Enhanced Content Utilisation: Combined Re-Use of Multi-Type e-Learning Content on Mobile Devices

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Abstract—**For many students, lecture podcasts are a valuable addition to live classes. The recorded lectures can be easily accessed and can be listened to virtually anywhere. This paper presents an approach that enriches lecture podcasts with a learning feedback component that enables course related quizzes to be integrated into mobile content. This is realized by using a standard iPod feature called iPod Notes. The quizzes can be automatically generated from the ViPS web based quiz system.**

Index Terms— **Content re-use, iPod notes, Lecture podcasts, Lecture recordings, Mobile content, Online assignments**

I. INTRODUCTION

With the emergence of powerful mobile devices like PDA's, mobile phones or basic audio/video players, mobile-learning (m-learning) becomes more and more important in universities. M-learning can extend the benefits of e-learning (e.g. access to information, learning anytime anywhere) to a much wider range of teaching and learning contexts. With mobile learning students get a new degree of freedom when and how they want to consume learning contents. Now they can replay lectures e.g. on the bus on their daily way to the university. A change can be observed, that more and more students are equipped with even a simple mp3 player.

Along the benefits of m-learning there are also many problems concerning the design, production and distribution of e-learning content for mobile devices. Typically, content needs to be formatted and converted to comply with the restrictions and requirements of mobile devices. It is too costly for universities to produce content that is only suitable for m-learning. In an ideal scenario regular produced e-learning content could be reused on mobile devices without manual action.

Another main question when considering mobile learning is, how students gain access to the content and how producers can distribute their material. Cellular network connections are still quite expensive for students. Therefore other ways of transferring content to mobile devices have to be utilized.

This paper will describe how e-learning content that is already in use at the University of Osnabrueck and the University of Applied Sciences Osnabrueck could be offered and re-used in an easy way that suits the needs of the students and complies with their mobile equipment.

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II. CLASSIC E-LEARNING CONTENT ON MOBILE DEVICES

At both universities in Osnabrueck the open source learn management system (LMS) Stud.IP [1] is used as an inherent part of teaching and learning since 2004 with about 18.000 participating students [2]. The system is the main resource and repository for e-learning content. It supports lecturers as well as students to organize their courses and to communicate between each other. Stud.IP offers a set of tools, like an overview of the course participants, a forum for discussions, a wiki for collaborative text generation, download areas to provide learning material and an online examination system called ViPS [3]. To limit the production costs for universities, m-learning should make use of these very different types of existing e-learning content. Lecture recordings e.g. have shown to be a cost-efficient and easy-to use way to produce e-learning content. At the University of Osnabrueck and at the University of Applied Sciences Osnabrueck, an automatic approach for lecture recordings using Stud.IP for the content distribution is currently under development [4] and being tested. It is designed to feature a fully automated production chain from starting the presentation to linking it to the corresponding course within the LMS. The production chain's main outputs are lecture recordings that can be viewed on a PC [5]. In addition to the consumption of these recordings on a PC, a highly accepted approach in our environment is to offer the audio/video recording of a lecture together with the synchronized presentation slides as an enhanced podcast or a video podcast.

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. With the combination of a fine granulated structure of a recorded lecture [5], an enhanced podcast allows a very precise navigation to specific content of a lecture even on a mobile device [6].

Currently Apple´s iPod is most suitable for the podcast technology. But usual podcasts or video podcasts can also be used on different computer platforms and on other mobile devices. Enhanced podcasts or video podcasts based on recorded lectures offer a very interesting approach to support the ubiquitous learning process. Associated with an online examination system like ViPS which is described more precisely in section 3, learning on the go gets even more attractive. Moreover, lecture recordings can influence the teaching style massively. Figure 1 gives an overview of the scenario.
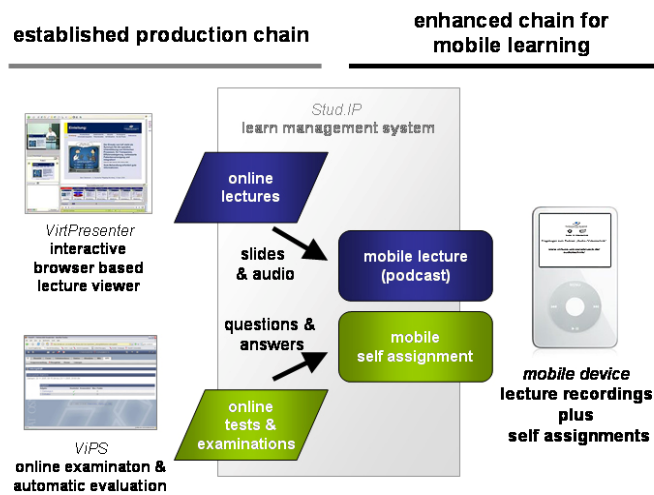
Fig. 1: Re-using existing learning content on mobile devices

