

# HAS THE TIME COME FOR USING VIDEO-BASED LECTURES OVER THE INTERNET? A TEST-CASE REPORT

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**Abstract:** The rapid expansion of the Internet has finally brought a wider availability of large bandwidth connections reaching the homes. This means that the content that can be delivered through the Internet is dramatically changing. We run the experiment of web-casting, on-demand delivering and producing CD's of a whole university course. We based our experiment on the use of a software developed at the University of Toronto: ePresence. We evaluated the acceptance by the students and the costs of the system. Results show excellent impact on students and low production costs.

## 1. INTRODUCTION

The recent diffusion of DSL technology (Digital Subscriber Line) for fast Internet access is dramatically changing the limits of what can be put online. It is making possible, for the first time (at least in the old continent), to reach a vast audience by delivering multimedia content on demand. This fact has an important impact on the distance learning scenario. In the past, many distance learning initiatives have been based on the diffusion of audio and video material in the form of VHS cassettes (see e.g. the Italian "Nettuno" program [1]). In some cases, the choice has been to broadcast lessons, sometimes during the night, so that students could program their VHS recorder to receive the lesson, and use it asynchronously at a later time. In other cases, lectures are distributed interactively through internet via satellite (see e.g. the Eutelsat OpenSky initiative[2]). In the present scenario, it is becoming feasible to use Internet as a transport for video streaming, and to use the additional possibilities that a PC offers to enhance the learning experience.

We used a system developed at the Knowledge Media Design Institute (KMDI) of the University of Toronto to perform an experiment with a class of first year computer science students. The system is able to deliver synchronously (by web-casting) and asynchronously (both on-line and through a CD) a video of a lesson or a seminar, augmented by a view of the slide that speaker is commenting, various ways to move through the lesson, and (in the case of synchronous interaction) an integrated chat. Our experiment consists in making a whole first-year course (about programming) available to the students through the internet, and through other media (a set of CDs). The present paper shortly describes the system, the experiment and the first results.

## 2. THE SYSTEM: e-Presence (UNIVERSITY OF TORONTO)

KMDI has begun an iterative, user-centered design and research project with the goal of making webcasting highly interactive, engaging, accessible in real-time and later. To date the project, directed by Prof. Ron Baecker, and Dr. Gale Moore, has succeeded in the creation of an innovative webcasting infrastructure. This includes support for video, audio, and slide broadcasting; slide browsing and review; submitting questions, integrated moderated chat, and semi-automated creation of event archives.

The system they developed (called ePresence) is presented in an internet browser divides a computer screen in several areas: the largest one presents an image (typically the slide that is projected for the "local" audience and a smaller one that contains a video, where typically the speaker is shown). The design derives from the idea that the most important cognitive factors are the voice, carried by an audio stream, and the slide that illustrates the concepts that the speaker is talking about. The actual video is less important from the point of view of carrying information, although its presence may be very useful by showing gesture, expressions, and contextual

indications (like when the speaker indicates some point on the slide saying “here you see...”). The video carried by the ePresence system is small so as to save bandwidth, but very fluid and sufficient for carrying the needed information (even when occasionally the speaker goes to the blackboard for drawing a sketch, or a video is projected for the local audience).

The web-cast version also contains a chat that allows remote viewers to interact with the speaker (through an intermediate person), while the recorded version has some facilities for navigating an indexed events (like “go to the time when slide X is presented”, or move forward or backward). Rather than giving additional descriptions of the system, we urge the reader to visit their web site [3] to experience using it.

### 3. THE CASE STUDY

In Trento, we tested the system by attending at one such seminar in real time, and were really impressed by its perfect usability. We also tested the off-line version, both as single individual and as a group: by projecting the screen on a wall, a group of viewers in Italy assisted asynchronously to a seminar that had taken place sometime earlier in Canada. In all cases the results were so good that we decided to ask Prof. Ronald Backer of the University of Toronto to start collaboration.

We envisioned using the system for a series of activities:

- web-casting and archiving the seminars held at our Department for any one who can be interested (like it is done in Toronto)
- having a structured organization for seminar exchange with companion Universities
- teaching (in real time) a local class and a remote one
- using the system for regular lessons.

