Multimedia support for individualized learning

EVA HLADKÁ, MILOŠ LIŠKA

Czech Abstract

Snaha vzdělávat stále větší část populace na vysokých školách vede k zvyšování počtu studentů na kurz (přednášku, cvičení) a k nemožnosti respektovat různou úroveň osvojování si vědomostí jednotlivými studenty. Proti tomuto trendu lze využít multimediální technologie a v úrovni asynchronní výuky umožnit studentům individuální přístup k přednáškám, aniž by byl zvýšen počet pedagogů.

Na FI MU se již po čtyři semestry provádí záznam přednášek, jejich zpracování a následné vystavení na webovém portálu. Studenti se tedy mohou i mimo přednášky vracet k jejich úplnému znění a podle své potřeby využívat záznam jako studijní materiál. Zaznamenávání přednášek bylo zprvu rozpačitě přijímáno pedagogy, ale po zkušenostech s nerušícím provozem kamer a výhodou zpětné vazby k vlastnímu výkonu se prosadilo. Studenti, od nichž tato aktivita vzešla, od začátku záznamy využívali a dnes je přímo vyžadují. Dalším efektem této aktivity je zpřístupnění přednášek studentům, kteří se nemohou výuky účastnit (např. pro nemoc). Přístup k záznamům je průběžně vyhodnocován a související statistiky jsou k dispozici na uvedeném portálu http://video.muni.cz.

Dvouletá zkušenost se zaznamenáváním přednášek ukazuje, jaké možnosti tato relativně jednoduchá multimediální podpora výuky poskytuje. Ze statistik využití záznamů a účasti studentů na přednáškách je vidět, že záznamy nenahrazují účast studentů na přednáškách, ale slouží jako studijní materiál. Umožňují volit individuální tempo studia včetně možnosti opakování náročnějších pasáží, aniž by bylo nutné zvyšovat počet přednášejících a konzultantů. Díky tomu se staly mezi studenty oblíbeným studijním materiálem.

Introduction

The growing number of students enrolled in universities stresses the capacity of lecture theatres and teachers. All students usually have to pass introductory courses in which a study group may consist of hundreds of students. Extensive technological support is the only solution when economical constraints are ale considered. Modern presentation and projection facilities are far from enough. Their main disadvantage is the de-personalization of the teaching process, as the speed of the lecture must be adjusted to an "averaged" student. It is almost impossible to ask questions during a lecture for several hundred students, and the teacher simply does not have enough time to answer all potential questions afterward (and or the quality of teaching assistants may vary considerably). Even access to the lecture material (slides) could not

compensate for the lack of individualized approach, leading to the substantially lower efficiency of the learning process.

One of the most promising solutions to this problem is that by means of lecture streaming. Several projects are already under way, usually aimed at external audience, where lectures are recorded and made available to students (see Mu (2002) from North Carolina, Stanford online [4], BMRC from Berkeley [1]).

Based on these experiences, we designed a new system and approach (see [2]). The primary target group were students attending the lectures—the goal was not to increase the number of external students but to provide lecture recordings as an additional teaching material.

The system has been used for two years (4 semesters). Its daily use, on the one hand, posed a lot of technical problems, and on the other hand lead to changes in teachers' and students' perception of this activity.

Technical realization

The lectures are recorded in two regimes, off-line and on-line. In the former, the lectures are recorded on mini-DV tapes and coded off-line to be made available through the Web portal. The later regime provides direct real time access to the lectures (the acquisition, coding, and transmission are simultaneous processes). The on-line processing system requires a lecture theatre equipped with an automatic camera system, an adequate audio system and facilities for coding and a storage system (see Fig. 1 for a schema). In such environment the processing can be automated and does not need any operators.

Our system uses two key software components: vloopback by Jeroen Vreeken [3], and a multiplexor.

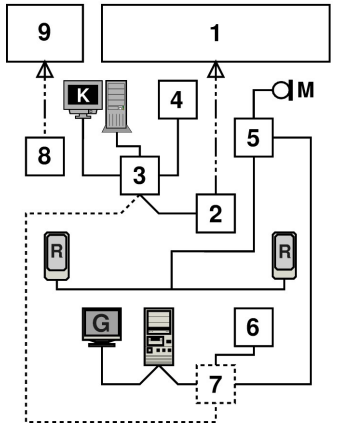

Figure 1: Technology schema for a lecture theatre. 1. Screen, 2. Projector, 3. Videoswitching matrix, 4. Capture camera, 5. Mixer, 6. Camera, 7. Videoswitching matrix, 8. Overhead projector, 9. Screen, K. Presentation computer, M. Microphones, R. Speakers, G. Capture and record computer

The software multiplexor was developed specifically for the purpose of this system and is dedicated for multiplexing the video data into two output pipes. It also allows to copy other data in digital form into these pipes. One stream can be stored while the other is processed in real time. The data are not lost even if the real-time streaming system crashes, and they can also be stored in a much higher quality then that of the streamed video.

