

International Internet Based Video Conferencing in Distance Education: A Low-Cost Option

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Abstract

Higher education institutions in Australia are increasingly embracing the Internet as a tool to support academic programs offered in the Asian region. The purpose of this study is to describe a low cost internet-based international video conferencing system and to assess staff attitudes toward its use to deliver lectures and tutorials to Hong Kong. The students are enrolled in undergraduate business programs at a regional campus of an Australian university. The video conferencing system is used to deliver around 50% of the course content with the remainder delivered in "face-to-face" mode requiring the lecturer concerned to travel to Hong Kong. To evaluate the use of the videoconferencing system, semi-structured interviews were conducted with staff involved in the program. The results revealed an overall positive attitude toward the technology itself, but revealed some shortcomings in its effectiveness as a teaching tool.

Keywords: Internet, desktop videoconferencing, distance education, staff perceptions.

Background

La Trobe University has been involved in teaching courses in Singapore, Hong Kong, Mainland China and Malaysia since the early 1990's. The students are mature age persons who usually work in junior management roles and are seeking the promotional opportunities a university degree can offer. Before the changeover from British to Chinese rule in 1997, the Hong Kong program was delivered using a combination of sixteen hours face-to-face teaching supplemented with course text and study guide. The face-to-face teaching was done in block mode over four nights in Hong Kong. Throughout the semester, students could contact the lecturer via email or fax to ask questions and receive feedback. After the change of government, the Hong Kong authorities reviewed all undergraduate programs run by universities external to Hong Kong. This resulted in significant changes to the university's operation in Hong Kong. The most significant of these was the requirement that each subject offered in Hong Kong have face-to-face contact hours comparable to those allocated to local university students in Australia or, that the subject be offered in a full distance education mode. There was no provision for the hybrid model that operated prior to the changeover.

A number of options were canvassed in an effort to comply with these requirements and maintain cost within the university's offshore program budget. The full face-to-face option would require staff to be absent from the university for a minimum four weeks, and was clearly not viable or desirable from both the

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university's and local students' perspectives. The full distance education mode was also untenable since it would have required a large investment in infrastructure, not to mention complete rewriting of all course notes and supplements since the current material assumed the lecturer would spend at least sixteen hours with the students in Hong Kong. The third option considered was to retain the email and

fax options and deliver twenty hours of face-to-face teaching in Hong Kong, supplemented with a further eighteen hours of videoconference delivered lectures and tutorials. Initially it was planned to deliver nine two-hour videoconference sessions spaced evenly throughout the semester. However, considerations of staff, student and room availability resulted in six three-hour sessions being adopted in the final model. One of the authors of this work investigated, implemented and provided technical support to academic staff teaching with the system and was involved in teaching one of the subjects offered. The other author conducted the interview with academic staff.

The Literature

Research into the efficacy and implementation of Desktop Video Conferencing (DVC) in learning environments has increased in recent times in recognition of the potential for the Internet to provide a cheaper alternative to traditional video conferencing using dedicated networks. Much of the early research focuses on issues surrounding system set-up (Foley and Schuck, 1998) while more recent work examines the impact on student learning outcomes. Extensive searching of the literature reveals little research into the reactions of academic staff to the medium. A notable exception is the work of Freeman (1998) who investigated student, academic and support staff attitudes towards a multi-campus videoconference system at Monash University, Australia. In this study academic staff reported a number of benefits of videoconference delivery such as, "incentives to be better prepared to meet student needs" which in turn forced them to consider how interaction with the students could be achieved and how to utilize the technology to improve their teaching method.

Much of the work is positive with respect to learning outcomes although some problems related to the degree of interaction and presentation have been reported. In a study involving undergraduate business students, Alavi, Wheeler & Valacich (1995) compare the traditional face-to-face collaborative learning environments with DVC collaborative learning environments and conclude that the two are equally effective in terms of student knowledge acquisition. Knight (1998) reports on comparative research that shows students' exam performance is not affected by a DVC learning environment. Kodama (1999) investigates both the technical and human aspects of DVC in distance education and concludes that it is an effective tool for this purpose.

