

## **Teaching via Podcasting: One year of Experience with Workflows, Tools and Usage in Higher Education**

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### **Abstract:**

Since spring 2006 lecture recordings have intensively been used as a teaching tool at two universities in Osnabrück. In the meantime several courses are provided with lecture recordings - especially podcasts - as complementary learning material. Podcasts are now established as a regular service for lecturing. In addition different distribution variants of lecture recordings have been investigated. This article presents how the use of lecture recordings and podcasts have changed the way of learning and teaching at our universities. As a conclusion a didactical concept for a blended learning/teaching style using podcasting is proposed.

### **Introduction**

Lecture recordings are a cost-efficient and easy-to-use way to produce e-learning content (Lauer & Ottmann 2002). Employing lecture recordings as supplementary material in a conventional lecture has become a widely used application scenario (Krüger 2005) even though lecture recordings can also be employed in a number of other ways (Mertens, Knaden, Krüger & Vornberger 2004). In a former paper (Mertens, Ketterl, Morisse, Vornberger 2006) a workflow and tools for automatic content distribution based on lecture recordings for stationary and mobile devices have been shown. Intensive experiences have been made with the limits of the automatic generation of content and the additional investments of manual post-production. This paper describes the experiences we made during the last year using this kind of technology in a higher education context.

What is generally important in the setting we are now using lecture recordings: The role of the teacher fundamentally changes. Initially we just offered the lecture recordings as additional material to the usual lecture documents (pdf document of presentation slides or a script) to our students. During that phase the way of lecturing did not change in principle. The actual scenario is more incisive: At the moment some of the lectures which work with the recordings of former courses are organized in a completely different way. The recordings are a central part of the teaching concept. The change in the use of lecture recordings has been made from enrichment of other material to an integral part of the teaching material. Concurrently the role of the teacher has changed from the classical teacher to a learning coach.

The structure of this article is as follows. At first we describe the integration of the lecture recordings into the curriculum of the respective lecture. Then we present the results of a technical and didactic evaluation. The potentials of podcasts used in an academic environment are explained in detail in the following section. The final section describes how the consequent usage of lecture recordings might induce a change in the teaching style. The paper closes with a summary and some final remarks.

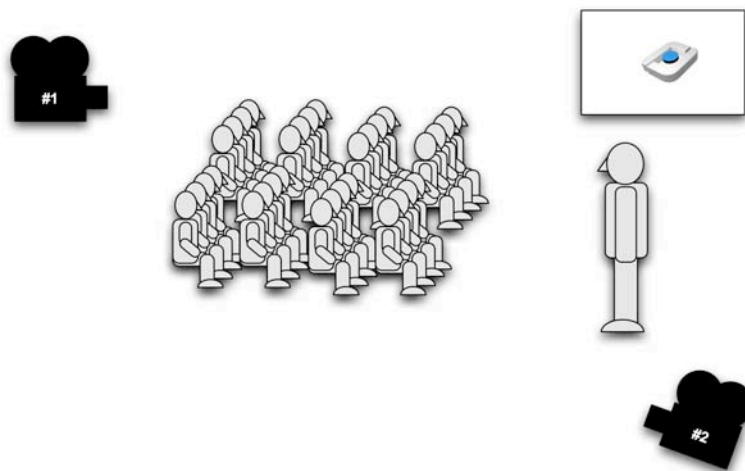
### **Integration of Recorded Lectures into the Lecture Curriculum**

The author offers the course „Audio- and Videotechnology“ each semester at the University of Applied Sciences in Osnabrück (Germany). This is an obligatory course for the students in the study course „Medieninformatik“ (Media and Computer Science). For students from other disciplines „Audio- and Videotechnology“ can be chosen as an

optional module. In general the University of Applied Sciences Osnabrück has an intensive model of support for the students. One of its advantages is that courses are given for relatively small student classes. The number of students varies between 15 and 35. The course „Audio- and Videotechnology“ is offered as V2 + P2 module, i.e. 2h per week for the lecture and 2h for practical exercises. The practical part provides insight in the practical work with audio and video. For this 4h per week the students get 5 ECTS (European Credit Transfer System) after successfully passing the final examination, which is a written test or homework.

