The *eLecture* – In Search of A Better Way of Teaching

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ABSTRACT

Advances in communication technologies are having an ever increasing impact on best practices in (distance) education. One of the most recent trends in eLearning involves offering an online version of face-to-face teaching. The virtual equivalent of a conventional lecture or oral presentation, additionally enriched with integrated interactive elements and access to additional learning resources, has been termed an "eLecture". According to Harasim [HAR,1995], the eLecture is one of the seven modes commonly used in Web-based learning, the seven being: eLectures, Ask-An-Expert, Mentorship, Tutor Support, Access To Network Resources, Informal Peer Interaction and Structured Group Activity. Advances in information technology are continuously producing ever more sub-categories of these modes. Many papers and online essays, either questioning or promoting this educational approach, have considered philosophical aspects of the eLecture within the framework of collaborative learning. This article deals with some practical aspects of the eLecture and with strategies for implementing this method of teaching. Some findings on my own 'best practices' will also be reviewed.

1. THE E-LECTURE CONCEPT

The eLecture is a passive, teacher-centered approach to learning, and assumes that students learn by receiving and assimilating knowledge individually, independent from others [see BOU,1983]. The primary aim of an eLecture is to provide re-usable learning resources on-line. In a typical eLecture scenario a learner can retrieve recorded lectures from an online repository without being able to annotate the material, track his learning progress or ask the system for advice. Within academic environments, the major goal of this kind of learning is the achievement of better preparation for exams. The strength of an eLecture is that, potentially, it can be accessed by anyone, at any time, and from any computer. It can also be used at the speed the student desires and re-used on demand. It thus has the potential dramatically to enhance and extend the traditional lecture form. At this point it is important to differentiate the eLecture from tele-teaching, in which a real lecture is transmitted live (in real time) [EFF,1998] and which is referred to as "synchronous learning". In using the term eLecture I shall mean an electronic lecture unit which contains at least one integrated continuous media component (audio or video). The weaknesses of the eLecture are the absence of the lecturer, the asynchronous manner in which the communication takes place and the loss both of social relationships and the sense of community that is usually present on a traditional campus. Recent observations

suggest, however, that the last of these problems is not as weighty as feared, since, despite the fears of some detractors in the educational sector, online communities have been proven to provide emotional bonds and promote multicultural sensitivity, and this opens up the possibility of a new kind of social interaction in cyberspace in the future,

Today, some eLecture content is still distributed on a storage medium, mainly on CD-ROM, but this kind of learning content delivery will probably fall into disuse in the near future. DVD is still considered an interesting alternative for the delivery of some special kinds of content, although it does not always quite fit the “anytime, anywhere learning” paradigm.

2. DESIGNING E-LECTURES FOR THE WEB

2.1. CURRENT STATE OF AFFAIRS

Most eLectures are simply video captures of live presentations (professors lecturing on specific topics) with interactivity reduced to timeline navigation. The largest obstacle to a truly effective eLecture is the enormous amount of bandwidth which videos use up. Another problem is that production of more sophisticated courseware, including video branching and “heavy” interaction, with different outcomes dependent on user’s decision, is extremely expensive and time consuming, thus not practicable in academic environments.

In my practice as a teacher I have found that it is of much greater importance for students to have a well designed package of lecture slides augmented with some carefully selected audio or video comments in the background, than it is to concentrate on the person of the lecturer himself talking on the video. I have observed students watching recorded lectures and discovered that they preferred to control the timeline slider rather than concentrate on the material itself and be engaged in activity which leads them to reflect on the content at a later time. One important reason for this is that in many cases the video component of the eLecture is unedited. This means that a large amount of unnecessary material is processed alongside the material which is relevant, and that, in turn, is beacuse the ”live” lecture may be pursuing additional goals arising from the ”live context”. For example, a lecturer may be talking about topics irrelevant to eLectures, such as exam regulations, the camera may be running before the lecturer enters, or an overenthusiastic cameraman may be at work who enjoys zooming in and out so much that he seldom attains the optimum viewpoint.

Another aspect is that not every lecture is prepared with recording in mind. Sometimes a lecturer may walk around heedless of the effect which this may have on the recording, and this may again be aggravated by our amateur cameraman. In most cases there is a no experienced director to cast his eye over the proceedings nor any media professional to hand who can guide the film making process from beginning to end, no one to shape the work nor to serve the lecturer as his creative coach. An eLecture is indeed a version of a normal lecture, but if it is shaped according only to the didactic premises of a normal lecture then a great deal can go wrong, and the final result can fail to meet expectations - didactic expectations included.

