VIDEO-BASED BLENDED LEARNING PRACTICE IN MASTER STUDIES

Mikko Myllymäki, Ismo Hakala
University of Jyväskylä, Kokkola University Consortium Chydenius
P.O.Box 567, FIN-67701, Kokkola, Finland
mikko.myllymaki@chydenius.fi, ismo.hakala@chydenius.fi

ABSTRACT
Challenges for an organizer of modern education can be met with the help of blended learning. There can be many different starting points and motivations for it. One way to arrange blended learning is to realize it using lecture videos alongside with face-to-face teaching. In Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius, the flexibility to participate in education has been increased with the help of lecture videos produced of face-to-face teaching for many years. For each lecture, the students of the degree program can select the best possible way to participate in the education and in a manner that suits to their current life situation. This paper describes a strong video-based practice that has taken root in the masters' program. The paper examines the importance of videos for study participation and considers, from the viewpoint of participation, the changes that videos have brought with them.

KEY WORDS
blended learning; lecture videos; educational technology; distance learning

1. Introduction

Education providers, whether they are companies or educational institutes, have often very different requirements and approaches in relation to organizing their own education. With the help of blended learning, these multifarious needs can be met in diverse manners. The term blended learning means the educational environment that combines face-to-face instruction with technology-mediated instruction [1]. So the term can be used for example to describe learning which takes place with the help of the mix of face-to-face classes, on-demand videos and real-time videos [2]. There are number of reasons for arranging education as blended learning [1], [3], [4].

The arguments for blended learning are often based on its possibilities to provide increasing flexibility [5], [6], [7]. It enables both compensation of occasional absences as well as very long-term distance study. Thus, the problems brought about by students’ time use limitations can be addressed. Increasing flexibility is important also in situations where the students have families, live far away from the campus area and subsequently cannot always participate face-to-face in the education offered [8]. Getting better learning outcomes is another aim in the use of blended learning [5], [8], [9]. Technological solutions would allow the opportunity to revise topics studied, for example. By offering several different participation alternatives for organized study, various kinds of learners can be provided with support [6], [7], [10]. In the best of cases, each learner can choose to participate in a way that is the best possible for that person. Diversified teaching arrangements with the help of technologies enable, in some cases, the use of completely new didactic teaching solutions. If blended learning is implemented in a way that some face-to-face learning could be replaced with another teaching mode, this can also result in economic savings [5], [11], [12]. Savings can be achieved, for example, in connection with travel and as decreased need for face-to-face teaching premises.

Different approaches also place many types of conditions for organizing education in the blended mode. One of the most critical conditions is the economic resources available. If cost-efficiency were to be included in these conditions, it would be necessary to make compromises in relation to quality and search for solutions that enable automation and, through it, implementation of the blended learning in as lightweight manner as possible. Another important thing to consider is whether the change to the blended mode would apply to the entire degree program or individual courses. Other points of departure to be considered that are dependent on education include transparency of the selected technologies to the lecturers, issues related to the distribution of materials such as support for mobile equipment, file formats, user rights and copyrights, as well as didactic solutions which these and other technologies must be able to provide support for. In addition, there may be many different viewpoints to the motivations to use blended learning and to its conditions of use, and these include the viewpoints of the teacher, the student and the education provider. Each viewpoint regards different key issues as critical.

To diversify teaching, traditional implementation of blended learning has relied on replacing some face-to-face modules by e-learning or including, from time to time, face-to-face situations to e-learning. In these cases, the student thus studies sometimes face-to-face and sometimes through e-learning. One differing interpretation about the implementation of blended
learning in a manner referred to above is to organize teaching in such a way that, for the same teaching situation, there would be several different alternative participation modes made available with the help of educational technology.

Use of lecture videos produced from face-to-face teaching is an educational arrangement that would make different participation alternatives feasible. The videos produced could be offered to the students in real time, making participation flexible regarding the location. As the videos would, in addition, be recorded and later offered to the students for viewing, one could talk about participation that is flexible regarding the time and location.

Market offers commercial video recording systems. However, if solution is wanted to be cost-effective and as suitable as possible for the needs of the education organizer, the modification of the solutions is often required. For this reason, a serious alternative to commercial solutions is to build a custom video recording system which is exactly customized to the intended use. Still, more important than technological solutions, are working practices, which are formed on top of them.

In Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius, the flexibility to participate in education has been increased with the help of the practice that is very strongly based on lecture videos. Education thus realized would allow the student him/herself decide about how to participate in it and at the same time determine what the degree of blending should be. This kind of blended learning that adapts to the student's life situation would seem to lead to the best level in participation.

This paper presents an educational practice that has developed in connection with the Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius. The practices related to classroom education have become well functioning between years 1999 and 2005, when all the teaching of the education program was arranged as traditional face-to-face education. In 2005, lecture videos were tested in few courses, and due to the good results it was decided to use the lecture videos throughout the education program. So video production in the master's degree program really started in 2006 and it is also well established over the years. The current practice is based on a blended education model which adapts to the student's life situations while strongly relying on lecture videos.

Apart from introducing the current practice, the paper examines issues related to the use of lecture videos: the importance of videos as a participation mode and the changes to study brought about by the use of lecture videos, among other things. The results are grounded on the outcome of extensive student interviews carried out in the second half of 2010, on log data collected about video use, attendance records from 2005 and 2010 as well as on data from the register of study credits.

2. Blended Learning in Master Studies in Mathematical Information Technology

The practice that has developed in connection with the Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius is very strongly based on lecture videos produced about face-to-face teaching and on the use of technologies complementing the videos. All the master's degree students are adults in active employment and most of them are also with a family. These students work in the IT sector where the work is often project-based and from time to time very taxing. The majority of the students also live far away from the campus area. Due to family and work considerations, the students living far away, unlike full-time young students, do not have the possibility of moving to the campus area.

In practice, the above-mentioned initial conditions mean that the students' chances to participate in the education offered are from time to time poor and due particularly to the limitations in time use. Increase in flexibility to participate in the education has, in fact, emerged as the most important motivation for the use of teaching technologies in the master's studies of information technology. The aim of the improvements in participation opportunities has been to enable the students to complete their studies better while keeping the throughput of students good in education. It wasn't desired, however, that the improved course completion brought about by new participation opportunities would take place at the cost of learning. Thus, no-one wanted that the practice based on lecture videos would weaken the grades.

To ensure that the increase in flexibility would benefit the students, it must cover all the teaching offer of the degree program. This will make studying possible also for students whose chances to participate in face-to-face education are very infrequent. However, the implementation of the practice with the master's studies in information technology has lacked significant economic resources. It is for this reason that one of the important conditions from the very beginning has been cost-efficiency.

Another important condition for the development of the practice is due to the desire to keep it as transparent as possible from the viewpoint of the lecturer and that of the student. Thus the desired aim has been that the activities in relation to the blended model would affect the face-to-face teaching situation as little as possible.

2.1 Face-to-Face Education

Face-to-face education is the foundation for the teaching as a whole. All teaching in the degree program is arranged as face-to-face teaching. In addition, face-to-face teaching is offered as real-time videos and as recordings made of it. Face-to-face teaching situation therefore, works as a production environment for lecture videos. Shooting of videos in face-to-face teaching situations is arranged in
such a way that the lecturer does not need to adapt his/her own teaching for the video recordings.

The courses are scheduled to be run as very compact entities in such a way that, typically, a single course is carried out in a few weekends. In practice this means that the duration of a single lecture session, and also the duration of a single lecture video, equals 3-4 traditional lectures.

2.2 Lecture Videos

All face-to-face situations of the degree program are recorded on video. The lecture videos can be viewed when desired either in real time at a pace determined by face-to-face learning or in a delayed mode with the help of the recordings. Students will get the use of the recordings in the evening of the day of lecture. The videos cannot be stored. To view them, the students need an Internet connection. The bandwidth requirement for videos is so moderate that a connection that satisfies it is available for all the students in the educational program. The lecture videos are kept ready for students’ use for the duration of the whole course.

All the lecture material shown by the lecturer's video projector can be seen on the video produced from the face-to-face teaching situation. Naturally, all discussions that have taken place in the teaching situation are well distinguishable on video also. Opportunities for two-way interaction between the lecturer and the student, who participates with the help of the video, did not exist at the time of study. Learning Management System’s (LMS) course-specific discussion forums take care of interaction. Figure 1 shows an example capture of a lecture video where a document camera is in use. Figure 2 shows capture of a lecture video where the lecturer uses digital teaching material and an interactive whiteboard.

