The Use of Video Conferencing in Distance Learning

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Abstract: This paper looks at video conferencing as an important method for information communication in distance education. It explains technologies behind video conferencing, in its integration of face-to-face and video-mediated meetings and if e-learning can replace classroom learning then will provide some problems and solutions to computing by distance education. Also in this paper will discuss how the video conference network management system works and how to bring people together in a video, audio and computing environment. Finally will give few case studies on different universities and their use of video conferencing nation wide.

Introduction

The history of video conferencing in its earliest form goes back to the 1960’s, when AT&T introduced the Picturephone at the World’s Fair in New York. While viewed as a fascinating curiosity, it never became popular and was too expensive to be practical for most consumers when it was offered for $160 a month in 1970. Commercial use of real video conferencing was first realized with Ericsson’s demonstration of the first trans-Atlantic LME video telephone call. In 1976, Nippon Telegraph and Telephone established video conferencing (VC) between Tokyo and Osaka for company use. IBM Japan followed suit in 1982 by establishing VC running at 48000bps to link up with already established internal IBM video conferencing links in the United States so that they could have weekly meetings.

In the late 1980’s, Mitsubishi began selling a still-picture phone that was basically a flop in the market place. They dropped the line two years after introducing it. In 1991, the first PC based video conferencing system was introduced by IBM – PicTel. It was a black and white system using what was at the time an incredibly inexpensive $30 per hour for the lines, while the system itself was $20,000. In June of the same year, DARTnet had successfully connected a transcontinental IP network of over a dozen research sites in the United States and Great Britain using T1 trunks. Today, DARTnet has evolved into the CAIRN system, which connects dozens of institutions.

In 1992, AT&T rolled out their own $1,500 video phone for the home market. It was a borderline success. That same year, the world’s first MBone audio/video broadcast took place and in July INRIA’s video conferencing system was introduced. This is the year that saw the first real explosion in video conferencing for businesses around the globe and eventually led to the standards developed by the ITU. The International Telecommunications Union (ITU) began developing standards for video conferencing coding in 1996, when they established Standard H.263 to reduce bandwidth for transmission for low bit rate communication. Microsoft finally came on board the video conferencing bandwagon with NetMeeting, a descendent of PictureTel’s Liveshare Plus, in August of 1996 (although it didn’t have video in this release). By December of the same year, Microsoft NetMeeting v2.0b2 with video had been released. That same month, VocalTec’s Internet Phone v4.0 for Windows was introduced.

In 2001, Windows XP messenger announced that it would now support Session Initiation Protocol. This was the same year the world’s first transatlantic tele-surgery took place utilizing video conferencing. In this instance, video conferencing was instrumental in allowing a surgeon in the U.S. to use a robot overseas to perform gall bladder surgery on a patient. It was one of the most compelling non-business uses in the history of video conferencing, and brought the technology to the attention of the medical profession and the general public.

2003 also saw the rise in use of video conferencing for off-campus classrooms. Interactive classrooms became more popular as the quality of streaming video increased and the delay decreased. Companies such as
VBrick provided various MPEG-4 systems to colleges across the country. Desktop video conferencing is also on the rise and gaining popularity.

Companies newer to the market are now refining the details of performance in addition to the nuts and bolts of transmission. In April of 2004, Applied Global Technologies developed a voice-activated camera for use in video conferencing that tracks the voice of various speakers in order to focus on whoever is speaking during a conference call. In March 2004, Linux announced the release of GnomeMeeting, an H.323 compliant, free video conferencing platform that is NetMeeting compatible. (Lucy P. Roberts, The History of Video Conferencing, November 13, 2004)

The Study

The research will be talking about a workshop called Summercore and how they use Video-Conferencing which turned out a big success in taking three universities Nobles, Tennessee and Tufts and Kyoto Nishi high school in Japan as will be explained in the case study below:

Two wonderful people who came to Summercore in different years but who both took to VC (“video-conferencing”) like fish to water are Scott Merrick and Donna Svinis ... Scott has two jobs in Tennessee and Donna wears at least two hats at Nobles, being in charge of the DLC (“Digital Language Center”) and being in charge of video-conferencing. Donna has an absolutely wonderful collection of VC resources and examples posted and two of them (Scott and Donna) have pulled off many successful VC projects between MA and TN!

