

# **Video Conferencing Application to Distance Education with Particular Reference to Small States**

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## **Abstract**

The paper looks at video conferencing as an important method for information communication in distance education. It explains in depth the technologies behind video conferencing, in its basic form of transmitting images (video) and speech (audio) back and forth between two or more physically separate locations, and makes brief reference to more complex applications in the form of interactive surveillance and security. The means of communication between learners and instructors in distance education must be provided by technologies. This paper discusses the technology behind video conferencing, the equipment necessary, such as end stations, cameras, video displays, microphones and speakers, and explores the role that video conferencing plays and its suitability in instructional delivery and distance education. Finally, attention is given to showing the importance of information communication through video conferencing in small states, emphasizing the economies of scale, the advantages and cost efficiency that can be effected using examples drawn from small states, including those of the Caribbean.

## **Introduction**

Video conferencing may be described as the transmission of image (video) and speech (audio) back and forth between physically separate locations. Thus, using video conferencing technology, two or more persons at different locations can see and hear each other at the same time, sometimes even sharing computer applications for collaboration. This is accomplished through the combined use of cameras (to capture and send images), video displays (to display incoming video images), microphones (to capture and send audio) and speakers (to play audio). Video conferencing can

also be point-to-point (between two endpoints), or multipoint (involving several endpoints in the same conversation).

Video conferencing stands out as a rich communications technology that offers new and interesting possibilities for distance education. This is because of its ability to combine diverse endpoints into a single setting, where audio and/or video clips, graphics, animations and computer applications from each can be shared in real-time, thus enabling whole new levels of interaction and precipitating entirely new communication and ideas. This can go a long way toward building

relationships and supporting collaboration, as well as improving retention and appeal to a variety of learning styles.

This paper looks at video conferencing as an important method for information communication in distance education. It explains in depth the technologies behind video conferencing, from its basic form in transmitting images and speech between two physically separate locations to more complex applications involving multiple points and mixed transmission media. The paper will also explore the role that video conferencing plays, and its suitability in instructional delivery and distance education, with particular reference to its applicability in small states. To this end, attention is given to showing the importance of information communication through video conferencing in small states, emphasizing the economies of scale, and the advantages and cost efficiency which can be effected using examples drawn from small states, including those of the Caribbean.

### **Brief History**

Video conferencing began over a decade ago with the introduction of expensive group conferencing systems designed to send and receive compressed audio and video over network connections that could guarantee a dedicated rate of transmission and predictable service. These connections include point-to-point T1 or fractional T1 communication links or switched connections using Integrated Services Data Network (ISDN). Standards surrounding how the audio and video would be compressed, how the endpoints would communicate with each other (i.e., initiating and terminating calls, negotiating audio/video compatibility, indicating error conditions during calls), and how the video streams would travel

over the network eventually evolved. Video conferencing systems, however, were not fully interoperable at the start. This meant that systems from different manufacturers were not fully compatible and, therefore, could not be used – at least, not easily – in the same network.

Development in this arena, nevertheless, continued apace, resulting in the emergence of useful video conferencing, facilitating interoperability between equipment of different vendors over these “reliable” connections. This interoperability was based on what is today called the H.320 standard. However, this also meant that video conferencing then was restricted to (a) those who could afford the technology (both systems and network connections) to establish video conferencing facilities (meeting rooms), and (b) those who were able to travel to a video conference-enabled meeting location.

Over the years, the above restrictions have changed. Technology for conducting video conferencing has become less expensive, more flexible, and now includes options for desktop video conferencing as well as group video conferencing. More ubiquitous network types, particularly TCP/IP as used on the Internet, are being called upon to provide less expensive and more flexible connections. In conjunction with this, a new standard has emerged for supporting audio/video conferencing over networks like TCP/IP that cannot guarantee reliability of service. The new standard, known as H.323, was recently finalized by the International Telecommunications Union (ITU), and is now being introduced in the latest video conferencing products.

Today, placing a video conferencing call is very similar to placing a telephone call. After the calling party connects, he or she sees the other person in color video and may be able to

transfer files or collaborate via options such as document sharing or “whiteboarding”. The video frame rate varies from 5 to 30 frames per second, depending on the connection, hardware, and software.

### **Video Conferencing Technology**

A video conference system must have audio-visual equipment (monitor, camera, microphone, and speaker), as well as a means of transmitting information between sites. Within this broad requirement spectrum, there are many different equipment and transmission platforms to choose from. Choice will, however, almost inevitably be influenced by economic factors. Thus, while one would expect a broadband satellite connection with studio-quality equipment to produce an excellent full-motion video connection, it is also true that the equipment and transmission expense in this case is very great, and is not always affordable.

More often than not, a less expensive approach to delivering the benefits of video conferencing has to be sought. Recent advances in computer and telecommunications technologies have sparked an interest in compressed video systems, which transmit information via today’s Internet or telephone network, greatly reducing the cost of video conferencing.

Video conferencing connections may be limited to a closed network (such as a local area network, LAN), or may use public networks (such as regular telephone lines). Quite often the video conferencing connection is effected via ISDN, which has become a popular choice as an economical solution for high-quality video conferencing. ISDN works over regular telephone lines, transmits at 128 Kbps per line, and provides dedicated bandwidth for smooth audio and video (15 to 30 frames per second).