2.3 Technological Solutions that Support the Practice

Of course, lecture videos alone are not sufficient to adequately diversify the teaching. Other solutions that support videos are also needed. Some of the solutions are directly connected with the lecture videos. These solutions include a LMS used for the distribution of lecture videos and a interactive whiteboard as the lecturer's tool to improve video usability. The role of the LMS as a distribution channel is more closely examined in Section III. Deployment of interactive whiteboards has made it possible to provide the lecturer with an unconstrained interface to show digital study material while in a face-to-face teaching situation. Notes and markings made on the interactive whiteboard show naturally also on the lecture videos.

Some of the technological solutions that support lecture videos are, by their nature, complementary to the videos. The aim with these solutions has been to make studying as flexible as possible also from viewpoints other than that of participation in face-to-face education. Here as a central technological solution emerges the LMS, which in the degree program is used as a material distribution channel, a communication device, a course management tool and a significant component in student administration. LMS functions as a kind of tool that brings together matters related to study, and also as a tool through which the student can get access to all study information and materials whenever he/she has an internet connection available. One important technological solution seems to be the web meeting system, which enables guidance from distance and is well suited for instructing small groups or individual students.

2.4 Participation in the Degree Program Study

The carrying thought of the education model in the master's program in mathematical information technology is to make participation in education as flexible as possible. Participation in the degree program education can take place in many different ways. The participation modes are participation face-to-face, participation with
the help of direct video transmissions, and participation by using on-demand videos. In addition, the student always has possible written course material at his/her disposal. Moreover, it is, of course, possible to study without resorting to videos or face-to-face learning, just by getting to know the written material. Lecture videos are made available for the students for the duration of the course. Thus, regardless of the participation mode, the recorded videos can be used for revision purposes.

Students do not need to decide about their participation mode beforehand; they can choose to participate in each lecture the way that is the most suitable in their own particular circumstances at any moment. Therefore, the student can participate in lectures of a course study in many different ways by flexibly combining various participation alternatives.

3. Production and Distribution of Lecture Videos

From the very beginning, the starting point for video production has been cost-efficiency and transparency for the lecturer and face-to-face students. An important principle, as far as distribution is concerned, has been that the student cannot store the videos. With this, problems related to copyrights have been avoided. Also, lecture videos are discarded once each course has been carried through.

3.1 Recording

The teaching premises of the Kokkola University Consortium have been designed with the production of videotapes in mind: among other things, the equipment required for recording is integrated into those premises. This is the precondition for being able to produce the teaching of the whole degree program cost-efficiently as lecture videos. Cost-efficiency has been achieved, above all, by high degree of automation. Automation potential needs also to be kept in mind always when planning new development targets.

The purpose of transparency in production is to allow the lecturer to concentrate on teaching in a way he/she wishes without having to pay attention to video shooting. Keeping the viewpoint of face-to-face students in mind, the aim has also been to ensure that shooting video would disturb the students as little as possible. The image source recorded on video automatically changes when, in a face-to-face teaching event, the lecturer changes the image source shown by the video projector. In this way, all the material shown by the lecturer’s video projector can be seen on the video without the lecturer having to attend to that aspect. Thus, changes to the lecturer’s teaching habits are not required. Only the chalk board and the overhead projector in the teaching area have been replaced by modern document cameras. If so wished, an interactive whiteboard can function as an interface to the computer.

As far as sound is concerned, all discussions taking place in the teaching situation are well distinguishable on video. The aim has been to build the microphone solutions for the premises in such a way that the lecturer’s voice is audible from any location in the teaching space and that the students’ comments and questions can be heard on video also.

Local recordings are also made of lectures – the problems in data networks, for example, will not affect the success in these cases. This ensures that there is a local backup copy if the real-time version becomes corrupted or fails otherwise.

3.2 Distribution

An unedited version of the video is distributed to the students in the evening of the lecture day, some hours after the lectures. The distribution system is timed to transfer the video to the media server as such, automatically. If required, small-scale editing can be done for the video during the weekday following the lecture.

Lecture videos are distributed to students from the media server. The videos cannot be stored by the students. The links for the videos are distributed to students through the Learning Management System and allocated in such a way that only those participating in the course can see the links to the course videos. The students also log on to the media server with their personal IDs for an access to the videos. This ensures that only the degree program students can access the videos. Additionally, personal log-ins facilitates research into videos and more efficient solutions for possible problem situations.

Lecture videos are discarded once each course has been carried through. This is possible because the production process is so light that the videos can be reproduced during the next face-to-face teaching session. With the disposability of videos, a situation has been reached where there are no problems as far as lecture payments and copyrights are concerned.

