From e-Learning to m-learning: a MOOC case study

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Abstract: Technically e-learning material can be downloaded from a PC environment to a mobile phone environment. But the context, environment, physical limitations of a mobile phone, sets limits to a mobile learning environment. The didactic model cannot be transferred usually from e-learning to mobile learning environment. In an experiment we test the limitations of a mobile learning environment and possible constraints after downloading e-learning material on a mobile device. Finally we researched possible didactic models.

Key words: e-m-learning, MobiDics, FETCH 2.0, didactic models, case study.

INTRODUCTION

Last years many well-known Universities invest in the development of Massive Open Online Courses (MOOCs) as a new way of e-learning. Interested students all over the world are able to download the teaching/learning material on their PC/laptop computer. There is no need to enrol as a student and to pay tuition fee. There is no pressure to complete the course and teachers are not directly involved in supervision and as a consequence the success rate is low. But success rate is not the only criterion for Universities to offer MOOCs. Public relation and teaching/learning innovations are the main reasons to offer MOOCs.

Nowadays almost every student has a smart phone or tablet computer at his disposal. Thanks to the worldwide coverage of wireless networks, a smart phone enables learning anytime anywhere. Usually Universities allow download of the e-learning material via iTUNES, YouTube without any adaptation. The question is if the downloaded material enables mobile learning. The used didactic model in the e-learning environment cannot be transferred to the mobile environment automatically but usually needs adaptation.

A mobile learning environment is usually quite different from a regular e-learning environment with respect to context, environment and technical limitations of a mobile device. In a train, bus, waiting halls mobile learning can take place. But such a learning environment is quite different from a regular study, library or lecture hall. It can be observed that students use their mobile anytime, anywhere. The question is how to design a didactic model such that m-learning can take place.

To research the problem in more details we took as case study a video lecture on a Pre-University Calculus course. Hundreds of students followed the course via TUDelft website and as a MOOC this course is free available for researchers. We consider two versions, the original e-learning material and the download on smart phone. Five experienced teachers/students in mathematics were requested to compare and review both versions on a set of criteria. This set of criteria forms a basis of a checklist which e-learning material has to satisfy before it can be downloaded on a smartphone. Possible adaptation of the learning material will be discussed. We also reviewed experiences of students of the course.

The considered MOOC has not an explicitly stated underlying didactic model. The course management tool is not well developed. MOOCs are supposed to run without explicit support of teachers. Students are supposed to manage their time themselves. Teachers involved in the experiment were requested to consider the most appropriate didactic models appropriate for the MOOC.

The outline of the paper is as follows. In the next section we discuss related work. Then we introduce the used MOOCs in our experiment. In section 4 we present the results of the interview with the teachers about the constraints of a mobile learning environment and the preferred didactic models. In the last section we take a conclusion.

RELATED WORK

In 2013 a book appeared [1] with the best papers published in the International Journal of Mobile and Blended Learning. It provides an overview of research topics, theoretical frameworks, used methodologies, evaluation of some tools. The paper of Kukulska-Hulme et all [2], about innovation in mobile learning: a European perspective is of special interest.

Classroom 2000 [3] at Georgia Institute of Technology was one of the first deployed projects to support learning with mobile devices. They designed special multimodal rooms for recording video lectures. Foley was one of the promoters of the project. During his visit at TUDelft in 2003 he started many projects on the use of mobile devices in the classroom. Special tools for asking questions during lecture via a mobile device, making lecture notes and distributing them between classmates.

iMobileU is one of the first communities of educational institutions with a shared interest in the development of mobile learning environments, including platforms. Kurogo started as an open source project in 2007 as a spinoff of MIT Mobile Framework [4].

MobiLER (Mobile Learning Environment) was developed at the Swiss Distance University of Applied Sciences. It integrates the learning management system (Moodle) activities in the mobile learning process. A valuable framework for analysis mobile learning is FRAME (Framework for Rational Analysis of Mobile Education) developed by Koole [5].

