Videoconferencing
Using Compressed Video for Distance Learning

This paper was originally written by two San Diego State University graduate students, Jennifer Mosby and Merry Woodruff. This paper was the original source for the Videoconferencing for Learning website. Below is the paper more or less as it was written in 1995.

- Understanding the Medium
  1. Advantages
  2. Technological Constraints
  3. Human Factors
- Instructional Strategies
  1. Set Expectations
  2. Engage Students
  3. Reduce Distractions
  4. Encourage Dialog
- Planning a Lesson
- Guidelines for Audio-Visual Aids
- Videoconferencing Checklist
- Evaluation
- Conclusion
- References

Introduction

Until recently, distance learning with two-way video was out of reach for many institutions. Innovations in telecommunications technologies have lowered equipment and transmission costs making two-way video feasible for small colleges, businesses, classrooms, libraries, and even homes. Unfortunately, access to the latest videoconferencing technology does not guarantee a valuable learning exchange. While compressed video holds great promise for expanding the classroom experience, it also amplifies poor teaching styles and strategies. With this in mind, instructors considering the use of compressed video will need to understand and work with the advantages and constraints of the medium to ensure a quality videoconferencing experience. In particular, instructors should plan to devote greater than normal effort toward preparation and development of instructional strategies that actively engage learners. The planning process and learning curve may seem excessive at first, but the shift from "knowledge disseminator" to "learning facilitator" is likely to enhance learning for both local and remote students. This article provides a path for instructors to develop and implement effective telelessons using two-way compressed video. This page is a compressed version of the AT&T Videoconferencing for Learning website (http://www.kn.att.com/wired/vidconf/). Feel free to download a pdf version of this article for your personal use or for training other teachers and librarians.

Understanding the Medium

Videoconferencing technology allows people at two or more locations to see and hear each other at the same time. It is possible to share computer applications such as Internet pages, library catalogs, documents, or software. This rich communications technology offers new possibilities for schools, colleges, and libraries including formal instruction (courses, lessons, and tutoring), connection with guest speakers and experts, electronic fieldtrips, multi-school project collaboration, professional activities such as meetings and interviews, and community events.

A videoconference system must have basic audio-visual equipment (monitor, camera, microphone, and speaker) as well as a means of transmitting information between sites (bandwidth). Videoconferencing connections may be limited to a closed network (such as a LAN) or may use public networks (such as regular phone lines). ISDN (Integrated Services Digital Network) is a regular copper phone line and is an economical solution for high-quality videoconferencing. Internet-based connections (IP) are increasing in popularity.

Many believe that the Internet will eventually replace ISDN as the medium of choice for videoconferencing. However, for the highest quality, ISDN is still most widely recommended.

Advantages of Interactive Videoconferencing

As an interactive communication medium, two-way video stands out in a number of ways. First of all, it's almost like being there. The visual connection and interaction among participants enhances understanding and helps participants feel connected to each other. This goes a long way toward building relationships in a way that e-mail, telephone, or online chat systems cannot. A videoconference can appeal to a variety of learning styles by including diverse media such as video or audio clips, graphics, animations, computer applications.

Establishes a visual connection among participants. A teacher can see and hear remote learners in real time. She/he can use conversation and body language to enhance communication. Frequent interaction increases understanding and encourages more personalized instruction. Interactive teaching strategies such as questioning and discussion can also help engage and motivate learners by making them active participants.

Enables connection with external resources. Remote experts can help validate understanding, provide feedback, and introduce practical examples. This real-world connection can greatly improve motivation, especially if students participate and the expert interacts at an appropriate level.

Supports use of diverse media. Photos, color graphics, even 3-D objects look great over video and can help convey a difficult concept or simplify instructions. You can attach a document camera to transmit high-quality still images. Many instructors project "slates" -- simple displays with a few major text points. Slates are an easy way to shift learner focus from the video screen to a learning activity. Attaching a computer will allow presentation of PowerPoint slides, Internet sites, and software.

Document sharing facilitates collaboration and feedback. Some systems allow application sharing -- users at each site can see and take control and edit a document. This kind of sharing encourages collaboration and real-time feedback.

Technological Constraints

Compressed video behaves differently than the broadcast video most of us are accustomed to. Understanding and working with these differences can help improve a videoconference. 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 by a piece of equipment called the codec (**co**der-**dec**oder) before it can be transmitted. Incoming signals are decoded by the codec before they are sent to the monitor and speakers. All this processing can take its toll on the resulting picture and sound, and can result in the following features:

Video "ghosting" or "tiling" is the codec's way of compensating for rapid information flow. One way the codec compacts information is by reducing frame rate (number of video images per second), which can make rapid motions appear jerky. The codec also drops resolution to compress information, which can make an image fuzzy or chunky. To reduce these effects, reduce the amount of visual information change. Avoid rapid motion, wear plain clothing, and hang a pastel curtain behind participants to reduce extraneous visual information.