We have also established ongoing VC projects with Tufts University. One of our French teachers regularly connects with a French professor there. The quality of the video is quite good but more important the quality of the VC activity is incredible. The professor at Tufts engages each of our students in French dialogue and the sense of a virtual classroom is wonderful. The audio is excellent (256K) and by controlling our camera with our remote control, we can quickly zoom in on the specific student who is being called on. The excitement and professional collaboration between the two teachers (Nobles and Tufts) has gone so well in just a month that the two of them are planning a collaborative course for this fall!

We have had tremendous success in connecting with language teachers between our school and Tufts. In each of the three languages taught at Nobles (French, Japanese, Spanish), we have worked at building relationships and securing a time slot where each participant can become moderately comfortable with the other. Once that happens, the next step is to launch a classroom project. Every year a group of Japanese students visits Nobles (and other independent schools) from Kyoto High School in Japan. Over the last year, they have been intrigued with what we are doing with VC and returned to Japan last year with a proposal to purchase their own VC setup. As of Fall 99, we have begun to video-conference with them! After that, they got a note from Tomoko Graham, Knobles Japanese teacher saying “12 students on Nobles side and 34 students on Kyoto side met at 5:30 pm our time this evening (and 7:30 am their time) to discuss "teenagers in Japan". We tested the VC connections at least 4 times between Nobles and Kyoto, exchanged numerous emails to figure technical problems, discuss the detailed procedure, faxed the synopsis of what students would say and ask, having students to go through dressed rehearsals ... all these preparations in December and January came into nice folds today.

The voice was clear...the visions were clear... I experienced that I was handling the camera back and forth on both ends more and more spontaneously during the hour thanks to Steve's training beforehand. We even ended the session almost exactly on time at 6:30pm and everybody had a chance to talk.

My students all enjoyed meeting with Japanese students, at least 8 of them came to Nobles two years ago, and some of my students went to their school during the summer. The exchange program between Nobles and KNHS has now become a year-round exchange through the video conferencing technology. Since KNHS students did most of talking this time, giving presentations on "teenage problems", "dreams about future", and "political activism", while Nobles students participated as active listeners, my plan is to now ask my students to express their reactions and opinions about the same issues about American teenagers. Steve will help me post these on the web using Video Streaming, which KNHS students can visit to learn more about what American students think after presenting their opinions.” (Video-Conferencing, the Next Generation NAIS 2000)

Findings
Here is an example showing the University of the West Indies (UWI) has offered and still offering distance education through UWIDEC (University of the West Indies Distance Education Centre). The delivery of distance education included/includes the use of video conferencing facilities, which link the three main campuses of the university in Jamaica, Trinidad and Barbados with centers in a number of other islands via a telecommunications network which includes both satellite and microwave links. UWIDEC is facilitating greater access to education for people in the region by enabling more persons to study an increasing variety of subjects in their home country. The UWI offer further training for practicing non-graduate teachers. Taught at a distance, it enables practicing teachers from non-campus countries to participate and gain qualification.

It was found that distance education is the best means of providing training for those teachers scattered through the islands. The regional collaboration in UWIDEC has brought other benefits. Regular discussions among student from different islands lead to a greater sense of connectedness. The governments of the islands feel they have a greater stake in the university. The number of courses offered through UWIDEC continues to grow by popular demand (Video Conferencing applications to distance education).