There is a broad range of factors which must be taken into account by an eLecture-designer. It can be difficult to create bilingual eLecture versions because the content which has been recorded in two different languages may not match exactly, or the amount of material which is / needs to be covered in one lecture in one language

may, for whatever reason, require two lecture units in another. In such circumstances it will be all but impossible to create a logical, comprehensible bilingual structure without considerable post-production editing.

2.2. **MEDIA**

The preparation of a recorded video can be a very arduous task. In order to synchronise the video material with the presentation slides the original material must be appropriately indexed. In addition to this there is the matter of the technical equipment which must be to hand in order to achieve this synchronisation and to make it possible to reproduce the material afterwards. An even greater problem arises when the lecturer's notes have to be recorded, too, and the lecturer has no access to multia-media aids, such as white-boards, which would make it possible to save his notes and comments in a file which could then be made available as a worksheet in an electronic lecture at a later date. If a great deal is written on a traditional board in the course of the lecture then it is usually impossible using only a video camera to reproduce what has been written in a quality suitable for public consumption. One might consider the use of MPEG-videos to achieve good enough quality for download purposes. Unfortunately, the videos produced in this manner are too large (up to several gigabytes per hour of recording) and are therefore unsuitable both for downloading and for playing directly on-line. There is thus no option but to offer such recordings extremely compressed and reduced in a streaming format (the term 'streaming' indicates the possibility of looking at audio-visual data without having first to transfer them). This process means un unavoidable loss of video quality, with the result that handwritten text will be blurred beyond recognition. Although the size of the video is indeed greatly reduced it is still unusual for it to be less than 50-100 MB per lecture unit and usually demands the availability of a reasonable internet access bandwidth (DSL) if it is to be played stutter-free.

Compression is currently one of the greatest challenges. The combination of broad bandwidth connectivity and MP3 audio have already solved many problems around data transfer, and the developments in the RealVideo sector are very promising, if not yet as effective as MP3. The Macromedia Shockwave format makes it possible to create truly animated and extremely compact vector based electronic slides, and complex interactive animations and is therefore predestined for use in the field of eLectures.

2.3 **AUTHORING**

The range and the quantity of material which can be presented in the asynchronous scenario of an eLecture exceed that of synchronous tele-teaching. As well as audio and video, additional material, such as slides or animations, may be delivered to assist exploration of certain topics in more depth, to match the different needs of learners and to emphasise selected topics. It is possible not only to reproduce the real lecture material but also to acquire a variety of presentation format-narratives, media elements, quizzes and navigation structures. For most of these areas a lot of material already exists. These are primarily transparencies or slides provided in a digital format. They may also be books, graphics and other material such as online

resources which need to be linked to an eLecture in some way. Some of this material needs to be reformatted, redrawn and prepared in a particular manner for publication.

The basic idea behind designing an eLecture is to conceive a system that is simple to use for lecturers who are not necessarily familiar with programming techniques. Thus, in order to create the course material efficiently and to speed up the production process it is important, that the lecturer uses authoring tools of his choice. New technical opportunities create new opportunities for authors, but as of today (2003), the tools most preferred for authoring are still the handy Microsoft Office Tools, such as PowerPoint and Word, a variety of Web-Editors and LaTeX. The latter is frequently used for the creation of books and publications. The material may need to be converted to the presentation format at a later time. The common formats are HTML, RTF, Macromedia's SWF and, recently, SMIL. SMIL (Synchronized Multimedia Integration Language) [W3C,2003] is an HTML-like markup language which enables the authoring of interactive audiovisual presentations. SMIL is typically used for "rich media" presentations which integrate the streaming of audio and video with images, text or any other media type.

This additional data accompanying a lecture cannot yet be recorded simply and appropriately synchronised with video using state-of-the-art recorders such as the MBone (Multicast Backbone) VCR [HIL,1997] and need to be manually hand-authored and assigned to the recorded audio and video at a later time. There are a number of approaches, which enable synchronisation of the recorded videos with hand-authored slides. Schremmer and Hilt from the University of Mannheim, for example, describe some procedures and a software system which automatically creates a CBT version from the transparencies and audio/video recording of a classroom [SCH,1999]. Currently, the projects at the University of Mannheim seem to have been discontinued, and no systematic evaluation of the acceptance of the product has been published. Yang et. all implemented a SMIL-based lesson recording system supporting the on-demand lectures for web-based multimedia distance learning [YAN,2001]. The lesson recording system records the live lecture given by the teacher and converts the materials of the lecture to SMIL.