Moodle is one of the most used course management system for digital learning environment. Moodle is open source software. It is an Internet application and has to be installed on a webserver. To use mobile devices as smart phones and tablets we need a Moodle applet with all or some of the Moodle activities. The research group of the UPC (Polytechnic University of Catalunya) developed Moodbile (mobile learning for Moodle) a Moodle Mobile App [6].

MobiDics is a mobile didactics toolbox. It supports the preparation, structuration and execution of university courses on mobile platforms [8]. The learning content in MobiDics consists of a collection of didactic methods, which represent a classic link between didactic background concepts and the formulated educational goals in class. The methods have been provided by PROFiL3, Sprachraum4 and the Centre for Learning and Teaching in Higher Education (Carl-von-Linde-Akademie/ProLehre5) which are professional training institutions at Technische Universität München and Ludwig-Maximilians-Universität Munich. The MobiDics database currently contains about 50 didactic methods and is continuously growing. In [9] we designed a special didactic model FETCH 2.0 for e-learning. MobiDics offers opportunities to adapt this model for the m-learning environment.

Motivation and personality characteristics as the abilities to control the study behaviour without external control of the teachers will be discussed in the paper. Social-network learning are proposed as alternatives for teacher control [9]. The assessment of emotions in e-learning environments [10,11] are considered as an important tool to reduce the high drop-out of students in MOOCs learning.

CASE STUDY TEACHING MATERIAL

From 2015 it is possible to access educational material from TUDelft via iTunes U. This programs allows students to download and synchronise lectures from TUDelft. iTunes U is one of the largest and fastest growing sources of free educational material. At this moment the database includes more than 200.000 items. As case study we selected the Pre-University Calculus MOOC. The MOOC includes material from Professor Delaware from University of Missouri Kansas City (UMKC). This is an example of a classical video lecture. It is selected because at this moment video lectures are used by many Universities. In an experiment described in the next section we evaluated the downloaded version on smartphones via iTunes U.
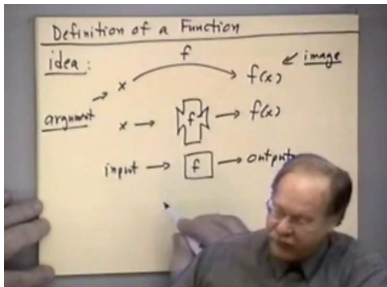
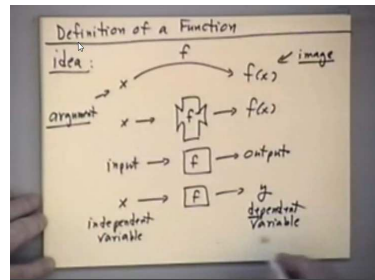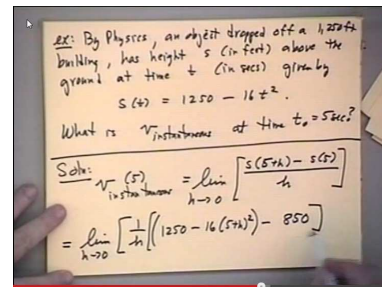Fig 1a Teacher in action during video lecture Fig 1b Display of a video lecture Fig 1c Display of an assignment

In Fig 1a, 1b we see the lecture notes with and without the lecturer in action. The presence of a lecturer makes the presentation more personalised and gives a student a higher feeling of presence in a lecture room. From the other site the lecturer takes place on the limited screen on an i-phone. In Fig 1c an example is presented and a detailed solution of an exercise. This is conform the common way lectures in mathematics are presented. But an i-phone offers more opportunities for context sensitive examples. In Figure 2 we observe students with an i-phone in a car. The co-driver is able to assess the speed by measuring the time between regular checkpoints along a road as lamppost or mile markers. A dynamic routing system available on every smart phone provides interesting applications of networks. In the present classical video lecture, this opportunities are not used. The video lecture has a simple time management system. At regular times the screen displayed in Figure 2a is displayed remembering and inviting students to do some exercises.