Audio delays can occur because it takes about a split second sometimes for information to compress, travel, and decompress. Videoconferencing novices occasionally experience a few awkward conversations due to this time delay. Since there's no way to prevent the delay, learn to finish thoughts in a single statement with an obvious conclusion. Listeners should avoid interrupting and use visual cues (like nodding) instead of verbal affirmations (like "uh huh").

Audio "clipping" or echo might take place if your audio system isn't properly configured. If you are experiencing audio problems, reset the echo canceler (if you have one) and reduce background noise. You should also check your equipment documentation for volume and microphone placement guidelines. Depending on equipment, use of headsets and external speakers can also improve audio quality.

Working With Human Factors

Another part of understanding two-way compressed video is understanding how it is perceived by its users and how these perceptions influence interaction within this medium. Try to keep the following human factors in mind as you explore videoconferencing via two-way video.

Videoconferencing etiquette must be established. Most people have not experienced videoconferencing and do not communicate as they would in a face-to-face situation. Unfortunately, we're just not accustomed to conversing with a television image, and two-way video etiquette has yet to be refined. Turning your back on the remote site and conversing "locally" is rude. Shuffling papers or dangly bracelets in constant motion near the microphone, entering or leaving during a meeting, even serving food and drinks can be extremely disruptive. By muting your microphone and switching camera positions, you can mask these activities and eliminate interruptions for the remote sites. The groundrules of your videoconference should be made clear at the onset. Better yet, a hard copy of the agenda and groundrules can be sent ahead of time.

Two-way videoconferencing is unlike one-way television, but many people have a difficult time changing ingrained habits and preconceptions produced by years of experience watching television. Not only do we tend to "tune out" what's on a television screen; we also expect to be entertained by it. We expect broadcast quality video, slick graphics, and a quick pace to keep us engaged. And if we're not fascinated, we quickly change channels to something more interesting. The behaviors we associate with television -- channel surfing, "spacing out," "vegging" -- are not optimal learner behaviors. Teachers who use two-way video must challenge basic learner preconceptions and set new expectations to maximize learning. Fortunately, good two-way video instructional strategies are also good classroom instructional strategies.

Instructional Strategies

Effective use of videoconferencing technology for learning requires practice and planning as well as attention to a few important instructional strategies. Two-way video works best as an interactive medium.

Set Expectations.

A simple way to challenge the television mentality is to communicate expectations to the learner prior to instruction. A simple letter or a few comments at the beginning of a lesson can go a long way toward helping learners understand differences between broadcast television and two-way compressed video. Keep it simple; but consider explaining the difference in audio/visual quality along with a few suggestions to optimize that quality. One might, for example, encourage learners to keep background noise and motion to a minimum and explain ways to deal with the audio delay. A teacher should also prepare learners for an active experience. Assign a pre-session activity or begin the lesson with a discussion. Actively involve learners early and often, using small group or hands-on activity, reading, writing, discussion, and questions to get them out of the passive "viewing" mode.

Engage Students with Variety and Interaction

Incorporate variety into instruction to keep interest and motivation high. Use relevant visuals or sounds to illustrate points, and if possible, bring in a guest speaker to share a different perspective, answer questions, or provide real-world feedback on student projects. Even with thrilling visuals and instructors, nobody wants to watch a talking head for hours; so make sure learners have an opportunity to focus attention away from the screen. Assign small group activities with a task that can be discussed later. Tag a break onto an activity to give students a chance to stretch and talk. Highly motivated learners in a tightly focused lesson can tolerate lengthy lectures; but as a rule of thumb, don't lecture for more than 15 minutes at one time. Instead, alternate lectures with activities or discussions.

Reduce Distractions

Since variety is so engaging, reduce the potential distraction of the screen by posting a still image or slate during a class activity. Don't be afraid to use silence. Music or chatter can distract students from learning.

Encourage Dialog

Asking a question can be daunting for students, especially if it means they must get the attention of a remote teacher and talk to a TV screen. Teachers can help by noting the body language of remote students and taking the time to query when students seem puzzled or disinterested. Eye contact and use of names both help make students feel more comfortable. These people skills are obvious and natural in a "live" classroom, but may seem awkward in a distance learning situation. "Eye contact" means looking at the

camera and the monitor rather than local students, and teachers might have to make a special effort to attend to remote learners. To help out introverted students, consider alternative modes for questions and comments. Make a fax machine available or solicit e-mail for questions and comments. Consider holding videoconference office hours or paying a visit to the remote site. Use resources creatively to establish rapport and help all learners participate.

