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FROM THE CLASSROOM TO THE COMPUTER SCREEN: DELIVERING A TRADITIONAL UNIVERSITY COURSE IN A NON-TRADITIONAL WAY

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FROM THE CLASSROOM TO THE COMPUTER SCREEN: DELIVERING A TRADITIONAL UNIVERSITY COURSE IN A NON-TRADITIONAL WAY.

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The present Technical Reports contains two complementary papers describing our experience with a system for delivering traditional lectures through computers and computer networks.

The first paper (Has the time come for using video-based lectures over the internet? A test-case report) contains a report of the overall setting, and of the expectations students had when they were presented the system. The paper was accepted at the CATE-IASTED conference held in Rhodes (Greece) in July 2003.

The second paper (Using the Web for diffusing multimedia lectures: a case study) contains an assessment of the real use and acceptance of the system. It was accepted at the ED-MEDIA 2003 Conference, held at Honolulu (Hawaii, USA) in June 2003.

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 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.

KEY WORDS

Web-casting, video on demand

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 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-line. Our experiment consists in making a whole first-year course (about object orient 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)

The Knowledge Media Design Institute (KMDI) of the University of Toronto has begun an iterative, user-centered design and research project with the goal of making web-casting:

- Highly interactive
- More engaging
- Accessible in real-time and later via structured, navigable, searchable archives
- Useful for knowledge transmission, building, and sharing
- Scalable and robust.

Work to date, supported by the Bell University Laboratories at the University of Toronto, has succeeded in the creation of a viable and innovative web-casting infrastructure. This includes support for video, audio, and slide broadcasting; slide browsing and review; submitting questions, integrated moderated chat, and a prototype of the automated creation of event archives.

The ePresence Lab is a research project of the KMDI of the University of Toronto directed by Prof. Ron Baecker, and Dr. Gale Moore. It regularly web-casts seminars held at the KMDI that can be viewed in real time or on demand at a later time.

Sample applications include the use of Internet broadband transmission for:

- Distance learning, e.g., lifelong learning, continuing medical education
- Presentations by global corporations, e.g., annual meetings, analyst briefings
- Briefings for the public, e.g., health and safety information

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 information carriers 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).