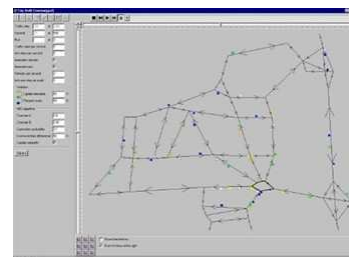Fig 2a Display with study Management Fig 2b Student in action with mobile device in a car Fig 2c Display of a dynamic traffic management system

CONSTRAINTS OF MOBILE DEVICES

The MOOC as described in the last section is available for students to download on their smart phone. Five teachers mathematics and five students members of curricula committee, were requested to follow some lessons of the MOOC. In an open interview their experiences were discussed. We list the discussion points without comments. These discussion points are the basis of a to be developed checklist next future to be satisfied before downloading e-learning material to smart phones.

1.Physical constraints of mobile devices. Limited size of the screen of a smart phone doesn't allow simultaneous presentation of a lecturer and its writing on a whiteboard. To keep the motivating and personalised presentation of a human face it is possible to present the lecturer in action and his notes one after the other. Another option is to show the notes and the voice recordings of the teacher simultaneously. A similar presentation can be observed at the weather forecast at TV.

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2. Wizard as pointer. An interesting option to focus and guide the attention of the student is the use of a wizard, pointing to special features. This is a challenging alternative for oral explanation from a lecturer.

3. Speed of presentation. Mobile e-learning offers the opportunity to zoom in to the real life presentation of the lecturer on a white board. The speed of reading is much faster than the speed of writing. Nevertheless the incremental presentation of the notes, at the speed of writing the text offers more advantages than the slide presentation and reading of the text by the lecturer.

4. Look up. Fast moving forward and backward is an option. But an additional link structure is needed to look up topics in the text in a fast way.

5. Mistakes during presentation. A point of discussion is, if a teacher is allowed to make mistakes, wipe the wrong text, or to present the learning material in a smooth way. One can argue that scientific papers also present research findings in a correct and smooth way. Failures and mistakes are usually not reported.

6. Environmental conditions. A student in a train, bus, waiting halls and have usually not a desk at their disposal to write, to type or compute. The study environment is quite different from a study room or a library. The designers of MOOCS assume that students are in common study environments, have a desk, pen paper, internet, keyboard mouse at their disposal. Usually they are not allowed to speak loudly. It is possible to read a book or newspaper on such places, to watch movies, use social media to read news media.

7. Restricted modalities. In public spaces it is not recommended to produce sound, either earplugs or other modalities instead of sound have to be used. But students are used to listen to downloaded music or reading via an e-reader (uni-modality).

8. Distracting features. In public spaces many features catch the attention of students. Changing modalities of transport or locations force an interrupt of the video lectures. As a consequence a video lectures should be split up in short movies. It proves that even in regular lectures, students are not able to concentrate longer than 15 minutes.

DIDACTIC MODELS

The learning goals of the Pre-Un Calculus MOOC is to offer starting students a refreshment of the mathematics learned at secondary school. Most of these students passed successfully their school exams in May and will start an academic study in September. It proves that the knowledge and abilities of students show some gaps. Some students forget some of the learned topics or never understood some topics in details. The MOOC offers students the opportunity to bridge the gap between school-exams and start of a study at a Technical University.

Experienced mathematical teachers took the initiative to design the MOOC to replace the summer schools. Unfortunately the learning goals, and used didactic models are not presented. The course is offered to the students. We interviewed a group of 5 teachers (3 from TUDelft and 2 from a secondary school) and discussed the possible underlying assumed teaching-learning models. The general opinion was that in the video lectures, the mathematics was lectured in a usual way, the mathematical topics, concepts, examples and exercises were presented on a white board with some interesting movies about applications. There was not a single underlying didactic model. The learning material can be used in different ways and offers an eclectic teaching–learning environment. We discuss the main models:

-Mastery learning. Students should have the abilities to solve linear equations, to differentiate and integrate polynomial functions and to compute extreme points. Students can train these abilities by solving many exercises and getting feedback. Some students need more training time then others to reach the same level. But the course offers enough exercises with solutions. There is no differentiation in students 'ability. Practice and drill is

common used in mathematics teaching to memorize and adopt concepts. The question is of course if deep learning takes place. Mastery learning was introduced by Bloom in 1968.