The contents of the course are the technical principles of Audio and Video in the context of computer sciences, i.e. analogue signals, digitization of audio and video signals, data compression of audio, still and moving images, distribution of audio and video especially over the internet. The fact that the techniques to produce and distribute the learning material matched the content of the course was an additional motivation to work with lecture recordings. Furthermore the lecturer could experiment with different types of distribution techniques.

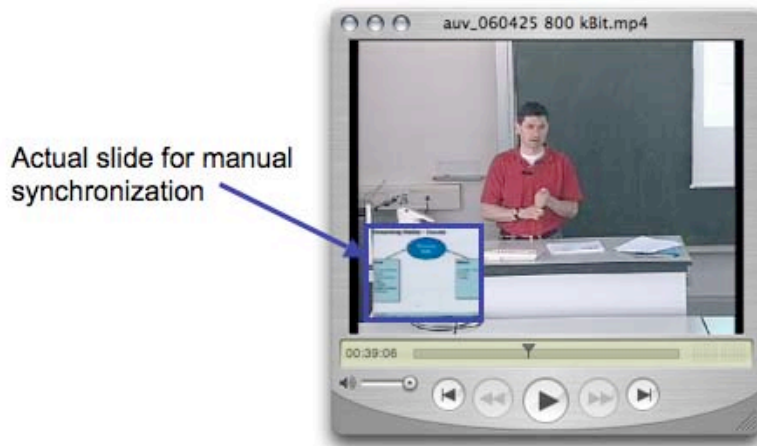
During the entire production and teaching process several variants of lecture recordings have been investigated. All variations were lecture recordings of regular course presentations, in which the lecturer presents the content in a lecture room in front of the students (see Figure 1). Contrary to other lecture recording services where lecture recordings are used to accomplish huge student numbers, e.g. in (Affolter, Wilding, Korner, Lautenschlager 2006), we see an advantage to offer this service especially to small groups because the content of the recordings can intensively be discussed among the teacher and the students (see didactic concept).



**Figure 1: Recorded lecture setting**

During the presentations, which were recorded in the former semester the lecturer used electronic slides showed with a beamer and a whiteboard for additional explanations. The lectures took place in a multimedia lecture room equipped with two beamers, two remote control cameras and stage lighting. The two cameras were mounted at the front side and the backside of the lecture room and delivered an analogue video signal to a control room for live production and storage. Before starting the lecture recordings, we needed the permission of the students that they accept to be seen in the picture. Otherwise it might be a legal problem to publish the material publicly. For our 'shooting' the camera at the front side was not used.

One of our goals was to prevent the acquisition of additional personal for the recording. Therefore we had to produce with a high degree of automatism and could not use the remote control option of the camera . Alternatively a suitable shot and the right position for the lecturer had to be defined before starting the recording.



**Figure 2: Pic-in-Pic shot of recorded lecture**

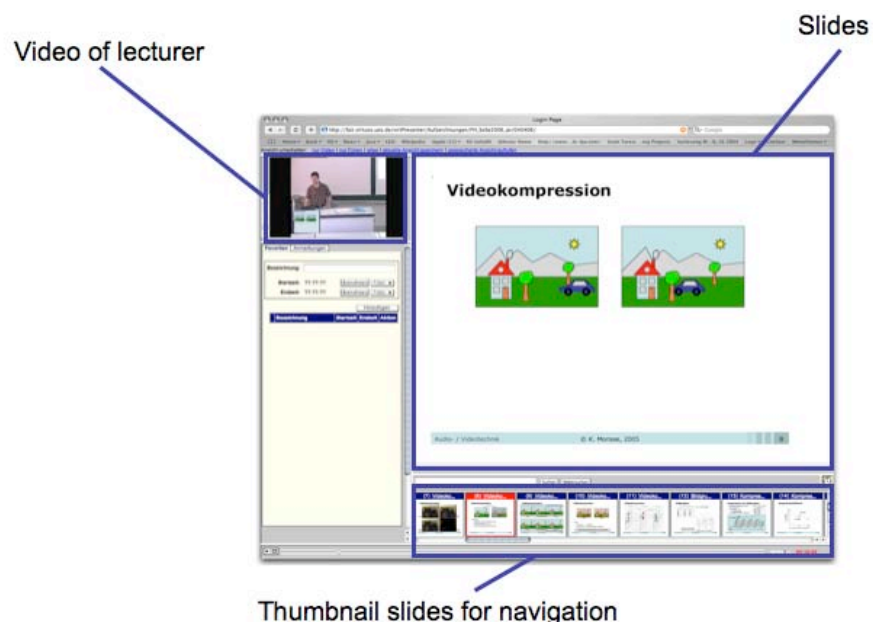
Complementary to the lecture recordings the students had access to electronic copies of the commented presentation slides (i.e. most of the slides have explanatory notes to the content of the slide). At the end of the production process those presentation slides are shown in the right lower corner of the lecture recording video stream (see Figure 2). The picture-in-picture shot can be used for a manual synchronization of the lecture recording and the electronic slide document.