ISDN has a number of advantages over other means of transmission:

- ISDN-based systems typically adhere to standards, so systems created by different vendors can still connect.
- ISDN works over regular phone lines, so no special wiring is necessary and availability is widespread.
- Once a connection is made, the bandwidth is connected to the call, so the quality is predictable.
- In most systems, bandwidth can be extended from 112 kbps to 384 kbps by increasing and multiplexing the number of ISDN lines.

In contrast, an Internet-based connection (as with CU-SeeMe) has to share bandwidth with other Internet data, which may cause audio clipping or delays as well as jerky video.

The most significant distinction among video conferencing systems has to do with how data is transmitted. Transmission is important not only because it impacts audio and video quality, but also because it limits connection options. For example, an Internet-based CU-SeeMe system could only connect with an ISDN-based VTel system through some sort of gateway.

### **The Importance of Standards, Openness and Interoperability**

The H.323 recommendation is an ITU standard for video conferencing over LANs that does not provide a guaranteed quality of service (QOS). This umbrella standard includes four major components - terminals, gateways, gatekeepers, and multipoint control units, enabling interoperability between vendor implementations of these components. H.323 also

includes recommendations for the provision of services such as Call Hold, Call Park/Pickup, Call Waiting and Message Waiting, as well as for communications between different administrative domains, efficient call signalling over the Internet, call and device management and low complexity single application terminals.

As in the case with all standards, here too, there was always a danger of either over-specification or under-specification. If the standard is over-specified, it runs the danger of stifling the development and implementation of cost-effective products. On the other hand, under-specified standards usually leave room for different interpretations, resulting in equally compliant yet non-interoperable implementations. The first version of the H.323 specification left significant latitude for vendor interpretation, which has enabled wide differentiation in the marketplace and led to poor interoperability among early products.

Fortunately, it would appear that market forces have already catalyzed several strategic partnerships among video conferencing vendors, which should eventually lead to increased interoperability in this arena. Indeed, there are even cases where vendors have sought to acquire complementary products in order to offer complete “turnkey” solutions. In others, joint ventures have been formed to assure interoperability within a broader product line.

We are still at the early stages of the H.323 lifecycle - while the specifications paint a picture of seamless conferencing over the Internet, today’s reality remains that of limited interoperability among a handful of standard H.323 products. As the standard continues to evolve through future versions, and as product cycles have time to reflect that evolution, this situation should improve.

## **Types of Video Conferencing Systems**

### ***Room-size***

Video conferencing systems have diversified in recent years. Initially, “room-size” video conferencing was the only method of delivery. In this environment, a lecturer made presentations from a high-tech classroom to students in both local and remote locations.

Room-size video conferencing systems typically use high quality audio-visual components, sophisticated codecs, and feature-rich control devices to create an experience suitable for a room full of participants. Room-size video conferencing is often used to support a traditional lecture mode characterized by:

- One-to-many interaction controlled by the teacher
- Distinct and unequal participation
- More formal communication

### ***Desktop***

Recent advances in technology, and the increasing availability of ISDN as a cheap delivery medium have promulgated the move toward “desktop” video conferencing. Desktop systems use a personal computer with special hardware and software to code and decode the signal. This kind of system uses cheaper components, and is most appropriate for individual or small group use. Desktop systems often include a document sharing feature, which allows participants to see and edit a computer document as they see and hear each other. Document sharing and the relatively low cost of desktop systems make this an ideal tool for communication, collaboration, and learning. Desktop video conferencing is usually characterized by:

- Many-to-many interaction

- Equal participation
- More relaxed method of control
- Informal communication among participants

## **Equipment Components**

### ***Codec***

In general, compressed video must transmit information via a smaller “pipe” than a televised broadcast. The camera and microphone take in more information than the “pipe” can handle, so the video and audio information must be processed before being transmitted. This is done by a codec (short for coder-decoder), a piece of equipment that takes the analog video signal and codes (digitizes and compresses) it for transmission, thus allowing video conferencing over regular telephone lines. The codec also has to decode (decompress and undigitize) the received transmission. This processing can take its toll on the video and sound quality, the most obvious consequence of a slow codec or low-bandwidth connection being a “jerky” picture and an audio time delay.

### ***Video Equipment***

While desktop systems display video in a small window on the computer monitor, room systems typically have one or two large video monitors and usually display the local audience as well as the remote audience. The camera can be anything from a tiny desktop camera that sits on top of a computer monitor (desktop system) to a high quality model with remote control pan and zoom features (room system). High-end systems often come with a document camera and a second video connection.

### ***Audio***

Most high quality systems come with a microphone designed to work best with a small

group of people. In many cases, an additional microphone can be connected as well, making the setup more versatile for larger groups. The best systems use sophisticated processing to cancel out background noise and echo.

### ***Controls***

Controls allow users to place calls, adjust volume, and sometimes even pan and zoom the camera. Desktop systems display controls and tools on the computer monitor window. Room systems come with remote control or console devices.