On the less positive side, Chao (1998) reports lower overall satisfaction from students in remote video linked locations than students in a face-to-face learning situation. The main issues identified in this research were presentation of material and interaction with the instructor.

In this paper we describe the essential elements required for implementing a successful international DVC learning environment and examine staff attitudes to being thrust into this environment. This paper contributes to the existing research in the following ways. It describes how to set up and implement a genuine low-cost DVC system that works; it discusses international program delivery using this system and focuses on the experiences of academic staff involved.

System Design

In Australia, conventional international video conferencing using dedicated digital phone lines (ISDN) is expensive, with the cost of a one-hour call to Hong Kong being US \$180 per hour for a single 128-kilobits per second (kbps) line. Although the university has good dedicated network (ISDN) video conferencing facilities, our Hong Kong partner does not, and the university was not able or prepared to invest upwards of US \$20,000 to provide these facilities. At any rate, the prohibitive connection costs ruled this option out at an early stage. This prompted an investigation of internet-based video conferencing since it offered a cheaper alternative. The cost reduction is due to the much lower price of the hardware and software involved and the much lower connection costs. Although Australian domestic Internet traffic cost is

negligible (approximately US \$11 per Gigabyte (Gb)), incoming international traffic is charged (based on university network traffic charges) at US \$55 per Gb. A typical videoconference session results in around 30 megabytes of international traffic per hour costing US \$1.60. This is less than one percent of the cost of a 128 kbps ISDN connection.

Feasibility and Product Selection

Initial trials using Microsoft NetMeeting® between the university and Hong Kong showed that point-to-point video conferencing was feasible. However, NetMeeting alone did not offer the control over bandwidth usage that was essential for a reliable link to be established. Further investigations unearthed a product that had the functionality of NetMeeting as well as bandwidth control and good quality echo cancellation. This product, by Sorenson Technologies, is called EnVision, which ships with a camera, microphone and hardware (PCI or USB versions of the product are available) that includes proprietary video and audio codecs (compression/decompression algorithms) that lower the bandwidth requirements considerably compared to NetMeeting. Bandwidth control was essential since although the university Internet connection operates at a minimum of 10 megabits per second (Mbps), the Hong Kong partner accesses the Internet through a 1.4 Mbps/512 kbps (downstream/upstream) broadband link. A test session between Australia and Hong Kong using EnVision was encouraging and it was decided to proceed with determining the optimal time for transmission and implementation of the classroom system.

The optimal transmission time was determined by measuring the response time of the university partner's server over a two-week period at five-minute intervals using the ping command and then taking daily averages. The best daily average response times were less than 400 milliseconds and occurred between 5am and 3pm Australian Eastern Standard Time AEST. Unfortunately, the students could not attend during this period due to the two-hour time difference and work commitments. The next best available period with average daily response times less than 700 milliseconds was between 8pm and 11pm AEST, which correspond to 6pm and 9pm Hong Kong time (HKT).

Of critical importance to successful video conferencing is clear audio. The most important considerations in the classroom are the audio system and the actual classroom layout (Lyons, 1999), which together determine the quality and intelligibility of the sound that is transmitted to listeners at each end of the link.

At the lecturer's end most (if not all) audio problems can be solved using a simple headset and microphone. Therefore no major audio problems were anticipated emanating from the Australian end of the link. For the Hong Kong end of the link, the situation is much more complex and required a more elaborate solution.

For sound that is crystal-clear, and for the audio system to be as user-friendly as possible, both the acoustics of the classroom and the design of the audio system must be optimised (Lyons 1999). In this case the acoustic properties of the classroom in Hong Kong were less than ideal without substantial redesign using sound absorbing materials. The audio system must be able to compensate for bad room acoustics and deliver intelligible speech for both students and lecturer.

