interested in sitting through lectures or reading long texts, it is not because their hardwiring is different. The obvious reason is that it is just because many attractive tools and alternatives are readily available and easily accessible. It is a case of *opportunity making the thief*.

A second conclusion we can draw from the research is that the – simultaneous - use of different sources and media does not in itself guarantee good results. Both through lack of concentration or invested time and the superficiality of many of the sources used, the risk of students only scratching the surface is very real.

And a final conclusion is that learning does not automatically get better from introducing more media or have students use laptops all the time. The research that suggests that note taking on paper is better than note taking on a computer (Mueller & Oppenheimer, 2014) is hotly debated, and if true, banning laptops from the lecture hall - like some departments in Groningen did recently - is probably not the best answer. But it does give reason to pose the question which technologies to use when; instead of simply believing all should be used all the time.

It is telling to see how the university library is becoming a more popular place to work again over the last few years. But students do not necessarily go there because of the

[4] OECD published a goed overview of reaerch on the matter (OECD, 2012).

available resources. It is now a place to concentrate; a place where devices can legitimately be turned off.

Myth 2: All young people are highly skilled 'digital natives'.

There is no doubt that many young people spend a lot of time on social media and are very competent in using the applications available for this part of the Internet. What is interesting is that these social media are also an important way of navigating other information sources. People navigate references posted by their peers and when they have more complex questions, they are more likely to ask peers through social media than enter a complex query in a search engine.

As a consequence, the skill set of 'digital natives' - both technical and social - may be highly developed, but it is also limited. It is concentrated around a limited set of applications for a limited set of uses. Their skill set will very often not automatically stretch out to, say, office applications, or the deeper workings of search engines, because these are not used on a regular basis. The fact that these applications also run on a digital device and use the same Internet does not mean very much.

So, yes, young people are highly skilled digital natives, but of a very specific and limited part of the digital landscape. Although this part of the landscape may be academically relevant, students still have to be introduced to, and trained in the use of the applications and technologies that are part of daily life for academics. Even the word processor that was a stepping stone into digital life for the professor, and has grown up with him or her to become as integral a part of daily life as is the coffee machine, can be a highly challenging application for the happy FaceBooker that is new to academic life.

Myth 3: New technologies DEmocratize access to information and services

Connected to the belief that young people use, and are competent in using, all aspects of the Internet, stands the belief that all young people are roughly equal in this respect, or even, that technology has led to more equality. The idea is that the easier information is obtainable, the more people will use it.

Regrettably, this is not true. Research by our universities' research group Media, Communication and Organization suggests that the use of internet sources closely matches other high level skills and is a representation of social status, and even stratifies or increases differences in social status (van Deursen & van Dijk, 2014). Statistics on the use of online learning services like MOOC's suggest something similar: students taking MOOC's, and especially those successfully finishing them in most cases already have a graduate degree. For example: 85% of students who have enrolled in Coursera has one or more degrees (Laurillard, 2014).

ICT does not necessarily make knowledge, information or services more accessible and the digitalization of services is also not always welcomed users. Research by our university's Center for e-Government Studies has shown that the aversion to e-servicing - in this case by a city council - does not correlate with technology aversion or technical skills in general. For some services people simply prefer people to machines. This may very well hold for students as well.

Conclusion

There is a lot of wishful thinking about the way in which young people are changing, higher education is disrupted, or ICT is changing the world. Reality shows a bit more nuance. This is not to say that we should not react to changes we see going on, or should not use new technologies to increase the quality and efficiency of our education. It is to say that it is easy to be naïve of the results it will have.

7. STUDENT DRIVEN LEARNING

Many of the professions highly skilled people have now, were unheard of only 20 years ago. Similarly, it is safe to say that we are unable to predict what our students will be doing 20 years from now. Except that they will likely work in a more complex and rapidly-changing environment, and that their jobs are likely to be less secure and less permanent than they are now.