We started with the last activity, and plan to implement the other activities later this year. We shall at first describe some of the boundary conditions that are the driving force for performing our experiment.

First, since a few years e-learning has become a priority at the Università di Trento. A laboratory has been created to assist professors (especially those with less familiarity with computer and internet technology) to publish on-line material for their courses. The approach is typically a blended learning one, where on line material and activity complement and support traditional classroom teaching. At the same time, the program aims at helping worker students who can follow courses only partially.

A second drive is the fact that at the School of Science courses are now organized in bimesters. During each bimester students follow only two or three courses, taking 7 or 8 hours a week per course. Such an intensive program has proven to be very effective to keep students on schedule, lowering the “time to market” of the final product of the process: student’s graduation. However, in such a tight schedule a few days of illness or absence for other reasons can have a disruptive effect on the student’s career, and it would be nice to have an “emergency recovery plan”.

Finally, a new program called “apprenticeship” has recently started: a number of computer science students enrolled in this plan are hired by local small or medium-size enterprises. They follow a special curriculum, spending one bimester at the University (following regular courses) and each other bimester in the company, where they perform some work that can also be evaluated as material for some exam (typically laboratories). They are supposed to follow on their own (by self study, or with the help of some tutor in the enterprise) the general part of the laboratory course (typically two hours per week). An agreement between each company and the teacher guaranties that the work performed in the company has aspects that are relevant to the course. At the end of the bimester the “apprentice” must pass the same exam that is given by regular students. To compensate for the extra load given by their job, in the bimesters “at work” apprentices take only one course (instead of the regular two or three): therefore their curriculum stretches over four years instead of the regular three. The apprenticeship program started this year: approximately one fourth of the first year students (28 out of 130) are enrolled as “apprentice”. This experiment is funded by the local government (Provincia Autonoma di Trento) that finances participating companies.

In this scenario, we decided to try to use the ePresence platform to support traditional teaching with multiple aims:

- experiment a technology that can help the apprenticeship program, by delivering in the companies a (low) number of traditional lectures, letting students remotely participate to the classroom lectures (preferably synchronously, but possibly asynchronously if their work does not permit following a lecture in real time);
- support other working students by bridging the gap given by their absence during (some) regular lectures;
- support regular students that might have presence problems for any reason;

- support foreign students who might have difficulties with the Italian language (they would benefit from the possibility of re-hearing portions of lectures);
- provide language support for Italian students attending to courses given in English (some courses are);
- give to all students the possibility to review pieces of a lecture at any time.

Secondary effects of the initiative are:

- to enrich the portfolio of the on-line learning initiative;
- to give students an additional signal that the University is taking care of them;
- having the possibility to show high-school students some university lectures (often we are required to “simulate” a university lecture to perspective students).

Our requirements were:

- the system should be usable (in some form) by students who do not have a large band connection;
- the lectures should be easily browsable, with some form of indexing and a direct access to any time-location in the lecture;
- it should be easy to integrate the system with other on-line learning material;
- a mild requirement about real time availability of the lectures (synchronous mode) and with some (even though limited) degree of immediate interaction (like posing questions to the teacher) (this modality is valuable especially in the context of the apprenticeship program).

The ePresence system fully satisfies all our requirements, and was therefore chosen as the infrastructure for the experiment.

Among the objectives of the experiment, we want to:

- evaluate the organizational costs of the initiative, and find out what the ratio costs/benefits is;
- evaluate on the field the use of multimedia in general, and of the e-presence technology in particular;
- measure the students satisfaction level;
- gather experience that can be precious in a possible extensive use of this technology;
- get new ideas about possible extensions of the technology or of its use.

One of the first findings was that approximately one fourth of the students have a fast internet connection at home. This is a very recent fact, since only two years ago a paper stemming from Finland (certainly not an underdeveloped country!) quoted “Synchronous communication or even delivery of asynchronous video lectures was out of question because of the low bandwidths available at students’ homes” [2]. The fact is even more surprising if one thinks that until recently the diffusion of the Internet in Italian homes was way below the average of the most industrialized countries: and in fact only two years ago very few of our students had an Internet connection at all.