The Classroom Set Up

The Hong Kong classroom comfortably accommodates up to 40 students in a traditional configuration of two blocks of four rows with up to five students per row. The classroom audio system combines sixteen push-to-talk microphones (two per row), connected to an eight-channel microphone mixer with a standard audio amplifier connected to classroom speakers. The mixer and audio amplifier plug directly into audio in/out plugs on the EnVision device. The push-to-talk microphones are essential as they prevent the lecturer's voice being echoed back through his/her speaker – a situation that quickly becomes intolerable. The

classroom camera is connected directly to the EnVision device and a standard data projector is connected to the computer to display the lecturer's image, whiteboard and shared applications to the class.

The Lecture Studio Set Up

The lecture studio is a small office that has been converted for the purpose. Apart from the usual office furniture, it houses a 733 Pentium PC containing the EnVision software and PCI card to which the camera, microphone and headphones are connected. In addition, it contains a Mimio device (<http://www.mimio.com>) attached to a conventional whiteboard, and a 12 by 18 inch Wacom Intuos graphic tablet (<http://www.wacom.com>) and pen. Like NetMeeting, EnVision provides a shared whiteboard and application sharing ability that allows the lecturer to display PowerPoint, excel or other applications across the Internet link. The whiteboard allows the lecturer to write and draw in a freehand fashion using either the Mimio device or the Wacom tablet. The total cost of the system (not including the two computers involved) was under US \$5,000.

Technical Support for Staff

For staff at the Australian end of the link on-site assistance was provided for the first session with support via mobile phone in subsequent sessions. At the Hong Kong end of the link, a technician is available when required and can be contacted by either the Hong Kong staff or the lecturer in Australia. As academic and support staff at both ends of the link have become more familiar with the system, calls for technical support have reduced. Most lecturers are proficient in the use of the system by the end of the second or third session and only need occasional reminders about where to find menu items on the DVC application software. In fact, several of the lecturers involved are now competent to introduce the system to colleagues as their turn comes around.

Method

A semi-structured interview protocol was developed and interviews were conducted with the six staff members that have used the system so far. The subjects taught were Business Finance, Consumer Behaviour, Forecasting, Human Resource Management, Introductory Psychology and Statistical Methods. At the time interviews were carried out, Consumer Behaviour, Introductory Psychology and Statistical Methods had been taught twice (by the same staff members), while the remaining three subjects had been taught once. Except for the Psychology lecturer, all staff involved in this study had taught in the university's offshore program both before and after the change to the current mode. The interviews covered the areas of teaching and learning, technical and communication issues and conditions of employment.

Results and Discussion

Teaching and Learning Issues

When asked to describe how a typical DVC session proceeds, all lecturers indicated that they usually started by chatting to the students in an effort to get to know them and encourage use of the microphones to ask questions throughout the session. With the exception of the Psychology lecturer, respondents felt that their videoconference delivery was similar to their face-to-face delivery to local students. The Psychology lecturer felt that the medium limited students' ability to engage in the detailed discussion of issues that characterizes local delivery of this subject. This lecturer did admit a degree of discomfort with the DVC method and felt that things would improve with more exposure to the system. Andrews and Klease (1998) report on the need for academic staff to undergo a "gestation" period in order for them to

understand the way the technology can be used effectively as well as its limitations. The experiences of the academic staff in this study support this view.

Of concern to all respondents was the number of latecomers to the sessions with most students arriving 30 minutes after the official starting time of 6pm HKT. In some cases, this caused time overruns in an effort to get through material, while in other cases it resulted in students missing material and in one case it resulted in more material being "crammed into" the face-to-face sessions in Hong Kong. As the students in the program are employed in demanding jobs and in most cases travel considerable distances to reach the classroom, it is not surprising that they are often late. This issue could be addressed by adjusting the timetable. However, the impact on academic staff must be considered, as pushing the start time back would involve working past midnight during the summer. Some lecturers have indicated they would not be happy with this.