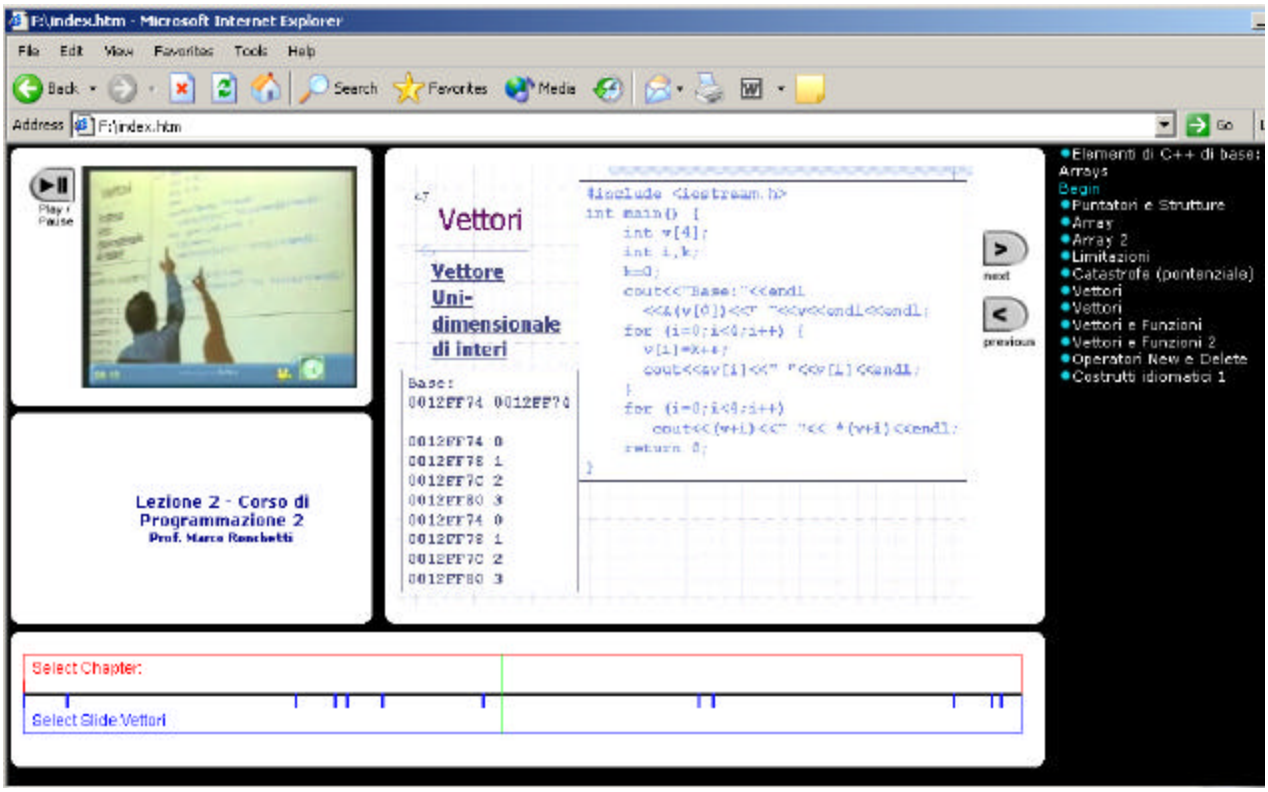

Fig. 1: *a view of the ePresence window.*

Figure 1 shows the e-Presence screenshot. The window (a normal browser) is divided in several portions. The (small) video is presented in the upper left corner, and below it there is the title of the event. In the center the larges sub-window shows the slide that is currently projected. If the resolution is not good enough, the user can double-click on the slide to obtain a larger version in a pop-up window. On the right there is the list of the slides (titles are shown). The user can navigate through the slides either clicking on the titles, or on two buttons that allow moving forward and back. In any case, when the speaker moves to another slide, the system follows her/him and presents the new slide. On the bottom a timeline allows moving to different times. The timeline is indexed by topic (seminar subsection) and by slide: small tics show a change (in topic or in slide). By moving the mouse over the tick a small pop-up shows the topic or the title of the slide.

In the web-cast version the time-line is replaced by a text chat that allows remote viewers to interact with the speaker (an intermediate person controls the chat and asks questions to the speaker in place of the remote user).

The audio and video stream acquired by the system is split and treaded by two machines: the first one puts together jpeg images with the audio-video stream, performs a compression on the fly, and web-casts the results. Remote users receive the stream with a delay by approximately 30 seconds (but they are not aware of it). The second machine saves the stream on disk, and later performs the post-processing needed to create the disk

image that can be used for producing a CD with the event, and to serve asynchronous on-line requests.
Since the presentation of the ePresence system is not the main focus of the present paper, we suggest the interested reader to get a feeling of the system by directly accessing ePresence on the web, either in its home site [3] or by directly looking at the lectures (in Italian!) described in the present paper [4].

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 (our University has a course in a town that is 30 Km away from the main location)
- using the system for regular lessons.

We started with the last activity, that is reported here, and plan to move 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 Facoltà di Scienze (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 (generally small or medium) enterprises. They follow a special curriculum, spending one bimester at the University (following regular courses) and each other bimester in the enterprise, 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 (through a substantial tax-reduction program) 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 (e.g. those participating to EEC programs favoring the student mobility, like Erasmus and Socrates programs, or those coming from other countries to get a degree in Italy) who might have difficulties with the Italian language (they would benefit from the possibility of re-hearing portions of lectures);
- symmetrically: language support for Italian students attending to courses given in English (like 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" an 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 browsed, 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 leaning material;
• the lectures should possibly be available in real time (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 student's 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" [5]. 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 that the students had, and to verify what kind of access they were able to have.
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 they foresee for the system. Among the reasons that the students indicate are:
- ability to recover lecture that were 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.
Right after finishing the course we will run a second survey, and a third one will be run after students pass the final exam.

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 the ePresence system are three well performing PC's, some software plus the video and audio 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 wan to leave the system unattended (approx. 10 minutes)
- starting the post-processing (half an hour). The post processing would than 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.

5. 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.

In fact, the response from our students was so good that, upon their request, we decided to extend the experiment to a second course during the last bimester,

6. AKNOWLEDGMENTS

This work would not have been possible without the collaboration of Prof. Ronald Baecker and his group. In particular, the assistance of Peter Wolff has been invaluable. The enthusiasm and availability of Alessandro Tomasi have also been key ingredients.

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Using the Web for diffusing multimedia lectures: a case study.