3.3 Future Developments

The practice related to video distribution lacked, most of all, two-way interaction between the lecturer and the student participating with the help of a video. It also lacked information about the identity of the students who had been watching the real-time transmission. Also, the students viewing the videos did not have opportunities for mutual interaction. To introduce these kinds of things requires that the practices and, above all, tools associated with video distribution be replaced. Distribution of videos is, as a matter of fact, at the focus of constant development work in Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius. As a solution to enable interaction and telepresence, a start has been made to develop a video sharing application just for this purpose [13]. The application will be integrated in the highest possible degree to the current practices and to LMS. With
the help of the application, it is also possible to further increase the flexibility of participation by making the application to support mobile devices also.

4. Evaluation of the Practice

The practice is evaluated in terms of participation before and after the introduction of lecture videos. In addition the cost efficiency of video production process and students' opinions of the suitability of lecture videos are considered.

In 2005, most of the teaching in the degree program was arranged as face-to-face teaching only. The practices related to face-to-face education has been developed since 1999. In 2005, lecture videos were tested in few courses, and due to the good results it was decided to use the lecture videos throughout the education program from the beginning of 2006. In 2010 all education was provided as a blended model based on videos. In 2010 participation in any study in the degree program was possible in three ways: by taking part in face-to-face learning, participating with the help of real-time video, or by participating in a delayed mode through on-demand videos.

The video-based blended learning practice enables distance learning. This has made it possible to market education to a wider area. It is clear that students' geographical dispersion has increased dramatically. This has, of course, the impact on participation and results. In data from 2005, only 8% of the students lived more than 100km away from the campus. In 2010 corresponding percentage was 41%.

The research data consists of statistics and attendance records for face-to-face study collected in connection with teaching that took place during Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius in 2005 and 2010. In addition, the results of an extensive student survey, which was carried out towards the end of 2010 as structured interviews of students, have been available. The student questionnaire was responded to by 67 students, which in practice includes all active students in the degree program.

The data for 2005 covers 10 courses, in which a total of 34 different students participated. Teaching arranged in these courses had a total worth of 54 study credits, and the courses included a total of 131 lectures. In 2010, 13 courses was organized in Kokkola. The research data for 2010 includes 10 of these courses for which the necessary statistics have been collected. A total of 58 individual students participated in these courses. For these courses in the 2010 data, teaching worth 40 study credits was arranged. The number of lectures in these courses totaled 104.

4.1 Participation

Resulting from a change to the practice, a significant increase of flexibility has been introduced to participation since 2005. The effects of the increasing flexibility are clear to see as a growth in the degree of participation presented in Figure 3. The lecture-specific degree of participation in the education in 2005 was on average 54% whereas in 2010, considering all the participation modes, the lecture-specific participation degree in the courses included in the data was on average 70%.

![Figure 3. The lecture-specific participation degree in the courses in years 2005 and 2010](image)

In the current practice videos play quite an important role for the participation in the degree program's educational offer. The real-time transmissions of 10 courses in the 2010 data were watched for about 600 hours while the viewing time spent for recordings was about 1800 hours. However, scrutinizing the proportions of students' participation modes tells more about the role of videos than do the user numbers. Figure 4 shows that of all the lecture participations nearly three-quarters took place with the help of videos and only one-quarter as face-to-face learning. Here a participation during which the student views the lecture concerned first time is counted as a participation.

![Figure 4. The relative shares of different participation methods in 2010 (n=1101).](image)

Though, on the whole, the participation rate has increased, participation through face-to-face learning has nevertheless fallen to 27% (2010) since 2005 (54%). This result is in line with other research [9][14]. When pondering over the significance of face-to-face education,
one should take note of the fact that participations with the help of real-time videos formed 17% of all participations. Nearly a half (44%) of the participations thus keeps in pace with face-to-face learning. Participation in this way naturally requires that there is face-to-face education available.

4.2 Cost-Efficiency

One of the important conditions for the video production has been cost-efficiency. Equipment purchases needed for video production are one-off expenditures by nature, and in the long run the greatest cost will be due to work required by the production of videos. In practice, cost-efficiency in relation to lecture videos means, above all, automation of video production processes as far as possible. Thanks to automation, videotaping lectures for a single weekend requires about an hour's work, regardless of the number of lecture hours offered during the weekend. Timing of longer lecture sessions or larger lecture series can be done beforehand, once and for all, many of the work stages having been rendered easier by the distance control facility in use. So it can be said that production process is very cost-efficiency.