## **Video Conference Systems in Distance Education**

Video conferencing systems are often used for distance learning, linking distant teachers and learners for instruction delivery. Some of the ways the technology is used for achieving this goal, bringing benefits to teachers, administrators and students, include the following:

- Students can take classes not offered at their institution.
- Learning institutions can offer classes during off-hours and to students who cannot attend traditional classes.
- Institutions can team up with businesses to offer employee training or certification.
- Teachers can team-teach with remote teachers, sharing subject matter expertise or a unique approach to a topic.
- “Master teachers” in particular subjects can be made available to a larger audience of students of wider geographic reaches.
- Students can meet with tutors for enrichment, remediation, or a helpful bit of personal attention. This is a good way for

businesses to support schools.

- A class, say, can communicate first-hand with experts in many fields to enhance understanding of a subject they are studying. This real-world contact can heighten interest, improving motivation and retention.
- Teachers and students can collaborate and exchange information with other schools in areas such as peer counseling, bilingualism, and student government.
- Students can communicate with video pen pals to experience diverse cultures and ways of life, both economic and ethnic. Video pals also provide an excellent opportunity for foreign language practice.
- Schools known for outstanding programmes or projects can model those projects for other schools.
- Contests between schools – debates, spelling bees, or research conferences – can take place via two-way video.
- Video conferencing can facilitate distributed cooperative learning, where groups at distant sites take on a learning task and teach remote peers.
- Distributed projects can make use of video conferencing technology for collaboration and communication.

It is important to keep in mind that the video conferencing sessions must be planned to ensure that the parties get the best out of the sessions. Where possible and appropriate, learners should also participate in planning the sessions. Like the telephone, video conferencing

works best as an interactive medium, and the audience and speaker will have to be prepared to use the technology effectively.

### **The Cost-effectiveness of Video Conferencing in Distance Education**

In small states and developing countries, especially, where education policy makers grapple every day with conflicting priorities as they face up to severely constrained resources for widening access to education, the cost-effectiveness of the delivery method takes on great importance. Distance education can be more cost-effective than traditional education. In general, distance education proves more cost-effective over its conventional counterparts when the economies of scale are such that the implementation of the distance education platform ensures an average cost per student lower than that in conventional systems. And this is true, too, for video conferencing systems, where, sometimes, cost-effectiveness can even be justified on cost avoidance alone.

This means that drop-out rates must be kept low and that care should be given to the selection of the delivery platform to ensure that it remains cost-effective. This should be backed up by investment of adequate resources in student services and central infrastructure. Market research takes on great importance in ensuring that courses attract sufficient numbers of students. Unfortunately, however, in the conflicting priorities faced by small states, the market research element is, quite often, one that is sacrificed.

### **University of the West Indies Distance Education Centre (UWIDEC)**

The University of the West Indies (UWI) offers distance education through UWIDEC (formerly

UWIDITE). The delivery of distance education here includes the use of video conferencing facilities, which link the three main campuses of the university in Jamaica, Trinidad and Barbados with centres 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 Certificate of Education courses are worthy of mention here. They offer further training for practising non-graduate teachers. Studied full-time, the Certificate, which consists of a common core and one specialism chosen from about a dozen, takes one year. Taught at a distance, it enables practising teachers from noncampus countries to participate and gain a qualification. The Certificate was first awarded in 1954; the distance version was introduced in 1983, with four specialisms, and already by 1985 Dominica had produced as many certificate holders as in the previous 30 years put together. Also, costs are less than half those that would have been incurred if the teachers had registered for the courses on campus and had to be replaced in the classroom while they studied.

It was found that distance education is the best means of providing training for these teachers scattered through the islands. The great strength of the programme is in its provision of specialist courses for upgrading professionals. Its communications system allows several countries to offer the same programmes, and enlarges the range of courses that the university can offer in noncampus countries.

The regional collaboration in UWIDEC has brought other benefits. Regular discussions

among students 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.

## **Summary and Conclusion**

Video conferencing involves the transmission of video and audio information between persons in physically separate locations. The technology to accomplish this makes use of cameras, microphones and speakers, supported by decoding and encoding equipment (codec) and appropriate transmission (telecommunications) facilities. ISDN stands out as the transmission medium of choice for high quality video conferencing, while delivery over the Internet continues to gain momentum. Video conferencing equipment, too, has diversified over the years – whereas “room-size” systems were once the only choice, technological advances are now shifting the pendulum toward “desk-top” systems. Further, the advent of video conferencing standards is pushing the envelope of interconnectivity and interoperability for these systems.

Video conferencing provides a viable alternative for the delivery of distance education. This is true not only for larger countries, but also for smaller states. Implementation of UWIDEC – a UWI-based distance education platform which incorporates video conferencing – proves this. Through the UWI distance teaching programme, it was found, for example, that distance education provides the best means of delivering training to teachers across a number of Caribbean islands.

Although video conferencing can be shown to offer several advantages in the delivery of

distance education, it is equally clear that the chance of realizing the potential is greatly enhanced if the implementation process is preceded by very careful design, paying due attention to ensuring selection of optimal systems, as these relate to both equipment and transmission media.

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