All lecturers reported using PowerPoint as a principal tool for presenting prepared material with the Forecasting and Statistical Methods lecturers making substantial use of the shared whiteboard as "it allows much more flexibility in presenting mathematical ideas and responses to student questions". The Statistical Methods lecturer, in response to student requests for more worked examples, reported almost exclusive use of the whiteboard in the most recent sessions. Other reasons given by this lecturer for the move away from the "slide show" approach are, a growing confidence in the technology and a desire to transfer the classroom technique to this medium. The Business Finance lecturer reported occasional use of the whiteboard to clarify calculation methods with the remaining lecturers reporting little or no use of this tool. Andrews and Klease (1998) argue against this "didactic teacher centred model" and note that academic staff in their study had a limited understanding of how to develop an interactive learning model. While we agree that both students and lecturers derive substantial benefits from classroom interaction, the traditional model of university lecturing is teacher centred with most interaction occurring in the tutorial context. It would therefore be unreasonable to expect an interactive model to emerge spontaneously in the DVC setting unless a substantial effort was applied to staff development.

The Consumer Behaviour, Business Finance and Human Resource Management lecturers all reported good attendance at the videoconferencing sessions with some attrition in the post visit sessions. The Forecasting, Psychology and Statistical Methods lecturers reported fair to good attendance in the first two or three sessions with a dramatic drop in attendance occurring in later sessions. Reasons offered by the lecturers for this behaviour include students' work commitments, lack of interest, and in one case, the availability of the session notes on the subject web page immediately after the session concluded. Of these, we feel that work commitments is the most likely reason for low attendance since the students are highly motivated individuals with demanding jobs. Deflem (2001) provides some evidence that the availability of lectures notes on the Internet has a negative effect on student attendance at lectures. Therefore, the low attendance at the some videoconference sessions may, in part, be due to this factor.

The timing of the visit to Hong Kong is normally about mid-way through the semester. Most lecturers felt this was appropriate. However, the Human Resource Management lecturer reported a degree of "flatness" in the post visit sessions with attendance dropping off and suggested that most if not all DVC sessions would be better placed before the visit. The reason given for this is that one can use the VC sessions to "build up student knowledge gradually so that they can take full advantage of the time spent with their lecturer in Hong Kong". Also, the visit would come much closer to the examination and students' motivation to learn and participate ought to be higher than when the exam is six or seven weeks away. This last observation is important as it emphasises the value students place on face-to-face contact. Most lecturers report that students really enjoy the visit and perhaps they view the post visit DVC sessions as anti-climactic.

When asked whether the hybrid model (see above) or the current DVC teaching method was preferred, all lecturers with experience of both preferred the current method. Reasons given included the ability to

cover material in more depth, having more opportunities to interact with students, getting to know the students before travelling to Hong Kong and an eagerness to embrace new teaching technologies.

Technical Issues

All lecturers involved reported being given adequate training in the use of the system. The time spent in training and familiarization was between two and eight hours. To a large extent, the training time depended on the general computing skills of the lecturer. All lecturers rated the user friendliness of the system high and found no major difficulties with its operation. In addition they were happy with the technical support given during the sessions. In particular, they valued the technical support via phone as it provided "a sense of security".

Although the system testing indicated it to be robust and relatively problem free, some technical problems were encountered. Some of these were due to minor misunderstandings about how the system works and others were due to network congestion. The most common minor problems were with the audio system. Some lecturers reported their voice being echoed back through the link. In most cases this was due to an "open microphone" at the Hong Kong end of the link and all lecturers were able to resolve this issue after it was explained to them. In other cases it was due to the classroom microphone mixer or audio amplifier volume being set too high. For the sessions concerned, turning down the volume on the lecturer's headset partially resolved the problem. Technical staff in Hong Kong have now resolved this problem.