To assess the effectiveness of interactive learning in a virtual mentor environment, we conducted two experiments using the Interactive E-Classroom of the LBA system. Subjects were undergraduate students at the University of Arizona (55.4% were male, either freshmen or sophomores) from more than 10 majors. In both studies, students were randomly assigned into the experimental groups. Students in traditional classroom groups took the regular lecture in a classroom and were allowed to ask the instructor questions, while students in e-learning groups were asked to use the Interactive E-Classroom in a research lab, and attended the lecture via the Internet. As illustrated in Table 1, the learning contents and group size of two experiments differed. The same instructors who taught the classroom group also prepared online course materials for the e-learning groups to ensure the lecture content was consistent across all experimental groups. During the study, every group had the same amount of time for lectures and went through the same experimental procedure. The learning effectiveness was assessed by objective measures of student learning (test grades) and subjective measures (perceived satisfaction). We gave each student a pre-lecture test and a post-lecture test (closed-book, closed-notes) on the content covered by the lectures and used the difference between the two scores as the individual learning performance. Learner satisfaction was evaluated after the experiments via a questionnaire, which employed a 7-point Likert scale ranging from extremely dissatisfied (1) to extremely satisfied (7). Although we used different learning contents and students in the two experiments, the results were consistent: the test grades of students who took lectures through the Interactive E-Classroom with interactive control and content synchronization (as illustrated in the figure) were significantly higher than those of students in traditional classroom groups (see Table 2). The difference in satisfaction levels of students in the classroom and e-learning groups was not significant.

Table 1:

<table>
<thead>
<tr>
<th>Lecture Content</th>
<th>Number of students in the classroom group</th>
<th>Number of students in e-learning group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study 1: Normalization (database)</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Study 2: Internet Search Engines</td>
<td>34</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 2:

<table>
<thead>
<tr>
<th>Study</th>
<th>Average/Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom group</td>
<td>Study1: 9.24/15</td>
</tr>
<tr>
<td>E-Learning group</td>
<td>10.88/15</td>
</tr>
</tbody>
</table>

In the post-study questionnaires, most students in e-learning groups reported they liked the multimedia presentation in the E-Classroom and were satisfied with the self-controlled learning process. They also thought that sufficient interactivity and flexibility was critical to an e-learning environment.

Conclusions

One of the most recent developments is to incorporate video conferencing into web based systems. A web based system using streaming video multi-casting is now reaching the education sector. Teachers and
Presenters can sit in their own office or in a nearby studio and present a ‘live’ lecture in front of a camera attached to a web server. Using a simple switching device and several cameras, the presenter can provide remote participants with graphics, whiteboard, flipchart and other visual aids as well as alternative views of the local classroom, lecture room, etc.

These images and sound are subsequently 'webcast' - sent via the Internet to anyone who wishes to take part. Alongside the video images and sound is a MS PowerPoint presentation or other graphical sequence transmitted in a .gif file format. Synchronizing software enables the graphic images and presentation materials to reach the viewers at the same time the presenter verbally cues them.

Beneath the tutor's video images is a text messaging box where students and participants can offer comments, ask questions, and receive responses from the presenter in real time. Research has shown that remote students are more likely to participate in such a discussion when they are ‘anonymous’ (Telematic Applications, Video Conferencing).

Here are some Technical considerations for videoconference:

When a videoconference is scheduled for domestic or international calls, there are many technical factors to consider. The following will help illustrate the minimum technical specifications required to receive a live videoconference stream using Netmeeting or Real Player 8 when the remote location does not have videoconference specific hardware like the Viewstations the school owns.

<table>
<thead>
<tr>
<th>Processor Speed</th>
<th>RAM</th>
<th>Free Hard Drive Space</th>
<th>Minimum Connection</th>
<th>Preferred Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIII Processor</td>
<td>128 min</td>
<td>Preferably -- 1 gig</td>
<td>128 Kbps</td>
<td>384 Kbps -down</td>
</tr>
</tbody>
</table>

During a videoconference, a CODEC (COder/DECoder) takes the analog video and audio signals from the videoconference room, digitizes and compresses them, and sends them via telephone lines or other form of connection to other meeting locations. Similarly, it receives the same type of signal from other locations and reverses the process to display the visual images on monitors and deliver audio through speakers.