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Abstract: The typical teaching approach, at least when classes are large, is still the classical lecture. By using the new high-speed Internet lines reaching the homes, it possible is to limit some of the drawbacks of this approach. We run an experiment by diffusing via Internet a whole university course. The course was web-cast (synchronously) and delivered on-demand (asynchronously). We also produced CD's for simulating fast connections for the students who did no have one. We based our experiment on a software developed at the University of Toronto: ePresence. We report here the indications we were able to extract after the end of the experiment.

Introduction

In the past teaching has involved a strong, direct interaction between teacher and student. Massive education has made this model impossible to apply: it does not scale well when the ratio students to teachers grows exceedingly, while maintaining a small ratio is too costly. In response to this, the typical education model has been for a very long time the classical lecture: at Universities this often means that tenths (and sometime even two or three hundred) students listen to a professor, and it is obvious that in such conditions the space for interaction and for individual needs is tiny.

The lecture model is under attack by people proposing learner centred modes (see e.g. Olson & Bruner, 1996), or stressing the social nature of learning (see e.g. Branson, 1998). For a critique of the lecture model see Kerns, 2002 and Donovan et al, 1999.

E-learning is an opportunity for a change. However, the traditional lecture is here to stay for some more time: information and telecommunication technologies have a chance to make it better. One possible way is by breaking space and time constraints. Lectures happen in a classroom at a time that is rigidly fixed, and these constrictions may interfere with student's needs. For instance, working students often cannot attend lectures, and end up studying on their own on books and notes. Students may get sick and loose lectures: in some disciplines (e.g. mathematics) loosing one or two lecture may seriously compromise the understanding of the rest of the course. Some students get tired, and sometimes in spite of being present in the room they are not following the discourse, or they lose some fragment. Being able to view lectures at different times and in different places, or to re-view some portion of a lecture may help considerably. For these reasons, in the past many distance learning initiatives have been based on the diffusion of audio and video material in the form of VHS cassettes. VHS cassettes can be requested at some office, or their content can be broadcasted on TV, sometimes during the night, so that students could program their VHS recorder to receive the lesson, and use it asynchronously at a later time. Of course both these models are very limited: TV bandwidth is limited, and students cannot get the content "on demand", and, physically getting a VHS cassette would solve only part of the problem (one still has spatial and temporal constraints).

Can Internet offer a viable solution? Not until recently: only two years ago a paper reporting an research performed in 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" (Haataja et al. 2001). Things are changing fast: 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.

Transport is not the only issue. The traditional VHS-based approach typically does not record a lecture held in a classroom, but prepares *ad-hoc* material: the costs are typically rather high, and a recorded course should be reused for at least a few years. Recording a traditional lecture would have lower costs, but also a poorer quality: it is generally difficult to see well on a screen the material that the teacher presents (slides, writing on the blackboard etc.). So there is a *format* issue, concerning how the lecture is presented.

We found a solution by using the e-presence software developed at the Knowledge Media Design Institute (KMDI) of the University of Toronto. 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. The system presents the lecture in an web browser. The browser window is divided 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). More information on the system can be obtained in (Baecker 2002, Baecker et al. 2003). The system can be seen on line (http://epresence.kmdi.toronto.edu): KMDI uses is for web-casting seminars.

Our experiment consisted in making a whole first-year course (Object Oriented Programming for Computer Science) available to the students through the internet, and through other media (a set of CDs). The present paper shortly describes the first results.

The case study

At University of Trento teachers are offered tools for e-learning support. We have on-line the syllabus, a diary with the lecture topics, lecture material (copy of the slides projected in the classroom, and some additional material), a discussion forum, a bulletin board, and self-assessment tools. However, we wanted to offer something more, especially to working students who's job schedule is incompatible with the lecture timetable. Moreover, this year we had a consistent number (25%) of first-year Computer Science students following a new program called "apprenticeship". Students enrolled in this plan are hired by local small or medium-size enterprises, and simultaneously they enroll at the University. 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 laboratory 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. Participating companies receive funds from the local government (Provincia Autonoma di Trento) in the form of tax cuts. A web-casting system would allow such students to follow on the job the two hours of the general part of the laboratory course.

We therefore decided to use innovative technology to:

- support 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);
- help other working students by bridging the gap given by their absence during (some) regular lectures;
- support regular students by giving them the opportunity ability to recover lectures lost due to forced absence (illness, work or other time-frame incompatibility);
- allow students ability to better organize their time, deciding not to be present at some lecture (elective absence);
- 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, to check their understanding or their notes.