Parallel to the discussion on *how* students will be learning in the future, there is a discussion on *what* they will be learning. There is wide consensus that modem professionals need more than just disciplinary skills. To quote a recent a survey into employer requirements of graduates:

> *"[...] with the emergence of high performance workplaces, basic interpersonal skills are required from everybody. Nowadays it is not enough to be a specialist anymore. Graduates also need to be able to communicate with others: clients, co-workers or colleagues outside the organization." (Humburg, Velden, & Verhagen, 2013, p. 101)*

The report goes on to stress how employers increasingly value general academic, problem-solving, and co-creation skills. A similar point is made in an earlier report by Gallup (The Gallup Organization, 2010).

Yet, both surveys show that in spite of all the talk about 21st century skills, it is still mostly disciplinary education that is the entrance ticket to the labor market. Graduates mostly land their first job on a degree in a recognizable discipline or job profile. But they build a *career* on other skills.

Expert knowledge is a valuable ticket to the workforce. But from an academic perspective it is not a goal in itself. Specialization also is an *instrument* to learn to *develop and use* knowledge on a deep, abstract level. This is a crucial academic skill.

Programs should also help students to develop a wider range of skills that enable them to transpose expert knowledge to different domains, and to communicate and interact with people from other disciplines. But these skills have to rest on a foundation that is given by the discipline. Programs should focus both on discipline - deep -, as well as for the boundary crossing competences - broad -, thus creating so-called *T-shaped professionals*.

To enable our students to cope with this demand for flexibility, is why we want them to become entrepreneurial "T-shaped professionals", who have deep knowledge of their field, but who can also venture off the beaten path; find new applications for their expertise; and, to quote Alvin Toffler: "Learn, unlearn, and relearn".

Flexibility and an entrepreneurial attitude are not developed in a lecture hall. To better prepare students for an uncertain future, our aim is to have them at the helm of their education as soon as possible. We coin this approach to learning *Student Driven Learning* (SDL). This is not something we started recently. The University of Twente has a long tradition in project led education and student-involvement in teaching. Recently we have taken a next major step on this road with the introduction of our Twente Educational Model (TEM) for undergraduate learning.

The University of Twente wants to train highly skilled professionals who are able to critically asses, combine and apply scientific knowledge and to add new knowledge. In Twente's vision on teaching, to do so students have to learn to function in three roles:

being a researcher, a designer and an organizer (Ruijter & Miedema, 2010). The best way to learn this is taking on these roles as soon as possible.

With respect to the learning content, we want students to gain a deep understanding of the core of certain field or discipline, rather than scratch the surface, even if this surface is very big. Yet at the same time, students have to be able to look and to work beyond the boundaries of their field or discipline. The T-shaped professional we are seeking to train is an expert with a deep enough understanding of his or her field to add its understanding, but who is also able to 'zoom out' and understand how his or her field relates to its context and translate and apply his or her understanding to that context.

Here as well, we want students to take control of their own learning as much as possible. Understanding is much better obtained if there is a question that has to be answered instead of when it is the understanding that is on the schedule for today. This so-called constructivist approach to learning has clear and well-proven advantages over classical lecture-driven education (see eg. Freeman et al., 2014).

So, in a nutshell, Student driven learning is a model of actively engaging students in the role of researcher, designer and/or organizer; simulating them to organize their learning around the questions they come up with through working on realistic cases and problems.

In a recent report, OECD nicely summarizes the characteristics of an effective modern learning environment. It fits our SDL-model like a glove:

1. Recognise the learners as its core participants, encourage their active engagement, and develop in them an understanding of their own activity as learners ("self-regulation").
2. Be founded on the social nature of learning and actively encourage group work and well- organised co-operative learning.
3. Have learning professionals who are highly attuned to the learners' motivations and the key role of emotions in achievement.
4. Be acutely sensitive to the individual differences among the learners in it, including their prior knowledge.
5. Devise programmes that demand hard work and challenge from all without excessive overload.
6. Operate with clarity of expectations and deploy assessment strategies consistent with these expectations; there should be strong emphasis on formative feedback to support learning.
7. Strongly promote "horizontal connectedness" across areas of knowledge and subjects as well as to the community and the wider world. (OECD, 2013)

Student Driven Learning is our guiding principle to our portfolio of undergraduate and graduate programs, but also to integrate new learning technologies.