When initiating a videoconference you will be dialing up your videoconference much like you do a phone call. This is called Dial-Up Two-way Interactive Videoconferencing.

There are two types of videoconferences can be conducted:

1. Point-to-Point Videoconference

Calls take place between two or three locations (or sites). There are many software applications that can be used to take part in a point-to-point videoconference. We recommend using Netmeeting from Microsoft. Please keep in mind that any H.320 and H.323 client can be used for videoconferences. We recommend Netmeeting because of our extensive use and knowledge of the product.

2. Multi-Point Videoconference

Calls take place among several (three or more) locations (or sites) and all participate in the same videoconference (similar to a telephone conference call). A Multi-Point Videoconference requires the use of a video bridge.

**Point-to-Point Conference**
- Enables your location to participate in a conference with three other locations.
- Three-way interactive video.
- Three-way audio.

**Multi-Point Conference**
- Enables your location to participate in a conference involving four or more locations in one videoconference with the use of a bridge.
- Multi-point interactive video.
- Multi-point audio bridging capability.
• Simply dial-up distant site using the buttons on the keypad.

• Simply dial into the Video Bridge Port via the buttons on the keypad.

**Dial-up Multi-Point Interactive Videoconferencing**

A multi-point videoconference is a conference involving three or more sites. All participating sites are linked through a multi-point bridging device. For the most part, you conduct a multi-point videoconference just as you would a point-to-point videoconference except you must first dial in and connect to a "bridge". A bridge connects four or more telecommunications sites so that they can all communicate together. A voice-activated multi-point conference enables all the sites involved in the conference to see and hear whoever is speaking. A voice-activated mode automatically switches among all the sites involved in the conference depending upon who is speaking. As an example: If site A begins to talk, all the other sites in the conference will see and hear site A. If site B speaks, the bridge will switch and everyone will now see and hear site B. The site at which the voice level is the loudest is the site viewed by all the other participating sites. You may notice a slight delay in the video switching, since it takes the system a moment to recognize that someone has spoken at a different site. However, the audio will be heard instantaneously (Videoconference / E-Learning Orientation Guide).

**Managed Devices**

The video devices are managed through the use of SNMP proxy agents running on a SUN workstation and the serial ports of the workstation are used to connect to the control ports of these devices. Connection may also be remote via modem. The present system supports four types of video conference devices:

1. PictureTel M8000 MCU (Multi-Point Control Unit) bridge
2. PictureTel S4000 Codecs
3. Ascend inverse multiplexers
4. VideoServer S2000 series MCU bridge

**Major Characteristics of the System**

The major characteristics of the system are:

• The use of standard network management protocol
• The system is reliable and has real-time response when a conference is monitored
• All components of a conference are controllable from a remote location
• The system makes use of all the usual network management tasks performed by a third-party network management system
• It provides a graphical indication of problems allowing immediate initiation of corrective action
• The system is distributed and scaleable

It can be made to work on any conference scheduling database with minimal changes (Videoconference / E-Learning Orientation Guide).

With the constant advances in video conferencing systems, it seems obvious that the technology will continue to evolve and become an integral part of business and personal life. As new advances are made and systems become more reasonably priced, keep in mind that choices are still determined by network type, system requirements and what your particular conferencing needs are. (Lucy P. Roberts, The History of Video Conferencing, November 13, 2004)

**References**

(Lucy P. Roberts, The History of Video Conferencing, November 13, 2004)

(Video-Conferencing, the Next Generation NAIS 2000) http://www.summercore.com/Distance.html

(Video Conferencing applications to distance education) http://col.org/resources/publications/smallstates00/2_conf_proc_Dallas.pdf

(Can e-learning replace classroom learning?). http://delivery.acm.org.ezproxy.libraries.psu.edu/10.1145/990000/986216/p75-zhang.pdf?key1=986216&key2=7148844111&coll=Portal&dl=GUIDE&CFID=42756411&CFTOKEN=97714385

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