-Discovery learning. According to Freudenthal (1973) the goal for mathematics education should be to support a process of guided reinvention in which the students can participate in negotiation processes that, to some extent, parallels the deliberations in the development of mathematics itself. In the current learning material, students are invited to discover the relation between linear equations of two variables and lines in the plane. The intersection of lines corresponds to solving a pair of corresponding equations. In the applications students are invited to discover the mathematics in our surrounding world.

-Network learning. The most innovative and challenging aspect of mobile learning is the option to be part of a learners community. Traditionally learning mathematics is an individual activity. Grading of assignments is an individual process. But thanks to mobile devices the attitude of students is changing. They are used to ask questions in a community and to share learning experiences with others. In the current MOOC the option to give group assignments is not yet employed but to share best solutions of assignments with other students via websites is promoted. Reviewed teachers realise that they are from apast generation and have no experience in network learning.

-Blended learning. The interviewed teachers have their doubts about MOOC. They expect that classroom lectures will be needed. In MOOCs the role of the teacher is minimised or digitised. But the role of the teacher as motivator, supervisor and course manager is difficult to implement in MOOCs. It is expected that only highly motivated, gifted students will profit from MOOCs. At this moment there is a lack of teachers, facilities and learning material for highly gifted students. Offering MOOCs to these students shows promising results. MOOCs offer opportunities to students not only interested in development of cognitive abilities but also development of social-emotional abilities. Schools founded at the principles and ideas of Rudolph Steiner becoming popular in the Netherlands. But the general opinion of the teachers was that integration of MOOCs blended learning, flipped classroom teaching-learning environment show interesting opportunities.

-(Un-)supervised learning. Students following the Pre-Un Calculus MOOC send their first reactions to the TUDelft website. In general can be concluded that the gifted students with a strong motivation for science and mathematics follow the MOOCs. They are positive about possible applications of mathematics and are proud to be a member of technical university community. Some students made movies of their first experiences at a University. This has a positive effects on other but similar students. But the main target group of the MOOCs were students with low grades in mathematics and having gaps in their secondary school mathematical knowledge. Some of these students enrol in the course but give up easily because of lack of motivation and inability to spend time and effort to such a course. A MOOC offers too much freedom to such students and not enough pressure to be involved in such a course. An appropriate course management tool for MOOCs is still missing. At this moment MOOCs are only for the happy few.

-Active-passive modes of learning. Watching movies, reading text or listening to sound recordings are the preferred activities. But all of them are passive modes of behaviour. To become active, to make assignments, writing reports are not preferred learning activities, not only because of the limitations of the mobile environment. In common learning environments managed by a teacher, deliverables are scheduled and required in time. In the mobile environment the teacher control should be replaced by social control in the network environment. Current assignments should stimulate more cooperation between students and should employ the possibilities of context sensitive learning via mobile devices.

CONCLUSIONS AND FUTURE WORK

In this paper we researched the educational material after downloading e-learning material on a mobile device. It proves that technically this is not a problem. But technical constraints of mobile devices, constraints from a mobile learning environment and the lack of specific didactic models limits the use of m-learning material. As a case study we tested a special MOOC developed at Delft University of Technology. A group of teachers/students were requested to follow this course on a mobile device and via open interviews their reactions were collected, with a special focus on limitations and opportunities of mobile devices and the most appropriate didactic models. It proves that an eclectic approach was preferred by the teachers. The teacher/learning material should enable different underlying didactic models. The possibilities of social network learning via m-learning are not fully explored but are promising for the future.

The first reactions of students taking the MOOC are discussed. It proves that the gifted, more successful students complete the MOOC successfully. Other students miss motivation and character to put themselves into action and to manage their study behaviour successfully. More data will be available after the end of the course in September 2015.

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