SDL in undergraduate education: the Twente Education Model (TEM)

SDL wants to maximize student engagement in learning and in the campus community. In undergraduate education, this is mostly done in groups of students working on projects or realistic problems. To take away obstacles to this mode of learning, the curriculum structure for undergraduate education was changed into a model of 10-week fulltime modules. The idea is that teaching not necessarily has to take the form of a 10-week

lecture based course, of which a number run parallel to each other, but that the modules would for example give room to spend a number of day to work fulltime on a certain subject, either in classes or through online resources.

Lectures are great and important means of transferring information to students. And students like lectures that are entertaining. It is interesting to see in this respect that the 'Education Prize' consistently goes to a teacher who is a good lecturer, and that project work usually does not get high grades on student evaluations. Yet, when asked where they have learned most, students do not very often refer to lectures. One thing lectures are not very good at, is delivering the knowledge a student needs at the time it is needed. A more flexible mode of content delivery will help the further development of TEM.

Another challenge that TEM is facing, is workload for teaching staff. In many cases the TEM modules have added a project or group work and extra tests to the teaching program, without cutting back on lectures and other teaching, effectively leading to a higher workload for staff - as well as for students. Putting parts of the classroom teaching and - formative - testing online can decrease the workload over time. It will however result in higher time investments in the beginning.

In the future, TEM should grow into a model that supports a wide variety of module-designs, some of which belong to the core of a specific program, and other open to students from different programs. Many of these module designs will depend less on classroom teaching. The availability of online sources can help in this development. Projects or problems can steer students through the sources available, either sources that have been pre-selected by the module designers, or sources students find themselves online. Coaches can help students navigate and critically assess the value of these sources, and help guarantee students understanding reaches the appropriate depth.

SDL in graduate education: flexibility

The discussion on the direction in which graduate education will develop is still in full swing. What is clear, is that the university is not likely to choose a organizational model for its graduate programs that is comparable to TEM in undergraduate programs. First because graduate students will on average be more capable of working alone or in freely chosen groups, instead of working on group projects. The second reason is that graduate education asks for more diversity in educational forms. And the diversity in forms of graduate education is likely to increase.

With the maturing of the Bologna system, we will see more mobility between undergraduate and graduate programs. Students entering the graduate programs will have a more diverse background, and their distribution over the programs is likely to change. Some fields might see big differences between the sizes of their undergraduate student body in comparison to their graduate population.

Government funding for masters programs is also likely to decrease. This might push students to combine their education with a job, or leave university for the labour market for a longer time, before entering a masters program. Students combining their program with a job or returning from the a professional career will want a different program from students coming directly from a bachelors program; in content, in educational approach, and in price point.

These trends all point towards more flexible arrangement for graduate programs; for masters and PDEng programs, and perhaps in time also for PhD's. These might be fulltime programs with curriculum flexibility to provide for diversity in influx, or part-time programs that can be taken a module a time. And they can be offered on-campus, on-line or in a blended form.

And finally: it is not self-evident that all students will want to do the full program with one provider. Situations in which students have taken courses from different providers and wish to round off their portfolio with a university degree are likely to occur more often and may even become the standard. We have mentioned Open Badges before as a platform to support this model. Some analysts go further still and ask the question what the added value of a degree is when the applicant for a job can show a training portfolio that is transparent and validated, together with an online profile badged with endorsements from colleagues and employers.

8. OER@UT: AN OPEN ACCESS STRATEGY FOR LEARNING

The open source movement started in software development but has had offspring in many fields. In the academic world we are familiar with the open access movement in publishing scientific research that is currently shaking up the publishing world. Open Educational Resources are the equivalent in teaching.