As the total amount of processed data is large, we were asked for a separate audiocopy of the lectures, used either by students with limited bandwidth access, or by vision impaired students. The used RealProducer version

did not support this in real time, so the audiostream is made available for off-line version only, after batch processing of the full records.

Access to the Records

The lectures are currently available to authorized users only. While the records are produced by one Faculty only, they can be seen by any teacher or student of the whole university. A web portal is used as the primary access point. The portal provides access both to off-line processed lectures and to the on-line streaming. The portal not only provides a simple and easy-to-use environment, where all records are ordered by year, subject (particular lecture) and date (when the lecture was given), but it also gives us a possibility to log all accesses.

All the logs are evaluated and the basic access statistics (e.g., number of accesses, the amount of data transferred etc.) are available to all authorized users.

Users' view

At the beginning (two years ago), only a small fraction of teachers agreed to have their lectures recorded. While we looked for a non-obtrusive way of lecture recording, quite a few teachers were concerned with the lack of any explicit scripts and artistic direction. They were afraid of the record quality, of their own mistakes and un-directed behavior being available "permanently" etc. This situation gradually changed over these two years, as most teachers understood the value of these records both as an additional study material, and also as a way to improve their own teaching skills (the mathematicians looked most eagerly to this possibility). Teachers are also contented that the increased number of students does not lead to an increased number of personal consultations. Also, references to particulars lectures can be given instead of other training material.

Students quickly adapted to the availability of the lectures' records. While they did not stop to attend the lectures—as they value the face-to-face contact with teachers—records became a regular part of their daily used material. The access pattern also changed during the two years. We started with negligible interest during the semester and high access rates before examinations; nowadays the access is more regular and rather high during the whole semester (with noticeable peaks still emerging during the examination period). Students started to become so accustomed that they consider non-recorded lectures as "unexpected".

The basic access statistic are given in Fig. 2. These statistics show the role of lecture records in students' learning and support our hypothesis about their increased regular use as asynchronous learning materials.

Technical problems

While the project was started as a students' activity gradually supported by the faculty management, one of its goals was to minimize direct personal assistance during the recording and coding. This is impossible to achieve without a specifically equipped lecture theatres. However, same equipment must be already available for on-line recording, making the off-line and on-line capture convergent.

The records occupy a substantial storage space (one semester data, i.e., 20 hours of recorded lectures per week, need some 80 GB). We use simple (S) ATA disk

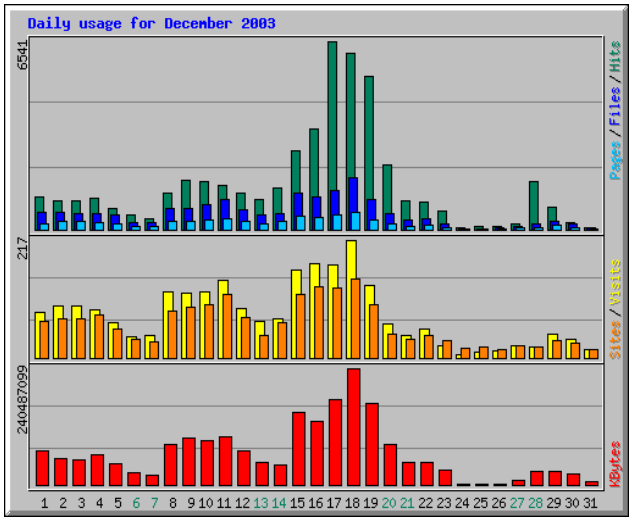

Figure 2: Statistics of daily usage

simultaneous accesses is usually necessary. Currently we experiment with more extensive data and access load balancing to increase the availability of the archives.

We are also working on video indexing that will allow to combine the lecture records with other study material (e.g., the slides) to provide a searchable environment where students will be able to find a presentation on a selected subject.

Conclusion

Two years of project running shows that the lecture records may play a very important role in the educational process. They give access to the teacher's personality (his way of presenting a subject, explanations, reaction to questions, etc.) in a more permanent way. Students can easily go back to difficult parts and "re-play" the teacher without overloading him. This opens a path to more individualized teaching and learning without an increase in the number of teachers—the Faculty can keep a smaller number of best teachers and "virtualize" them to a large number of students. Another by-product is the support of (temporarily or permanently) handicapped people with limited access to lectures. They can "visit" lectures they were unable to attend personally. And, last but not least, teachers are using the same material to improve lectures.

References

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MU, X. – MARCHIONINI, G. 2002. Interactive shared educational environment (ISEE): Design, Architecture, and User Interface. April 2002. Technical Report: TR-202-09.

[1] http://bmrc.berkeley.edu

[2] http://library.digiscript.com

[3] http://motion.sourceforge.net/vloopback

[4] http://stanford-online.edu

Contacts

RNDr. Eva Hladká, Bc. Miloš Liška
Faculty of Informatics, Masaryk University
Botanická 68a, 602 00 Brno, Czech Republic
eva@fi.muni.cz, xliska@fi.muni.cz, ludek@fi.muni.cz