### Technical Evaluation

To get a general idea of the diverse realization possibilities of lecture recordings and their potential benefit, several variants of lecture recordings have been used:

- Live and On-demand Streaming of a lecture
- Synchronized on-demand Presentation of audio, video and slides
- Podcasting

In addition to those formats the presented slides with additional comments have been made available to the students in advance to the lecture.



**Figure 3: Synchronized presentation of video and slides**

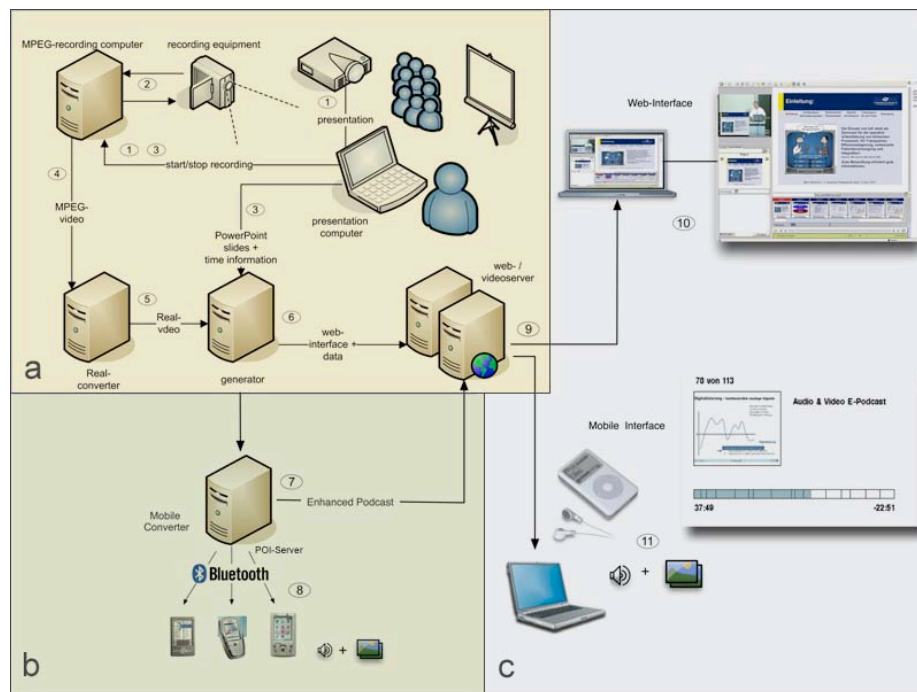
### Live and On-demand Streaming

Live- and on-demand streaming had been offered as an additional service to the live lecture, which was given each week of a semester. Both variants can be realized with minimal efforts with available technology. In Osnabrück, we prefer the Apple Quicktime streaming technology. The analogue composite signal coming from the camera in the lecture room has been digitized and then streamed by the publicly available Apple Quicktime Broadcaster to a streaming server used in the university for the distribution. Concurrently the digitized material had been recorded on disk for the on-demand service. The necessary effort for supporting this kind of lecture recording is very low. The recorded material must be cut at the start and the end and must be coded to a streaming format (usually we are using MPEG-4 in two quality levels for broadband and narrowband networks). To gain access to the material, the URL to the stream had to be published on a web site.