Planning a Lesson

Many of us think of extended course delivery and distance learning when we first set out to videoconference. In reality, it's easier to get started in videoconferencing by taking "baby-steps." This is done by participating in programs and field trips that others have created and have already worked the bugs out. You can use our Videoconferencing Directory (http://www.kn.att.com/wired/vidconf/directory.cfm) to see what's available. Meetings and simple collaborative events can also be conducted without much fanfare and will provide opportunities to become familiar with both the equipment and the nature of videoconferencing. At the very least, the teacher or librarian must know how to use the components of the videoconferencing system. They must manage local and remote sites and should be able to connect to and collaborate with remote experts or guests. When you're ready to start creating a lesson for two-way video, it's important to plan with the all of the above tips and strategies in mind. Consider using a lesson plan matrix that includes:

Learner Outcomes	Methods and Activities	Materials	Time	Equipment Cues	Notes
What do you expect your learners to accomplish?	How will you convey the topic (lecture, discussion, hands-on activity)?	What audio/visual aids, handouts, etc. will you use to support your instruction?	About how much time will it take?	Do you need to show an instructional "slate" with the document camera or play an audio clip?	Do you need to prepare a visual or get handouts to remote learners?

After you've completed your lesson plan, review it with the following questions in mind:

- How much total time is spent in lecture? (Keep it less than 50% -- 30% is better.)
- How much time is spent lecturing at any given time? (Keep it less than 20 minutes.)
- Are breaks included?
- Can a remote facilitator or guest lecturer facilitate some of the lesson?
- Is rapport established with remote learners?
- Do learners know what to expect?
- Can any of the lesson be done prior to the video connection (via print, e-mail, World Wide Web, or with the remote facilitator)?
- What support is needed to make the lesson a success?
- Is evaluation time included?

Guidelines for Audio-Visual Aids

As in any instructional setting, effective use of audio-visual aids can greatly enhance distance learning. You can use images, objects, audio or video clips much as you would in a normal class with a few caveats to guide you:

Pay attention to the screen's aspect ratio. A TV monitor has a different shape than 8.5 X 11 paper or overhead transparencies, so make sure printed visuals fit within a 3 X 4 ratio. It's safe to use a "landscape" orientation with a 3 inch, text-free boundary.

Use large, bold text for instructional "slates." Remote viewers will thank you if they don't have to squint to see text. They'll also appreciate simple fonts and concise, bulleted information. Test ahead of time if possible to determine the best font size.

Use colors in the middle of the color spectrum. Next time the television news is on, pay attention to the colors chosen for graphics. You won't see a lot of black on white, because it just doesn't look good on a

screen. Yellow on blue is common, however, because it presents a clear, readable image. For on-the-fly writing, use a bold color ink pen on pastel paper.

Use video carefully. Many videoconferencing systems allow transmission of video from an auxiliary source such as a VCR or camcorder, but transmitted video may appear jerky or fuzzy to remote viewers. In general, it's best to keep video segments brief. To show a lengthy segment, send a videotape to the remote facilitator.

Obtain written authorization before you use copyrighted materials. Use of copyrighted material in a distance learning situation requires permission, so obtain clearance before broadcasting audio-visuals.

Videoconferencing Checklist

In addition to lesson planning, teachers need to attend to details such as equipment use, room set-up, and appearance. Use the following checklist to keep on track.In addition to lesson planning, teachers need to attend to details such as equipment use, room set-up, and appearance. Use the following checklist to keep on track. You can download this checklist (MS Word) from our website and edit it as needed at http://www.kn.att.com/wired/vidconf/checklist.doc

Date of Conference: _____
Time: _____
Purpose: _____
Far End ISDN numbers: _____
Far End telephone number: _____
Local ISDN numbers: _____
Local phone number: _____
Technical contact: _____

To do well in advance:
_____ practice using equipment
_____ prepare lesson plan and materials and obtain copyright clearance if necessary
_____ schedule a date and time for the telelesson
_____ arrange for remote facilitators, guest speakers, technical support, etc.
_____ reserve equipment/room
_____ consider how you will set up the room (background, cameras, clock, etc.)
_____ for more than two sites (multipoint), schedule a bridge
_____ develop a back-up plan in case of technical problems
_____ schedule a practice session