Before starting the experiment, we thought that on-line streaming was not actually essential, and we got it as an extra bonus from the e-presence system, but we thought that the really relevant feature was the ability to produce CD-ROMs that the students could copy. We found out that, although the CD is still a very important option, the on-line streaming is actually becoming very important.

## 4. FIRST ASSESSMENT

At the beginning of the course the system was announced and shown to the students. After they were able to access the system for the first lessons, a survey was conducted to assess the expectations the students had, and to verify what kind of access they were able to have. (Another assessment will be made at the end).

As far as their access to the Internet from home is concerned, it turned out that 77% has a standard 56K analog modem, 22% has some kind of fast connection and 1% has no connection at all. The fast connections are divided in a 7% of ISDN connection, and a 15% of ADSL. As we mentioned before, this result came as a surprise. ADSL connections exist since a couple of years, but it is only in relatively few months that the major Italian telecom company pushes a massive advertisement campaign for ADSL connection. Moreover, the technology is still available only in a minority of telephone switches, so that even in relatively large cities the coverage is only partial.

25% of the students have little or no personal interest in the service provided by the ePresence system. 3% think that they will never use it, 22% thinks that they might use it in rare occasions (like if they were not able to attend lectures due to illness).

The remaining 75% anticipates using the system often or very often. We were surprised from such expectation, since they work on a rather tight schedule: we therefore think that (due to time constraints) such

anticipated usage is not realistic. However, we believe that this comes as a strong indication that they perceive the system as something that is really useful.

Although the students can access the on-line registration at the University, 60% of the students showed an interest in getting copies of the CD versions. We are currently monitoring this aspect that we believe is significant: in fact for each two-hours lesson a CD is needed. The cost of the whole series of CD will be therefore comparable with the cost of a textbook. That means that probably this parameter will be a significant indicator of the real use of the system.

We tried to understand which use the students foresee for the system. They indicated:

- ability to recover lectures lost due to forced absence (illness, work or other time-frame incompatibility);
- ability to better organize their time, deciding not to be present at some lecture (elective absence);
- review some critical point (cases of poor understanding of a section due to concentration drop, excessive speed in an explanation or intrinsic difficulty);
- review of lectures as a confirmation that their understanding is correct;
- ability to check the correctness of notes taken during a lecture;
- perception of a better service provided by the university.

Our aim is also to assess the additional cost that the system adds to traditional lectures. Costs can be split in two parts: initial investment, and running costs. As often is the case, the initial investment is an important parameter, but running costs are the most important issue.

The requirements for ePresence are three well performing PC's, some software plus the audio/video acquisition devices. The initial investment is therefore derived from the costs of hardware and software acquisition and installation, and the training of the person who is in charge of running the system (a short time was sufficient).

The work needed to obtain the final result for each event (that is the origin of the running cost) is not much. We had one person part-time dedicated to the project. His tasks were:

- setting up the system before each lecture (approx. 10 minutes)
- running the system during the lecture (moving the camera, verifying the smoothness of the process)
- removing the system after each lecture (for safety reason: the classroom was used for other courses, and we did not want to leave the system unattended (approx. 10 minutes)
- starting the post-processing (half an hour). The post processing would then go by itself for approx. three hours
- ending the post-processing (uploading the video on the web site, producing the master CD): approximately half an hour.

The total work for a 50 hour course was therefore approximately 80 hours.

## 4. CONCLUSION

We think that the time for start harvesting on-line multimedia has finally come. Low cost availability of broadband Internet connections can be leveraged for enhancing the offering of on-line learning system. Even rather traditional classroom education can be enhanced by the availability of such systems. Our experiment indicates that the ePresence system developed at the University of Toronto is a very useful tool. Students were very excited by the availability of the new system. The amount of additional work needed for moving from the traditional lecture to the web-cast, available on line and on CD lecture is reasonable (much less than what one would expect for traditional type of multimedia production).

Probably in the future the way to present didactic material will not be a simple reproduction of traditional lectures. It is reasonable to expect a shift from the today mostly-written communication to a blend of oral, visual and written interaction. However, we have strong indication that even the direct approach of putting on-line traditional lectures is today very helpful to students, especially when supported by well thought system that emphasizes the right components like the ePresence system does.

## REFERENCES

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