On a few occasions problems establishing a connection were encountered. This was most likely due to network congestion and was usually resolved by the Hong Kong end of the link disconnecting from the network and then reconnecting. It is believed that doing this results in a different (less congested) server being selected. On three occasions a connection could not be established resulting in severely truncated or cancelled sessions. On one of these occasions the problem was traced to a faulty modem in Hong Kong. On another occasion the cause was incorrect settings on the Hong Kong computer. For the remaining occasion no cause was identified but network failure is considered the most likely culprit.

As stated earlier, two methods of input to the electronic whiteboard are available – the Mimio device and the Wacom tablet. All lecturers that use the whiteboard found the Mimio device to be reasonable but were not happy with its overall accuracy and the fact that they could not see what was on the computer screen while they were writing on the whiteboard. The accuracy problem appears to be related to reflection of the infrared signal from the Mimio pens within the studio environment and was not resolved. Viewing the screen while writing on the whiteboard was not achievable without adding another monitor to the system and so this problem is also unresolved. The Wacom tablet solves these problems and is considered much easier to use and has been adopted by all lecturers concerned.

When asked about student perceptions of the system most lecturers believed that they were happy. However, reluctance on the students' part, to openly criticize authority figures may be preventing their true feelings coming through. Also, students appeared somewhat inhibited by the presence of the camera in the room and some sought to stay out of its range. This behaviour was also reported in research by Comeaux (1995).

The Human Resource Management Lecturer felt that technical problems have a huge impact on student disposition towards the system. This lecturer went on to say that the system should be developed further with the aim of increasing the quality and reliability.

Enhancements suggested include – a separate monitor displaying a larger image of the class, a remotely controlled camera or one that automatically focuses on the student, improved audio in the studio and better studio cooling as the lights make the room uncomfortably hot.

Communication Issues

Most lecturers reported establishing a limited rapport with students using the system. The consensus was that although the system provided much needed contact with students, it is much easier to engage them in a face-to-face situation. One lecturer commented, "it is not the same as being there but it is the next best thing provided there are no technical problems". Another lecturer noted that technical problems resulted in a loss of confidence in the system by students making it difficult to refocus them on the work at hand.

The only communication issue attributed to cultural differences was reluctance by students to ask questions in an open forum. This tends to be the case during face-to-face sessions and was not attributed to the medium. However, in face-to-face sessions the coffee break is a time when students will approach the lecturer one-on-one and the inability to have these discussions was considered a limitation (albeit inherent) of the system.

Conditions of Employment Issues

None of the lecturers were completely happy with the timetabling of the sessions (8pm to 12pm AEST and 9pm to 12pm Summer AEST) but admitted there was little that could be done about it due to the time difference (2 or 3 hours) between Australia and Hong Kong. Most felt that they received adequate recognition of their involvement in the program by the university with department heads allocating a full subject load in all cases. Some lecturers reported problems with sitting at the computer for long periods and agreed that a break is required every 45 to 50 minutes. One lecturer reported vision problems resulting from focusing on the image of the students for long periods and another commented on the warm temperature in the room due to the incandescent lighting which is necessary due the interference with video caused fluorescent lighting.

Conclusion

At the time of this writing 56 three hour DVC sessions have been completed with three of these severely disrupted or cancelled due to technical problems most of which have been resolved. It thus appears that the technology is reliable and that the quality of service of the Internet connection is adequate for the purpose. The DVC system itself is very inexpensive when compared to systems using dedicated ISDN networks and demonstrates that low-cost international videoconferencing for distance education is possible. Academic staff appear to have few problems adapting to the technology and are able to transfer their classroom techniques to the medium with few modifications. The students' learning experience depends heavily on the system reliability and the amount of preparation undertaken by the lecturer. Although the system is viewed as an important means of communicating with students throughout the semester, it is the face-to-face environment that is favoured by both lecturers and students. Technical support at both ends of the link is essential if lecturer and student confidence is to be maintained. Any technical problems during a session have a dramatic effect on students' confidence in the system and result in a poor learning environment. The system now in place will continue to be improved and upgraded in an effort to enhance the learning experience. This must be accompanied by staff development if the full potential of the medium is to be realised.

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