4.3 Students’ Opinions

The results of an extensive survey conducted among students during the winter of 2010 indicate that the desire to participate in face-to-face learning is well alive. Based on the survey, 54% of the students would prefer face-to-face study as the participation mode, 24% would prefer videos and 22% would prefer a combination of videos and face-to-face education (Figure 5). In practice, however, adult students in active employment do not have the opportunities to participate in face-to-face education. When asked about which participation mode would suit best to the students’ schedules, the response was that participation with the help of recordings would suit best to 51% of the students. Participation in face-to-face education suited best only to 11% of them. According to earlier studies also, this can depend on the course and the students’ life situation: even students whose studies have emphasis on video participation, participate during some courses extensively in face-to-face education [15].

When we examine the students’ experiences about the benefits obtained from videos, the important role of the videos and their increased use is easy to understand. The opinion of almost all the students who took part in the student survey was that lecture videos are beneficial for study participation, time use efficiency, revision, completion of learning tasks and for understanding many kinds of issues. A mere 4% of the students felt that lecture videos make learning more difficult to some degree. A clear majority did not regard videos as disturbance. The results provide support for earlier studies, according to which video use has a positive effect on both course completions as well as on grades obtained [9], [16].

Functionality of videos for their use purpose is underpinned by the student survey, in which nearly two-thirds of the students stated that absences from face-to-face education and participation with the help of videos instead do not make learning more difficult. One should nevertheless pay attention to the fact that one in four students experienced absences from face-to-face education as a factor that makes learning more difficult. This, of course, provides support for face-to-face education.

In addition to lecture videos playing an important role in study participation, their availability from the viewpoint of the education provider is a matter of a great importance, also when viewed from a marketing angle. As a positive consequence of the practice, we can also see that deployment of videos has enabled a growth in student numbers. When education can be made available as distance study, the set of potential students becomes considerably larger. The number of students who live far away from the campus has, in fact, increased constantly, which further emphasizes the necessity for videos. Of the students who responded to the student survey, 94% were of the opinion that what attracted them towards master’s studies in information technology had a lot to do with or was greatly influenced by that the studies were made feasible to carry out alongside work.

5. Conclusion

The results clearly show that the practice that has developed in connection with the Master Studies in Mathematical Information Technology at the Kokkola University Consortium Chydenius is functional and taken into use by the students. The practice is based on a blended teaching model which strongly relies on lecture videos. Practice consists of three elements, face-to-face teaching, real-time videos and on-demand videos.

The presented blended model is at its best in giving the students an opportunity to flexibly participate in the education provided. The educational arrangements can be made such that, for each lecture, the students can select the best possible way to participate and in a manner that best suits to their current life situation. Organized this way, the teaching offers maximal flexibility from the participation point-of-view. The clear positive impact of
the practice is growth in the degree of participation which is due to more flexible participation opportunities. Another positive thing that lecture videos enable is a possibility to revise the difficult issues. This is useful for students especially when preparing for exams. The practice which enables distance learning makes it possible to market education to a wider area, which will make the set of potential students much larger. The number of students has increased considerably since the introduction of blended learning practice. It is also important to notice that the practice is very cost-effective.

One might regard the changes in interaction brought by the use of lecture videos as the negative impact. Forming groups is also more challenging in the blended model education that is based on lecture videos. It must be noted, however, that the practice enables the participation in face-to-face education, if desired, if a student is experiencing that the use of videos is making the learning more difficult. The negative impacts are, therefore, relevant specifically to those students who cannot participate in face-to-face education even if they wanted, for one reason or another.

The practice enables participation in face-to-face learning or participation with real-time video that keeps pace with face-to-face learning. It would seem that when students can freely select their participation mode, the recordings’ share is clearly the most significant but nevertheless only about the same size as the share of real time participation.

The research results show that in order to serve a heterogeneous set of adult students, face-to-face learning, real-time and on-demand videos cannot be removed from the practice. The practice should be maintained as it is, so that the student can choose his/her participation mode, even if the selection is not always feasible due to practical considerations. From the viewpoint of the education provider, the positive impacts of the practice are significant enough to justify directing resources for the development of education based on the model.

Acknowledgements

The authors wish to thank the European Commission and The European Regional Development Fund for the grant given to the “Ubiquitous Learning Environment for Adult Education” project, the Executive Agency for its help and all the partners of the project for their contribution.

References