### Synchronized on-demand Presentation

The synchronized presentation of audio, video and the used slides (see Figure 3) needs more efforts to generate. However, we use a highly automated production chain consisting of several systems. An overview of the complete scenario is given in Figure 4, a complete description can be found in (Ketterl, Mertens, Morisse, Vornberger 2006). Starting point is virtPresenter, a PowerPoint-based lecture recording system. The final result offers a fine granulated access to the learning material for the students. The resulting lecture recording is a web enabled presentation that incorporates a number of navigation features like full text search on the slide text or structural elements based on slide animations that are combined to a hypermedia navigation concept (Mertens, Schneider, Müller & Vornberger 2004).

A disadvantage of the system is the lack of system-independence. On the lecturers side a Microsoft Windows enabled PC with some additional software libraries to connect virtPresenter with PowerPoint is required during recording. A more restrictive requirement is a Windows Platform on the clients' side. This is inadequate in a university context, where several students are using Linux or Apple Mac OS X.



**Figure 4: Media production chain from (Ketterl, Mertens, Morisse, Vornberger 2006)**

## Podcasting

With the availability of podcast technology the offered lecture recording material has been extended into podcasts. The word Podcast is a combination of the word Broadcast and the name of the popular audio player from Apple Computer called iPod. Podcasts can be used with a variety of digital audio formats and can be played on almost any audio player or computer. Even on mobile phones it is possible to use podcasts. The term Podcasting describes the production, distribution and the automatic download of audio data from a publisher to a subscriber over the Internet. For academic purposes the podcast subscription model is very interesting. The digital sound object is passed to a Web site or a Blog in a data structure called an RSS 2.0 envelope or feed. RSS stands for Real Simple Syndication and is an agreed specification of XML tags. This envelope contains all the information about the audio object (e.g. URIs, publish dates, titles, accompanying text descriptions) in a XML data structure.

In general, three types of podcasts can be differentiated:

- Audio Podcast
- Enhanced Podcast (Still Images + Audio)
- Video-Podcast (Moving Images + Audio)

Enhanced Podcasts do not only contain audio information, but also integrate new data information that can be synchronized to the audio information. E.g. an image or an URL can be shown at a certain time concurrently to the audio information in a synchronized manner. There are software tools available to support the production process as well as the consumption of Enhanced Podcasts. Most of them are free- or shareware. Like usual Audio Podcasts, Enhanced Podcasts can be used on different platforms and devices. Players are available for Windows or Mac computers as well as for mobile devices. A video podcast is usually H.264 coded video sequence embedded with an RSS envelope in the podcast structure. In the context of lecture recording they are typically used to show a picture of the lecturer or a screen capture sequence.

All forms of podcasting offer the additional benefit of supporting learning processes. This has been investigated e.g. in (Ketterl, Mertens, Morisse, Vornberger 2006) or (Ketterl, Mertens, Morisse 2006). It is an interesting and important feature, however not in the focus of this paper.

Enhanced podcasts and video podcasts based on recorded lectures offer a very interesting approach to support the ubiquitous learning process. With the combination of a fine granulated structure of a recorded lecture, a podcast allows a very precise navigation to specific content of a lecture that can be used anytime and anywhere. However, especially considering the very tight financial and personal resources at universities, the production process is desired to be automatized to a high degree. A manual step in the production workflow of a supplementary podcast for a lecture is difficult to realize. Through the combination of virtPresenter lecture recordings and Apples ChapterTool for segmentation of podcasts it is possible to automate the creation of Enhanced Podcasts on base of recorded lectures. However, if different media types are used in a lecture to explain some specific issues (e.g. electronic slides, animations, video, audio) an automatic production chain will fail. To change the setting, e.g. from lecturer to shown media, a manual adjustment is necessary. This can be done at time of recording. However, it requires a direction and the corresponding technical equipment. As an alternative it can be done manually at time of post-production, which destroys the automatic production chain. As a matter of fact, before winter term 2006, a special version of the “Audio & Video” podcast had been produced, where the lecture recordings from former semesters were used. It is a mixture of enhanced podcast episodes and video podcast episodes. Additional material (animations, video sequences, audio) was integrated in moving pictures from the lecturer and still pictures from the slides. In addition, the typical animation steps of a PowerPoint presentation were partially integrated in the podcast.

