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ABSTRACT

Since 1990 West Virginia University has offered a distance education program leading to teaching certification and a master's degree in either severe/multiple disabilities or early intervention/early childhood special education. The courses were offered via satellite transmission, but in response to demand for these courses in areas without satellite access, the program is using webcasting technology to transmit class sessions over the Internet by means of Web simulcasts and re-broadcasts. The program has used two systems to deliver webcasts: Apple's QuickTime streaming format and RealNetwork's RealMedia streaming format. QuickTime streaming was easy to use, had high quality images, and offered excellent results with cable modem or fiber line Internet connections, but only fair results with 56K telephone modem access. RealMedia streaming provided lower quality video but allowed the stream to be adjusted to the user's Internet access, making the webcasts more accessible via telephone modems and lower bandwidth connections. The program decided to stay with RealMedia because it is more easily accessed by a wider range of equipment, even though overall video quality is not as good as with QuickTime. Hardware and software needs and costs are described for each system. (Contains 5 references and 15 resources on webcasting.) (TD)

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LIVE BROADCASTING ONLINE: INTERACTIVE TRAINING FOR RURAL SPECIAL EDUCATORS

Abstract

This paper describes how to use a desktop computer and inexpensive software plus a PC or Macintosh streaming server to deliver live interactive class sessions via video with audio streaming on the Internet. Although the use of Web-based instruction for preservice and inservice program delivery in special education and disability services is expanding rapidly, most existing programs rely primarily on text presentation and asynchronous (delayed time) technologies such as threaded discussions. Relatively little use has been made to date of the Web's multimedia capabilities or synchronous (real time) technologies such as audio- or videoconferencing. The use of webcasting technology (both simulcasts in real time and re-broadcasts on demand) represents a fairly inexpensive, simple to use mechanism for delivering personnel preparation programs for practitioners working in early intervention, special education, or adult disability services in rural areas without the need for high bandwidth connections. The distance education program in Severe/Multiple Disabilities and Early Intervention Special Education at West Virginia University has successfully utilized webcasting technology to deliver a graduate certification and degree program to practicing but uncertified special educators working in rural areas of the United States as well as in several other locations around the world.

Objectives

The paper will accomplish five (5) objectives:

1. to describe the application of live and archived webcasting technology to personnel preparation programs for rural special educators;
2. to illustrate hardware and software needed to create, deliver, and receive webcasts;
3. to present initial evaluation data on participant performance and perceptions;
4. to discuss the pros and cons of using webcasting for preservice and inservice training and
5. to disseminate information about resources helpful in planning for webcasting.

The procedures and outcomes described in this project may be useful for college and university faculty and/or state and local school personnel who are currently using or may be considering web-based training options in rural areas.

Introduction to the Webcasting Project

Effective and efficient personnel preparation programs at the preservice and inservice level are essential in insuring a free appropriate public education for all children, but especially in rural areas, where staff recruitment, retention, and development are critical issues. Emerging technologies offer promising solutions to the challenges colleges and universities as well as state and local education agencies face in providing accessible and appropriate training to rural special educators. The webcasting technology described in this session is an innovative approach to helping special education personnel acquire knowledge and skills needed to deliver best practices in rural schools and to acquiring full credentials for licensure/certification in special education or disability services.

Background of the Webcasting Project

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Technology-mediated distance education is rapidly becoming widely used for personnel preparation in special education at both the preservice and inservice levels. Today's telecommunications technologies allow quality programs to be delivered to many individuals effectively and efficiently without the barriers of time and space (Howard et al., 1992). A number of universities are now using distance education to address critical personnel shortages, especially in low incidence disabilities and in rural areas (Ludlow, 1998). Although web-based instruction is just now being explored for its distance education potential, it has many promising applications in teacher education in special education. Web-based instruction is especially appropriate for on-the-job training of practitioners because it allows learners to work at home or school to process materials at their own pace, to interact with the instructor and other practitioners as needed, and to receive individually designed feedback as they apply information to real world settings (Kelker et al. 1992; Kendal, 1992). Recent availability of streaming media and higher bandwidth connections now permit the delivery of live interactive sessions on the Internet in real time. Teacher education programs can harness the potential of this exciting new technology to develop more accessible, lower cost distance education programs.