One week prior to conference:
_____ share your expectations with participants
_____ make sure the remote site has necessary materials
_____ share ISDN and telephone numbers and determine who will place the call
_____ find out who to contact if there are problems
_____ practice with remote facilitators
_____ decide what to wear (avoid loud patterns, red, & white)

Day of Conference:
_____ arrange the room
_____ connect with remote site 15-30 minutes prior to the meeting time
_____ check audio, video, lighting, auxiliary equipment (document camera, VCR, etc.)
_____ preview local camera angle and preset angles if possible
_____ keep ISDN and telephone numbers handy during the conference
_____ view yourself occasionally (make sure the other end can see whomever is speaking)

Evaluation

A good deal of planning and preparation probably went into setting up and conducting your videoconference. Don't lose an opportunity to make the next one better! When the videoconference is over, take formal steps to evaluate what could be done to improve the next one. Consider taping the session and viewing it later. Jot

down notes during and after the session. Get feedback from participants. Not only are there technical issues that might benefit from an evaluation; but the instructional or content presentation aspects might also be improved. Here are some questions to ask yourself, learners, and support staff:

- What were the intended outcomes of the lesson? Were they achieved?
- Were expectations clear **prior** to the lesson?
- Was the lesson technically effective?
- What did you like/dislike about using the technology?
- What would have improved the lesson?
- What should be done differently next time?
- How did the experience compare to a more typical classroom experience (pros/cons)?

In 1995, we worked with Dr. Victoria Bernhardt, Director of Education for the Future, to devise evaluation forms to be used by our Education First demonstration sites and by our staff as we experimented with videoconferencing. The forms have been modified slightly since then and are available for download as MS Word documents. Feel free to customize them (for example, the original form provided an opportunity to add comments after each question), or print it and use it as is. The form below is the Instructor Evaluation Form (http://www.kn.att.com/wired/vidconf/InstructorEvaluation.doc). There is also a similar Particpant Evaluation Form (http://www.kn.att.com/wired/vidconf/ViewerEvaluation.doc)

Instructor Evaluation Form					
Instructor(s):	Date of videoconference:				
Title of videoconference:	Length of videoconference:				
Number of viewers:	Number of sites:				
What were the intended outcomes of the videoconference and how well were they achieved? (please attach description if necessary)					
Circle the number that represents your feelings about these questions	Not at all Effective				Very Effective
How effective was the content of the videoconference? (how well was the content delivered)	1	2	3	4	5
How well did the content of the videoconference connect to your curriculum?	1	2	3	4	5
How effective was the videoconference technically, e.g., clear picture, clear sound? (how well the technology worked)	1	2	3	4	5
What did you like about using the technology?					
What were the benefits of using this technology?					
What did you not like about using the technology?					
What would have made the videoconference better?					
What will you do differently the next time?					
General comments?					

Conclusion

There's no doubt that two-way compressed video can provide exciting and valuable experiences for learners. By allowing access and interaction with resources that might have otherwise been too inconvenient or expensive, two-way compressed video opens a world of new opportunities. Instructors may need to plan and prepare more than usual to take advantage of this medium; but strategies that work best with this medium

are likely to improve motivation and learning. The payoff should be more than enough to compensate for the extra effort necessary for an effective videoconferencing experience.

For more information, see the AT&T Videoconferencing for Learning website. The Videoconferencing for Learning website is a comprehensive look at the educational uses of videoconferencing for teachers, librarians, students, administrators, technology coordinators, and others interested in the use of this technology. The site includes the following sections: Ideas and Examples; Communication Skills; Working With Compressed Video; Equipment; Instructional Strategies; additional Links, and a Glossary. We also sponsor a videoconferencing listserv called the Collaboration Collage (http://www.kn.att.com/wired/vidconf/ed1vidconf.html) for seeking subject-area experts or classroom collaborations, for posting questions, and for sharing successes or lessons learned. This entire page is available for you to download (Adobe pdf)

References

Acker, S.R. & McCain, T.A. (1993) Two-way videoconferencing for K-12 populations: A research synthesis and action agenda. International Teleconferencing Association Yearbook. pp. 47-54.

Strom, J.L. (1994) Bringing People Together: Distance Learning Now. School and College. December. pp. 11-14.

Ostendorf, V.A. (1989) Teaching Through Interactive Television: a practical introduction to business television and distance education. Virginia A. Ostendorf, Inc. Littleton, CO.

Ostendorf, V.A. (1994) The Two-Way Video Classroom. Virginia A. Ostendorf, Inc. Littleton, CO.