III. LECTURE PODCASTS

The distribution of the mobile learning content is handled by Stud.IP. Students register themselves for their courses in the LMS. After this they can either subscribe to a podcast of a course with a podcast client software (podcatcher) like iTunes or they can download available podcast episodes one by one. With a subscription, the podcatcher software automatically downloads new podcast episodes as soon as they are finished and released. After downloading, the lecture podcasts can easily be transferred to mobile devices to be viewed [7].

Since March 2006 podcasts are used as an easy to produce (and easy to use) supplement for lecture recordings at both universities in Osnabrück. In the beginning, podcasts were only an add-on of the standard lecture recordings, as a further re-use of the recordings on a mobile device. But during the last few months we had very positive feedback from our students as well as from external podcast subscribers from outside the universities that let us know that we should enlarge our podcast efforts.

It was eye-catching that students as well as external users were using Apple´s iTunes as the primary podcast client. The reasons for this fact are manifold. iTunes makes syncing podcasts as easy as managing them. A further reason certainly is the simple handling of different file types (Video & Audio: MP3, WAV, AIFF, MPEG4, Apple Lossless, M4P/AAC Protected Content, and a variety of QuickTime supported media formats as well) and several media resources (user library, streaming radio server) as well as the seamless integration of the popular online music store. Apple's iTunes Music Store (iTMS) lets customers search within an enormous catalogue of tracks, including music from all major labels. The significant feature for podcasting is that besides the commercial music and film offer, one can also easily find free of charge podcasts and video podcasts with different topics from various producers in iTunes. These podcasts can be uploaded by anyone registered in the iTMS.

Besides the distribution over the internal university LMS we also experimented with Apple´s iTunes music store as a distribution platform to make the lecture podcasts available as

Open Scientific and Educational Content (OSEC) for a wider community. Several lectures from Osnabrück can be found in the iTMS. A public evaluation gave us very positive feedback for this offer. To get an impression of the impact of our lecture podcasts on external users, we announced an online survey to our subscribers.

A special podcast episode was created to point learners to an online questionnaire. 205 individuals participated in the survey. This survey makes it obvious who's using podcasts and which devices are used. Additionally iTunes was confirmed to be the main podcast client software. 163 out of 205 watch lecture podcasts on a PC or a laptop. 30 users prefer Apple´s iPod for consumption and the rest of the subscribers use other mobile devices (Sony PSP, or some mobile phones). Also noticeable is that most users have seen/listened to whole podcasts episodes. They haven't skipped parts of individual episodes, but rather follow the whole episodes. Thus, it became obvious that the majority use podcasts on a usual computer or a laptop rather than on a mobile device. A main reason for that is currently that only a marginal rate of students has an expensive iPod device.

The fact that we used an online survey may, however, have influenced results since really mobile users might have ignored the survey, because they have listened to the podcast when they did not have access to a computer. Nevertheless we are going to improve the mobile model, because the survey has further shown that students as well as external listeners are more and more equipped with iPods and other powerful mobile devices. In doing so we're bringing another existing learning content resource from the LMS to mobile devices. This resource is specified in the next chapter.

In some lectures, the style of teaching has been changed completely. In the first trials podcast or lecture recordings in general have been used as an enrichment of the learning material. In the last term, teaching has been changed from presentation to coaching. Instead of presenting the learning content in the classroom, the pure presentation has been moved to the podcast platform and is supported with coaching meetings, where the students can ask specific questions to the podcast material. Additionally, an intensive practical work in the context of the lecture had to be done by the students.