Podcasts, as other forms of recorded lectures, can be published on internal web site of the university. However, podcasts can also be published on a popular podcasting platform, the Apple iTunes Music Store (iTMS). It is a very popular platform for publishing digital music and, in the last months, it also has developed to a platform for distributing learning material. On the iTunes platform podcasts can be categorized in different content categories. For learning material in a higher education context usually the category “Education – Higher Education” is used. Within this group most of the available podcasts (about 100 in April 2007) are pure audio podcasts. Some of them are published as a video podcast, usually showing the lecturer in the classroom or a screen capturing of the presentation. Only a very few of them are published as enhanced podcasts. The reason for this is the higher production complexity to synchronize the audio track with the corresponding still pictures.

## **Evaluation and User Experience**

At our university all lectures are evaluated by the students in form of an evaluation questionnaire each semester. In general, the service of lecture recordings was evaluated in several evaluations very positive. The live streaming offers the students an “any-where” comfort, i.e. they do not have to be at the lecture time in the lecture room but they can join the lecture from anywhere in the world. Unfortunately without the possibility for the students to ask further questions to the taught content. The same disadvantage is true for the students following the on-demand streaming version of the lecture. However, the students did use both variants. As anticipated the streaming service of the lecture reduced the students joining the lecture live in the classroom dramatically. Only 1/3 to 1/4 of the students visited the live lecture after publishing the streaming content.

The feedback of the students to the accompanying streaming service to a live lecture was very positive. Concerning the making of the recordings there were different opinions to the camera angle. Some of the students preferred a full screen streaming of the slide; others preferred a full screen streaming of the lecturer or at least an active change between both settings. The latter is interesting; it indicates that the person who is speaking seems to be important for the viewer. The the ‘human factor’ of a completely electronic, mediated lecture still appears to be a basic need of the viewer. There seems to be a clear emotional demand in electronic learning matters.

Furthermore the students claimed a fast and precise access to specific topics of the learning material to prepare themselves for the final examination as efficient as possible. However, this is not possible with the used Quicktime Streaming technology. It only offers a timeline based navigation, which is too rough for the mentioned navigation demands. This very precise navigation with a search option is offered by the synchronized presentation of the lecture (Figure 3). But with this technology the restrictive requirements of specific software libraries caused technical problems in our quite well-equipped lab. Therefore the use of podcasts as a distribution channel seemed to be a very good compromise between comfortable usage and additional benefit for the students.

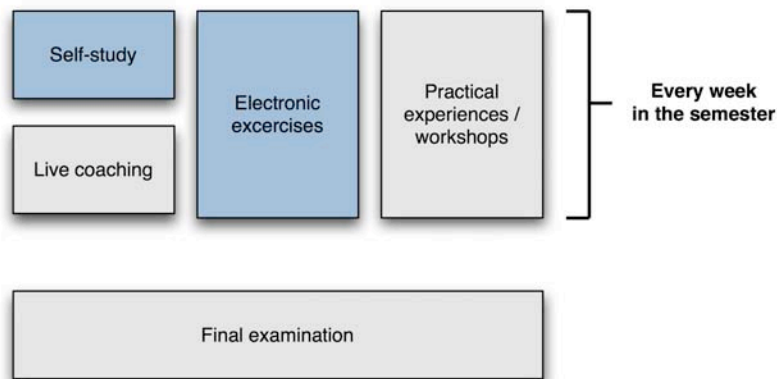
The publicly available podcasts in the iTunes were very popular. After publishing the lecture “Audio- & Videotechnique” in the German iTunes from October 2006 to February 2007, each of the 35 episodes was downloaded more than 1.200 times. For several weeks the course was in the top ten charts of the iTunes. A final questionnaire for the external users gave very interesting results about the external users, their used devices and their motivation to subscribe this podcast. In (Schulze, Ketterl, Gruber, Hamborg 2007) this evaluation is described in more detail.

A quite interesting result of the questionnaire was that the students pointed at a ‘dangerous’ effect in the context of using comfortable streaming services: The typical attitude “the material is available anytime, thus I will go through it later” could be observed. To help the students to avoid that kind of ‘self-deception’ additional motivating factors for a continuous preoccupation with the lecture recordings had to be found.