Description of the Webcasting Project

West Virginia University (WVU) has offered a distance education program at the graduate level leading to teaching certification and a Master's degree in either Severe/Multiple Disabilities or Early Intervention/Early Childhood Special Education since 1990. All courses in these programs have been offered via unencrypted C-band satellite transmission to individuals attending at colleges, schools, public libraries, and other public sites throughout West Virginia and the surrounding Appalachian region. However, frequent requests by individuals living in more remote rural areas in this region, in other parts of the country without satellite access, or in international locations outside the satellite footprint (signal distribution area) prompted the program coordinator to consider how the program could accommodate these prospective students and expand its service area. In response to this demand, the program has begun to utilize webcasting technology since 2001 to transmit class sessions over the Internet to individuals without satellite access, by means of both web simulcasts and re-broadcasts.

Web simulcasts. Web simulcasts are live class sessions streamed over the Internet at the same time as satellite broadcasts. They are delivered to students who live outside the state borders of West Virginia, primarily in other areas of the United States that do not have satellite access. These students view each simulcast on a desktop computer at their home or workplace during the class session hours from 5:00 to 7:00 p.m. one night per week throughout the academic semester. They interact with the instructor and other students in the course by calling a toll-free telephone number to access the course audio conference bridging system. Both instructor and simulcast student must make allowances for a 10 to 30 second delay between the time a question is asked or a problem is posed on air and the time the distant student is able to respond to it. If the student uses a phone modem to access the Web, s/he must use a second phone line or a cellular phone to make calls during class time.

Web re-broadcasts. Web re-broadcasts are archived class sessions streamed over the Internet after each live class session that can be accessed on demand at any time. They are delivered to students who live outside continental North America where time zone differences do not permit viewing of simulcasts. They also are available to all students in the course (including those who participate by satellite transmission or simulcasts) as a mechanism for reviewing course content or as a means of making up class sessions missed due to technical problems or personal reasons. These students view each re-broadcast on a desktop computer at their home or workplace but obviously they cannot interact in real time with the instructor or other students during the live class session. To simulate live interactions with international students, the instructor provides them with discussion questions and class activities one week prior to each scheduled class session and invites them to send written comments which s/he then reads during the live class session. These students also have other opportunities to interact with their classmates through a variety of structured and unstructured online activities during the course.

Developing and Delivering Webcasts

The hardware and software needed to implement webcasting technology is readily available, simple to install and operate, and low in cost for instructor and learner. The WVU Program has used two (2) different systems

to deliver webcasts, one primarily a Macintosh computer-based system and the other a Wintel computer-based system. Each of these systems is described below along with cost estimates for setting them up.

1. QuickTime streaming format

Apple's QuickTime streaming format is the easiest system to use for webcasting, especially for those with relatively little technology expertise. The QuickTime tools are the least expensive and most user friendly for audio and video streaming, whether in real or delayed time mode (Sauer, 2001). QuickTime also has the dual advantages of cross-platform compatibility and high quality images with "skip protection" technology (Waggoner, 2001).

QuickTime streaming was used for webcasts during the first year of the project, and the instructor and media producer worked with students to identify and solve problems and fine-tune the system. They concluded that Apple's QuickTime streaming provided high quality video but only a single stream of 56Kbps, which was too fast for some phone modems and too slow for high speed connections. In general, the QuickTime webcasts offered excellent results with cable modem or fiber line internet connections, but only fair results with 56K telephone modem access; the international sites were able to get good audio signal but no video signal.

The program coordinator purchased all hardware and software using internal grant funds in the summer preceding the first academic year of the project. The media producer set up an Apple OSX streaming server in a departmental office and obtained a static Internet Protocol (IP) address and a dedicated access line from university administration. He also installed Sorenson Broadcaster software on an Apple Powerbook 5300 (laptop selected for easy transport to and from the broadcast studio during classes) to create the live streams and a copy of Quicktime 4.0 Pro to convert the archived files to a Web-friendly format. Finally, he created a special icon and page within the WebCT course management system software where students could select individual links for the live and archived streams. The program coordinator wrote an extensive set of directions illustrated with screen shots to assist students in preparing their computers for webcasts; these directions were added to the WebCT course system as an HTML page with links to other Web sites.