Many universities have started publishing recordings of their lectures some years ago. The reasons where mostly idealistic; sharing the knowledge they have accumulated – in many cases through public funding – for the greater good of humanity. But there were also more mundane reasons; mostly building a reputation, and increasing quality. The quality argument perhaps needs some explanation. The idea is that teachers will invest more effort in a lecture if they know it will be published to the world. It is hard to proof this is true. Fact is that teachers who participate in video lectures are more likely to follow training. The question of course is what the direction of the causality is here.

One can debate the question if MOOC's are open. They are free - mostly -, but they are not open in the sense that they can be added to any curriculum at any time, either completely or in parts. Sometimes because of restrictions in their organization - time of delivery or requirements to see or use a specific part - and sometimes explicitly in their copyright regulations.

Many OER are not that interactive. They can consist only of online text or sheets, sometimes edited by many collaborating teachers – both writers and reviewers - under a public license; very much like the model we know from software-development. In this case, the aim of the OER is explicitly to offer high quality learning materials at a low, or even at no price.

In spite of all these developments, the field of OER is still relatively small. Big publishing houses show no real signs of worry over the developments, although we do see them offering more services around their textbooks. To publishers, perhaps this is not just new business, but also a strategy to increase their grip on higher education.

The arguments mentioned above for an OER strategy - public service, reputation, quality, and independence from publishers – might in themselves be enough reason for the university to start participating in the OER community. From an SDL perspective, an extra argument can be given. If we want students to take charge of their own education as much as possible, opening up many different learning sources is a logical step. If we only rely on material from publishers, it will also be a very expensive step. OER are out there, so lets see how we can use them. And with their use comes the social responsibility to also give back the material we produce to the OER community.

Parallel to open access in research publishing, the University of Twente should commit itself to Open Educational Resources in education. This means using open resources as much as possible in education, and opening up our own educational productions to the outside world.

If we are serious about OER, we will have to develop support structures in our organization. The user side of this structure will be discussed in more detail below. Here, we round of with a few remarks on the production side.

Open is not the same as free for anyone to use in any way. There is a copyright system for open access publishing, called Creative Commons (CC). It allows for producers of content to clarify the copyright status of their work - who can use it and under which

conditions - through standardized pictograms. The pictogram on the front of this document for example, grants users the right to use this document whole or in part, as long as the producer is mentioned. There are a number of combinations one can choose from (see https://creativecommons.org/licenses/). Adopting this system for our publications - either video, text or any other medium – will be necessary.

The system to implement Creative Commons in our university should pose as little effort for teaching staff as possible. Some training or information will be unavoidable, but a system that simply asks the contributor which license he or she wants to use as part of the upload procedure to the campus repository should be possible. And of course 'not open' can be one of the options, for example if the material will also be published through a publisher that does not allow open publishing, or if the material is part of a research contract that does not – yet – allow publishing.

A final remark is on the use of copyrighted material in our productions. We all like to use pictures and other material in our presentations, and since we only show them to a limited audience, we mostly do not worry much about copyrights on these materials. When we publish to the world, this changes. We have to be sure the material we use in our productions is free of copyright or is also copyrighted under Creative Commons. This is easier said than done. Those who frequently browse the Internet for a nice picture to support an argument will have noticed that copyright restrictions are rarely very clear and that finding good material that is free to use can be very time consuming. That is why an open access strategy will not only require awareness, but also facilities to help use and re-use appropriate content.

9. SUGGESTED PROJECTS & SHOWCASES (SOME ALREADY RUNNING)

Program- and course design:

1. Flipping the classroom in first-year Mathematics
2. TEM-modules using OER and Learning Store
3. Blended master program
4. On-campus master
5. 2 MOOC's

Assessment:

6. Formative self assessment
7. Peer reviewing
8. Digital testing facility (soft- and hardware)
9. Plagiarism detection

Learning environment:

10. Learning Store
11. Classroom of the future
12. Project room of the future
13. Office of the future

Information systems / backbone

14. Re-assess architecture and use of Learning Management and Student Administration systems (BlackBoard and OSIRIS)
15. Use of API's for connecting applications locally
16. Pilot CANVAS

Organization

17. One support portal (web, phone) and support team for ICT in education - joint effort of OD, B&A, ICTS, FB, HR, M&C.

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