IV. ViPS ONLINE EXAMINATION SYSTEM

A. What is VIPS

ViPS (Virtuelles Prüfungssystem – Virtual Examination System) is an online examination system that is developed and used at the University of Osnabrueck to conduct online exercises and examinations [8]. The focus of ViPS is on the automatic evaluation of student exams and assignments. ViPS is integrated in our local Stud.IP-LMS installation. At the University of Osnabrueck ViPS is utilised especially in courses with a large number of participants, where regular examinations would produce an enormous workload for the lecturer. ViPS should help to reduce that workload by the automatic evaluation of answers provided by the students.

There are two types of scenarios where ViPS is used. With exercises during a semester, a lecturer can provide feedback to the students about their learning progress. Final examinations
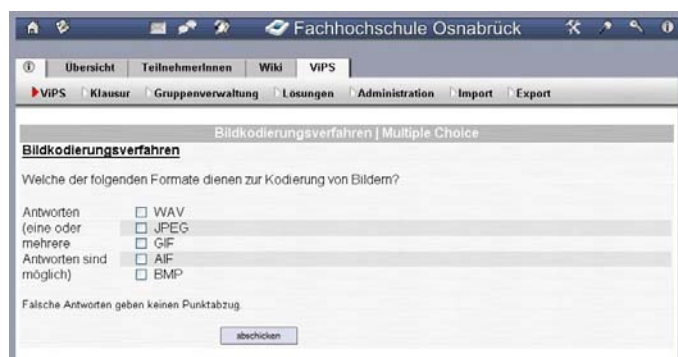
Fig. 2: A question of the ViPS system as seen by students

Fig. 3: The mobile learning workflow

at the end of a semester are used to assess the knowledge of students. Exercises can either be completed by a group of students or by an individual. Examinations are always designed to be conducted individually.

ViPS enables lecturers to create, maintain and evaluate virtual exercises. It supports different types of questions. Most of them can be evaluated automatically, e.g. single choice, multiple choice and the mapping of terms. As a complement there are also types of questions without the support of automatic evaluation, like questions with free text answers. Fig. 2 depicts a typical question of the ViPS system.

B. How is it used for mobile learning?

In the context of mobile learning, we use ViPS as a resource for questions that should help the listeners of our lecture podcasts to asses their understanding of the learning content. The original lecture recordings, from which podcasts are produced, are associated with a course inside our LMS Stud.IP. Since ViPS is also an integral part, we are able to define and extract questions that are associated with that course. The lecturer defines, which questions he wants to use for a specific lecture podcast. To be able to use the questions in the regular ViPS system and also for mobile learning, the lecturer is currently restricted to the use of single choice questions.

V. MOBILE LEARNING WITH SELF ASSESSMENT

A. Combination of podcasts and notes

Lecture podcasts have shown to be a popular way to deliver learning content to students and interested persons outside the university, that normally don't get access to this type of learning material. The main reason for the success of lecture podcasts is the easy way of distribution where it is possible to reach a big amount of users in a very convenient way.

Our experiences in lecturing have shown that listeners of lecture recordings need to have a way of evaluating their learning progress. This is especially the case in the mobile scenario. The problem with mobile lecture podcasts is, that listeners tend to be distracted by their surrounding environment. Therefore it is important to provide listeners a feedback of how well they understood the contents of the podcast they listened to.
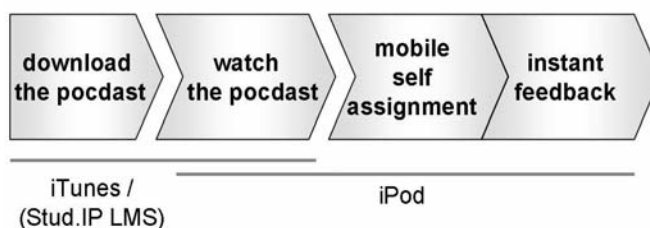
We realized this by reusing another existing resource of e-learning content. Likewise the lecture recordings get reused as lecture podcasts we reuse questions for the mobile user from the ViPS examination system. We transform exercises of a lecture into a mobile self assignment and bundle this with the corresponding podcast. The bundle can then be used on a mobile lecture player, e.g. the Apple iPod. **Error! Reference source not found.** gives an overview of a student's mobile learning workflow.