At the broadcast studio, the production switcher was connected to the Powerbook with a cable and to another desktop computer within the studio so that the producer could monitor the live streams. The Broadcaster software was used to convert the output from the studio switcher on the fly into a Quicktime audio and video stream using the Real Time Streaming Protocol (RTSP). A single stream was sent to the program server at another location where students could access the class session via a link within the university's WebCT course management software. During the class session, the instructor monitored the simulcast with a desktop computer. After each broadcast, QuickTime Pro software was used to prepare the archived files (by means of "hinting") for delivery on demand. These archived files were then uploaded to the program server so that students could access the re-broadcasts on demand at any time throughout the course.

In this system, the instructor requires the following equipment:

- *Apple OSX streaming server equipped with a 733 MHz processor and 256 MB RAM and a 1 GB drive with a 50 stream license with no server tax (cost about \$5000)

- *Apple Macintosh G3 Powerbook 5300 with 400 MHz processor speed and 250 MB RAM to house the encoder software and facilitate transport to any site from which the class will be transmitted (for example, a broadcast studio, the instructor's office, etc.). (cost about \$3000)

- *Sorenson Broadcaster streaming software to digitize the audio and video signal at a single data rate on the fly from the camera in real time (cost about \$300)

- *XLR8 Interview external USB video capture device to convert the broadcast signal to digital video signal prior to encoding (cost about \$300)

- *Apple QuickTime Pro software (cost about \$30)

TOTAL INSTRUCTOR COST FOR QT STREAMING: approximately \$8630

This system requires students to have the following equipment:

*desktop computer of either platform with at least 300 MHz processor and 64 MB RAM and with audio and video cards (cost varies because newer computers come equipped with such features while older computers may need to have special cards installed – since students must have computers to access other Web components of the course, this generally requires no additional costs to them)

*free copy of Apple QuickTime Player 4.0 downloaded to their computer's desktop and installed in their browser's plug-ins folder to view the webcasts (no cost)

TOTAL STUDENT COST FOR QT STREAMING: none

2. RealMedia Streaming Format

RealNetwork's Real Media streaming format is another streaming system that is not too difficult or costly to use for webcasting and is better suited to the varying nature of bandwidth currently available to end users on the Internet. RealMedia streaming has the advantage of producing several streams at different access rates or using patented Surestream technology to offer a single stream that automatically adjusts to the user's access rate (Waggoner, 2001). For this reason, the RealMedia tools are more expensive but offer greater flexibility (Sauer, 2001). In order to insure greater access to the webcasts, the program coordinator and media producer investigated other options for transmitting live and archived video streams, deciding to use RealMedia streaming for webcasts during all subsequent years of the project. They concluded that RealMedia streaming provides lower quality video but the Surestream technology allows the stream to be adjusted to the user's Internet access, making the webcasts more accessible via telephone modems and lower bandwidth connections. The Real Media webcasts offered excellent results with cable modem or fiber line internet connections, and good results with 56K telephone modem access; the international sites were able to get good audio signal and fair video signal.

The program coordinator and media producer collaborated with technical personnel at the West Virginia Education Network (EDNET) in Institute, West Virginia to transmit live webcasts and record archived webcasts for the remaining courses in the project. EDNET personnel set up a rack-mounted Athlon ATX computer to run the encoder software. They purchased an annual 100 stream Real Producer Pro license from RealNetworks to encode the streams on the fly from the live satellite broadcasts and installed an internal PCI video capture card to convert the analog signal sent from the WVU broadcast studio to digital signal. They used a Microsoft Windows NT 4.0 server to store and serve the live and archived video streams.

In this system, the instructor requires the following equipment:

*Microsoft Windows NT server equipped with a 700 MHz dual processor and 86 MB RAM plus a 10 GB drive (cost about \$3500)

*RealNetworks RealProducer Pro streaming software to encode simulcasts and re-broadcasts with a 100 stream license (cost about \$2000)

*Athlon ATX computer with 500 MHz processor and 64 MB RAM to house the encoder software (cost about \$1000)

*Microsoft Windows 2000 Pro server software (cost about \$1000)

ViewCast Osprey 100 internal PCI video capture card to convert the broadcast signal to digital video signal prior to encoding (cost about \$200)

Additional equipment needed if no broadcast facility is available:

TOTAL INSTRUCTOR COST FOR RM STREAMING: approximately \$7700

This system requires students to have the following equipment:

*desktop computer of either platform with at least 300 MHz processor and 64 MB RAM and with audio and video cards (cost varies because newer computers come equipped with such features while older computers may need to have special cards installed – since students must have computers to access other Web components of the course, this generally requires no additional costs to them)

*free copy of RealNetworks RealMedia Player 8.0 Basic downloaded to their computer's desktop and installed in their browser's plug-ins folder to view the webcasts (no cost)

TOTAL STUDENT COST FOR RM STREAMING: none

NOTE: In the WVU program, class sessions are broadcast for satellite transmission from either a television studio or an electronic classroom, so the audio and video signal was taken directly from the studio's switcher and cabled into the laptop computer for conversion to the streaming format. However, several trials were also successfully conducted in which the simulcast was streamed directly from the instructor's office using a digital camera and wireless microphone.

Additional equipment needed if no broadcast facility is available:

*Sony DVX1000 digital camera to record video signal when not in a television production facility (cost about \$3000)

*Sony ECM44BC omni-directional lavalier microphone to record audio signal from instructor to the camera (cost about \$200)

*Bogen 3001 BN video tripod with fluid head (cost about \$150)

ADDITIONAL COST IF NO STUDIO ACCESS (EITHER SYSTEM): \$3350

Implications of the Webcasting Project

The WVU Webcasting Project represents an innovative model of Web-based training that has been developed, implemented, and evaluated with practicing special educators and related services specialists in rural areas, both locally and globally. The availability of web simulcasts has enabled students living in states other than West Virginia to participate in the certification and degree program; to date, 10 students have enrolled in courses from states such as California, Colorado, Florida, Indiana, New Jersey, New York, North Carolina, and Virginia. The first student to have completed the program via the simulcast model will graduate in Spring 2003. The simulcasts are also used frequently by students in West Virginia when they cannot access the satellite broadcasts due to technical problems at their site or if they must be absent due to illness or bad weather. The availability of re-broadcasts has allowed six (6) individuals living in international areas to join the program; four students have enrolled from Saipan, an island in the South Pacific, one has enrolled from Iceland, and another from Japan. The first international student to complete the program via re-broadcasts graduated in Spring 2002 and two more will finish in Spring 2003. The re-broadcasts are also used often by all students to review content or activities from the broadcast/webcast sessions as needed throughout the course. Beginning with the Spring 2002 semester, program staff no longer make videotape copies of class sessions for students who miss class because they can access the webcasts online more quickly and with less effort. The program coordinator has made the decision to stay with the

Real Media video streaming for the time being, because it is more easily accessed by a wider range of equipment, even though the overall quality of the video image is not as good as the Quicktime streaming.

Webcasting is now a permanent component of the distance education program in Severe/Multiple Disabilities at WVU and it may also be appropriate for other personnel preparation programs in rural areas. The advantages of webcasting include enhanced access to training programs in even the most remote rural areas; reduction in the cost and effort associated with duplicating videotapes copies of class sessions; and provision of opportunity for national and even international outreach. The disadvantages of webcasting are the lower quality of the video image online compared with high quality images via satellite; the bandwidth limitations in some areas of the country or the world; and the continuing technical difficulties with the streaming server and the users' computers. Nevertheless, webcasting represents a viable option for delivering instruction in real and/or delayed time as well as an acceptable balance between program quality and accessibility.

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Resources for More Information about Webcasting

Apple products are available from <http://www.apple.com>
Sorenson Broadcaster is available from <http://www.sorenson.com>
XLR8 products are available from <http://www.xlr8.com>
Microsoft products are available from <http://www.microsoft.com>
Real Networks products are available from <http://www.real.com>
Athlon products are available from <http://amd.com>
Viewcast products are available from <http://viewcast.com>
Sony products are available from <http://www.sony.com>
Bogen products are available from <http://www.bogen.com>
Discount prices on media products are available from <http://bhphoto.com>

Austerberry, D., & Starks, G. (2002). *The technology of video and audio streaming*. Burlington, MA: Focal Press.

Mack, S. (2002). *Streaming media bible*. New York: Hungry Minds, Inc.

Topic, M. (2002). *Streaming media demystified*. New York: McGraw-Hill.

Digital Video, a magazine available at no cost from <http://www.dv.com>

AV Multimedia Producer, a magazine available at no cost from <http://www.avvideo.com>

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