2.4 **SYSTEMS**

The rapid pace of change makes it extremely important to find more flexible ways to publish and disseminate high quality information and learning material to the recipient, quickly, widely and with high impact. This demands, on the one hand, swift authoring and conversion of material into the necessary format, and, on the other hand, an uncomplicated and flexible publication of the material, integrating it into existing (learning) structures and online paths. Didactic considerations suggest that it is often much more sensible not to start with a recorded lecture which has to be synchronized afterwards with extra material, but rather to augment the lecture with well conceived material based on the lecture, for example, with audio (narration) and, perhaps other material including videos.

The technical parameters lead one to the conclusion that PowerPoint, Flash und XML offer a reasonable combination of tools and technologies. PowerPoint makes swift authoring possible. Flash makes it possible to import easily PowerPoint-slides which have been saved in the Metafile-Format; audio and video can be streamed. XML, furthermore, makes flexible creation and administration of navigation trees possible, and also rapid updates of existing courses.

Several companies offer tools [POW, 2003, ROB, 2003] which make it possible to convert PowerPoint-Presentations to Flash. ARTICULATE goes a step further and offers a complete platform, providing tools for the creation, delivery, tracking and managing of rich-media communications and of training [ART, 2003].

3. THE GRANULATION OF ELECTRONIC MATERIAL

In general, designing eLectures means capturing the whole of a lecturer's presentation. The recording of a lecture may take up to 90 minutes, so it is sometimes desirable to break it up into smaller, well-delimited parts and create a number of (self-contained) learning units. There are two reasons for this. An appropriate segmenting of knowledge makes it possible for self study to be more flexible. Obstacles such as the available bandwidth or hardware restrictions (screen resolution or memory for example) may also be overcome in this manner. The granulation process is possible only in cases where a suitable navigational structure for a segmented eLecture can be offered. Since most of the video based eLectures contain a complete learning unit to be streamed all at once no segmenting for this kind of eLecture can be offered. Segmenting would require video editing which could considerably increase the overall production costs.

4. IN SEARCH OF AN APPROPRIATE E-LECTURE SYSTEM

A good design principle is to keep things as simple as possible, and to ensure that the system does not require state of the art hardware in order to function. Thus, the greatest possible accessibility to the electronic material on the net is ensured. One great challenge is to work out an optimum way to provide online learning within an attractive, aesthetic and motivational environment with maximum user control.

It was a desire to make a range of multi-media lectures, which I give at the University of Mittweida, suitable for on-line purposes which gave rise to the idea of Flash–based Modules [ELE,2004]. This concept makes it possible, in a relatively flexible manner, to bring together lecture slides in the Flash-Format and to put them on-line. The eLecture module has been designed as a free eLecture package to facilitate the design and presentation of lectures in an electronic form. A XML driven navigation system enables students to access material on a specific topic. The slides may contain links to deeper slide layers, audiovisuals, quizzes and other types of documents, as is usual in web pages. The lecturer can easily insert and combine existing documents to create a new presentation. However, the process of generating flash slides and enhancing them with narration needs to be done manually, so long as no "Export to Flash" function in PowerPoint is available. One possible way of creating a Flash slide manually, is to design its content in PowerPoint, export the PowerPoint slide to a metafile and import the metafile to Flash. The SWF file generated from Flash can easily be integrated in the overall eLecture structure thereafter. One can, of course, use the existing tools such as PowerPresenter (see above) to generate rich-media "flash slides" from PowerPoint, preserving nearly all its actions and transition features, but in my practical experience this has inhibited the lecturer's design freedom, as the generated output was always encapsulated, and no editing was possible.

As already mentioned, the incorporation of video into the eLecture resources pool is rather difficult and may pose problems since the amount of material to be integrated may be enormous. Working on an eLecture project with the University of Erlangen-Nuremberg (Lectures on Fluid Dynamics by Prof. Dr. Dr. Franz Durst) we faced the problem of viewing and classing about 70 hours of video recordings, from which an online course had to be structured. We soon realized that the only reasonable way to create the eLecture out of this material was to cut the recordings into pieces and create picture sequences out of them. At least 70 percent of the video material turned out to be of little relevance for the eLecture version (the teachers walk around or talk about things, which cannot be seen on a slide), so that only the audio track was of importance. Furthermore, even in those parts of the videos where slide content was discussed or explanations or formulas were drawn directly onto a blackboard, the video output was not able to show this content in any reasonable quality after conversion, for example, to the RealMedia format.

The problem with the presentation of videos in the form of picture sequences is that the audio has to be synchronized afterwards in Flash. This is worth the effort, however, since even at an output rate of one picture every 5 – 10 seconds if the individual frames chosen are appropriate the volume of data can be reduced by 40 – 80%, which, in terms of megabytes, can mean a reduction from 100MB to around 20 MB.