Secondary effects of the initiative are:

- to enrich the portfolio of the on-line learning initiative;
- to give students the perception of a better service provided by the university;
- 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 support both synchronous and asynchronous modes;
- synchronous mode should allow at leas some limited degree of interaction;
- the lectures should be easily browsed, with some form of indexing and a direct access to any time-location in the lecture;
- lectures should be available (in some form) also to students who do not have a large band Internet connection;
- production costs should be minimal, so as to eventually allow scaling the approach to most courses.

The e-Presence system fully satisfies all our requirements, and was therefore chosen as the infrastructure for the experiment. The objectives of the experiment were to:

- measure the students satisfaction level;
- evaluate on the field the organizational costs of the initiative, and find out what the ratio costs/benefits is;
- 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.

When we started we did not really expect students to be able to access lectures from home: only two years ago a minority of our (Compute Science!) students had an Internet connection at home. By now, we were expecting all of them to have standard (56K) Internet connection available at home. We were therefore surprised to find that 22% has some kind of fast connection (7% ISDN, and 15% ADSL) that allows accessing multimedia content. A recent advertisement campaign for ADSL done by the major national phone company is evidently having success, even though not all of telephone switches enable such technology.

Students not having a fast connection at home could anyhow use computers in the University labs, or get a copy of CD-ROMs on which lectures were copied. We started by recording one lecture per CD. Later we discovered that the CD version provided by default by the system included streams at several resolution (like the Real Server does). By using only one resolution, we were able to store five to seven lectures per CD (25% of the lectures last for three quarter of hour, 75% for one and a half hour). The whole course -41 lecture hours in 23 lessons (7.5 laboratory hours were not recorded on the system)- fits in5 CDs, and would fit on a single DVD support.

Some students asked us to provide a third possibility, i.e. to allow to download the content of the CD from the net. A few working students not residents in town had problems in coming to get the CDs at the University, did not have fast connection at home but had friends with a fast connection. For those students, the possibility of asking friends to download the CD content and remotely create a CD copy was a desirable option, so we provided it.

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. Results of students expectations were presented in detail elsewhere (Ronchetti 2003): in summary, the expectations were enthusiastic.

We monitored the actual use of the system, and found that students excitement was not a transitory fact. We are able to identify two effects: a initial high use of the system due to curiosity, and later a correlation between the use of the system and the difficulty of the subjects. The course presented Object Oriented Programming in both C++ and Java. At the beginning the basic concepts were given, and shown in C++. The central part of the course had an introduction to Java, and in the last part the most difficult concepts were presented in both C++ and Java (but mainly in C++, which has rich and difficult elements like copy constructors, objects in stack, operator overloading, static binding etc.).

On the average, the first six lectures were viewed 73 times each (we had approximately hundred students). This very high rate was certainly due to curiosity. The last two-third of the lectures averaged 29 users. However, the in the central part of the course (that we consider to be the easiest) the use dropped to an average of 20 viewers per lecture, while the last five lectures (containing the most difficult topics) average almost twice as much, with 36 viewers.

We also monitored the number of CDs that were requested by the students. We already mentioned that we had two formats: CDs with single lectures (that were typically available the day after the lecture), and CDs that contain collections of five to seven lectures (that were available towards the end of the course). We produced an average of 18 copies for each single-lecture CD, and 15 of each of the multi-lecture CDs, for a total of approximately 350 CDs.

We think that only a very small number of students used the third possibility we provided, i.e. to download the CD content: we did not yet have the time to analyze the web-server logs.

In total hence approximately 60 students per lecture used the system: half of them using the on-line version, and half using the CD version. Only in very few cases the real time version (web-casting) was used.

Conclusions

Although the traditional lecture model is not the best for favoring learning, it is still widely used. We found that even this traditional model can be improved by using modern technology, and in particular by the new low-cost broadband Internet connections. Our results shows that students find an added value in having a multimedia version of the traditional lecture, especially if provided through a tool that has a well-thought user interface like the e-Presence system. Contrary to what one could expect, students tend not to use such possibility as a replacement of the lecture in the classroom but rather as an integration (we did not observe an abnormal drop in the presence in the classroom). Also, the mode we used (one single person overlooking the system, controlling two cameras and performing post-processing) presented very limited costs (approximately one and a half hour per lecture hour, including the presence at the lecture) and does not require special skills, so it is an affordable expense (a more detailed discussion of costs is give in Ronchetti 2003). The success was such that students demanded that, after the experimental phase, the system stays in production. We are currently using it for two other courses, and plan to continue on the next academic year.

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