## **Didactical Conception of a Blended Learning Scenario based on Podcasting**

In the current semester we organised the use of recorded lectures in a didactically new way. In the former semesters recorded lectures in all described variants were used as supplementary material to the regular live presentation in the classroom. Based on the experiences gained in the past, we developed a didactical concept for blended learning based on podcasting (see Figure 5). This concept is embedded in the academic framework of teaching modules in the following way. A module like “Audio-/Videotechnique” with 4 teaching hours per week and 15 weeks per semester is calculated with a workload of 150 h per student for the whole semester. This 150 h are divided in several parts:

- 30 h lectures, 15 h lab work, 2 h final examination
- 15 h preparation for final exam, 58 h working in small student groups (without lecturer), 30 h preparation of lectures



**Figure 5: Building blocks of didactic concept**

The didactic concept consists of five building blocks. The first four blocks are repeated weekly during the semester. The final examination as the final block is done only once.

### Block 1: Self-Study

Weekly the students are provided with new podcast episodes. The content of those podcasts was recorded during the course in the former semester. New episodes are published each week in the iTMS. Thus for the students a very tight schedule to work on the offered material which is published.

### Block 2: Live Coaching

Weekly there is one meeting with both the students and the lecturer. The goal of that meeting is to discuss the content of the relevant podcast episode - not to repeat the content of the podcast or to present new content. From the lecturers point of view it is expected that the students watched the corresponding episodes and tried to understand the content. The students can use the meeting to clarify misunderstandings or to ask for things they did not understand by listening to the podcast.

### Block 3: Electronic Exercises

Accompanying to the podcasts a system with electronic exercises has been set up (see Figure 6) within the learning management system, which is the open source platform Stud.IP. To each podcast episode there is a couple of exercises to the specific content of that episode which can only be solved in the “publish week” of this episode. This block is an essential motivation for the students to work on the podcast episodes in a continuous way during the semester and to prevent from the attitude “I have the content and I will look on it later”.

The screenshot shows a web interface for a learning management system. The main content area displays a table of tasks for the course 'Analoge Audiosignale - SoSe07'. The table has three columns: 'Aufgaben' (Tasks), 'bearbeitet' (Processed), and 'max. Punkte' (Max. Points). The tasks and their statuses are as follows:

Aufgaben	bearbeitet	max. Punkte
Schallsignale	✓	8
Entstehung von Schallwellen	✗	4
Schallgeschwindigkeit	✗	4
Wellenlänge	✗	1
Reiner Ton	✗	3
Schallbereiche	✗	4
Mikrofone	✗	4

Below this table, there is another section for 'Analoge Videosignale (1) - SoSe07' with a similar table structure.

### Figure 6: Electronic exercises

#### Block 4: Practical Experience

To get some practical experience with the media types Audio and Video the lecture is accompanied by some lab hours. This time is used for working with cameras, non-linear editing and compositing systems, setting up streaming scenarios and other relevant work. This block is used to consolidate the theoretic background by practical work.

#### Block 5: Final examination

The lecture is finished with a final examination. Usually this is a written examination or homework.

### Summary and Further Investigations

Recorded lectures as a supplementary service for students are used at several universities. This paper describes ways of using recorded lectures in the context of higher education in Osnabrück. Different technological approaches are available – with commercial as well as free software. Starting with a simple streaming approach and a sophisticated synchronized presentation approach, podcasts with an easy-to-use distribution strategy (subscription model) have turned out to be the favorite format for the distribution of recorded lectures. They offer a fine granulated access to the content and can be used platform-independent. Based on intensive experiences with different forms of recorded lectures, a new didactical concept for a podcast-based blended learning approach has been developed. This concept is under investigation in the current semester at the University of Applied Science in Osnabrück (from March to July 2007).

As a next step we will examine the usage of podcasts in combination with other learning material (scripts, wikipedia, books etc.) from the HCI (Human computer interface) point of view within the current semester. We are going to observe the user interactions by means of an eye-tracker and video observation. Another issue is to bring the electronic exercises to mobile devices (e.g. iPod). For further readings see (Ketterl, K., Heinrich, T., Mertens, R., Morisse, K. 2007).

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