B. Implementing mobile assignments

We choose the Apple iPod as the reference platform for implementing the mobile assignments because of its feature called iPod Notes. iPod Notes enables the iPod to display interactive personal multimedia presentations [9]. The Notes feature is supported for iPod models beginning with third-generation iPod models with touch wheel. It provides the display of text including simple hypertext features.

A note is a small text documents that can be enriched with HTML-style commands. The list of commands supported by iPod Notes is rather small. It is able to display text with simple links to other notes or media files on the iPod. Notes can currently hyperlink to four types of media files: photos, audio files, graphics used as album cover art and videos. In addition iPod Notes recognizes some special text files that can store preferences, display menus or refer to other notes or media files as symbolic links. These files are identified by their name or extension.

One requirement we wanted to satisfy with our mobile self-assignments is the instant feedback to the user. Listeners of our podcasts should read corresponding questions, choose one of the possible answers and get the immediate feedback, if they chose the right answer. The user interface of an iPod does not allow the input of text therefore it is only possible to use pre-formulated answers. With this single choice questions can be implemented. Multiple choice questions aren't possible yet, since the iPod Notes specification doesn't support real input formulas. The feature of linking notes to each other allows us to implement simple exercises. An exercise consists of several note files in a folder. Each question is written into a document followed by several possible answers. The answers are hyperlinks to other note documents. A user can select an answer and switches with this action to the referenced note document. Depending on the answer he chose, he gets directed to a different document. If the answer is right the user can go on to the next question or if the selected answer was wrong the user could follow a link back to the lecture podcast to repeat the explanation of the topic. Fig. 4 gives an example of how a single-choice question is displayed on an iPod.
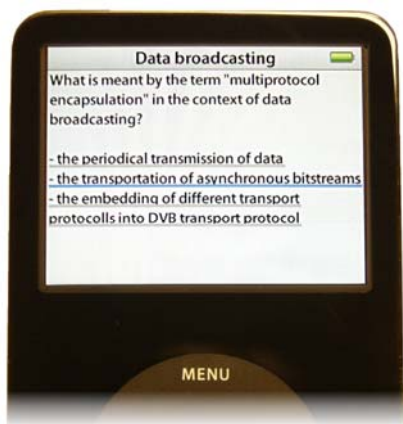
Fig. 4: Photo of an iPod displaying a question of a mobile
 self-assignment

Currently there is a limitation in the ease of distribution of iPod Notes: Notes must be transferred manually to an iPod. Apple iTunes doesn't support the automatic transfer of notes. This is a real drawback for external listeners from outside the university. For students we are offering lecture podcasts via Stud.IP or an internal website, where we are able to offer the lecture podcasts in combination with the mobile self-assignments. There are also indications, that with iTunes U, the iTunes university portal, it is possible to provide iPod Notes via iTunes, but we were not able to verify that up to now [10].

Students have to download the exercise as a compressed archive file. After decompression, they have to move the folder with the exercise to a folder called "notes" on the iPod. After disconnecting the iPod the test can be found under the item "notes" in the iPod menu.

VI. CONCLUSION AND FUTURE TRENDS

This contribution presented a practicable and easy to use procedure to bring traditional e-learning content to users of mobile devices. The consequent re-use of existing learning content has proved to be a cost efficient way for universities to provide students with mobile learning services. Also the techniques employed like the iPod Notes feature aren't new, the combination of lecture podcasts with simple text-based mobile self-assignments open new opportunities in the mobile learning experience. Linking assignments and podcasts on a mobile device in a sophisticated information design is a possibility that was neglected in the past. Due to the fact that the iPod becomes more and more attractive for students it is very important to include such devices (or simple mp3 players) in learning processes. In contrast there are certainly critical comments, if there would be enough (student) users equipped with an expensive device like an iPod that would

benefit from this mobile content. We also have to answer, if the featured media files are adequate to really support a student who didn't understand a topic or a single part of it. Nevertheless we believe that lecture podcasts in combination with self assignments are a promising way to attract more people to m-learning. Considering the survey in section III that has shown that most users would consume lecture podcast not on a mobile device but rather on a normal PC could tighten their learning aims when they could train their knowledge with self assignments on a mobile device. In the future we will expand our free podcast learning offerings based on lecture recordings in Apple´s music store.

Further questions that we will have to focus on in the future are how to deal with the copyright for the used learning material and how to integrate mobile learning into services like off-the-job trainings that might be offered by a university.

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