In order to determine the parts which belong to a single slide, the sequences need to be appropriately indexed and positioned on the timeline. This is so that the recorded audio can be assigned to the corresponding slides. A further reduction in the volume of data can be achieved by making the slides available completely in the intrinsically scalable vector format. It is possible to zoom the vector graphics at will without any loss of information or quality. Vector graphics are extraordinarily useful for creating geometric shapes, drawings, diagrams and formulas. If all the optimization aspects of media integration are taken into account it is possible to generate extracts from lectures which are 10 – 15 minutes long, possess a complete audio-track and are no larger than 2.5 – 3 MB. The reader can find some examples of implementation on the dedicated eLecture website http://www.e-lecture.org [ELE,2004].

5. SUMMARY

Against the background of a radically altered economic situation, education providers are faced with growing pressure to incorporate e-learning components into their plans for professional training. This implies that self-study phases must increasingly be included in training courses [WIE, 2003]. The teacher becomes a ‘learning process facilitator’ and his main task is to create a student centered learning environment, promoting student motivation as well as intentional learning activity.

The eLecture development process starts with identifying the educational goals, and developing the educational material and supplementary concepts. As new technologies emerge, new delivery methods and the redesigning of available eLectures need to be considered. Since live teaching and web lecturing require different sets of expertise and professional skills, it is essential that not only lecturers but also multimedia experts be involved in the development process of eLectures. It is not only the didactic aspects that matter. One has to carefully preselect and prepare all the media elements which are to be integrated (different sources such as videotapes, books, articles or presentations from previous semesters are likely to be available) and

one has to find out how the available technology can be used to build a better and more flexible learning environment.

The prototype of an eLecture-module presented in this article makes use of the advantages of Flash technology in the design and in the structuring of electronic lectures. This system can be augmented at any time with a learning management system and it is currently being tested in an academic environment.

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6. REFERENCES AND ONLINE RESSOURCES

[ART, 2003] ARTICULATE, http://www.articulateglobal.com .

[BOU, 1983] Bouton, C., & Garth, R.Y., **Learning in Groups. (New Directions in Teaching and Learning, No. 14)**., San Francisco: Jossey-Bass, 1983.

[DIS,2003] http://distance-ed.fullerton.edu .

[ECK,1997] Eckert, W. Geyer and W. Effelsberg: **A Distance Learning System for Higher Education Based on Telecommunications and Multimedia,** in Proc. ED-MEDIA'97, World Conference on Educational Multimedia and Hypermedia, Calgary, Canada, June 1997.

[ELE,2004] The E-Lecture Portal by WIERZBICKI.ORG, http://www.e-lecture.org .

[EFF,1998] W. Effelsberg, W. Geyer: **Tools for Digital Lecturing - What We Have and What we Need**. In: Proc. BITE'98, Bringing Information Technology to Education, Maastricht, Netherlands, March 1998.

[HAR,1995] Harasim, L., Hiltz, S.R., Teles, L., & Turoff, M., **Learning Networks**, Cambridge, MA, MIT Press.

[HIL,1999] V. Hilt, C. Kuhmünch, N**ew Tools for Synchronous and Asynchronous Teaching and Learning in the Internet**, University of Mannheim

[HOL,1997] Holfelder, W., **Interactive Remote Recording and Playback of Multicast Videoconferences. Interactive Distributed Multimedia Systems and Telecommunication Services**, 1997, LNCS 1309, Springer Verlag, pp. 450-463.

[POW,2003] PresentationPRO, http://www.presentationpro.com .

[ROB,2003] Power2Comm RoboTools, http://www.power2comm.com .

[SCH,1999] Schremmer, C., Hilt., V, **A Systematic Approach to the Automatic Conversion of a „Live" Lecture into a Multimedia CBT Course**, 2nd International Conference on New Learning Technologies, University of Bern, Bern, CH, 30.08.1999; http://www.cg.cs.tu-bs.de/v3d2/pubs/emulib-nlt99.pdf .

[WIE,2003] Wierzbicki, R.J, Wankelmuth, G., **How much standardisation does e-learning need?,** Scholars Conference, Tampere 2003, Finland.

[W3C,2003] http://www.w3.org/AudioVideo/ .

[YAN,2001] Chun-Chuan Yang, Yi-Zheng Yang, and Kwin-Yee Lin, **SMIL-based Lesson Recording System for Distance Learning**, Proceedings of 2001 Conf. on Distributed Multimedia Systems (DMS2001), pp. 486-489, 2001.
http://www.csie.ncnu.edu.tw/~ccyang/Publication/DMS2001.pdf

Curriculum vitae

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