Options for Science teacher Professional Development Through Distance Education

by

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Introduction

Distance learing is increasingly becoming the educational focus of many universities, high schools and corporations worldwide. This is due in part to the fact that distance education is *seemingly* cost effective for institutions and time effective for the learner. There have been many different learning technologies and delivery strategies used in the field of distance education in recent years. Distance education adminsitrators are diligently attempting to create the most effective design for learning from a distance. Science has been argued by some as the most difficult topic to teach from a distance. As many science educators are being coerced to develop online/distance courses, this paper will describe the lessons learned from experiences using three delivery modes for the purpose of presenting science content to rural elementary school teachers.

The three delivery modes used in this project were: (1) interactive television (through telecommunications technologies) with real-time presentations by science experts facilitated by a host (*live*); (2) interactive television with videotapes of presentations by science experts supported by real-time, wrap-around discussions conducted by a host (*video*); and (3) asynchronous, web-based sessions with streamed video presentations by science experts supported by discussion board interactions among participants and the science experts (*web*). Examples of where to begin and what to expect during the transition from the traditional science classroom to cyber-science will be discussed.

Project Setting

A professional development project targeting teachers in rural school districts provided an opportunity to research alternative forms of distance delivery systems. Teachers need to constantly modify both their content knowledge and pedagogical skills to meet the needs of the increasingly diverse populations of students in schools today (Watson, 1992) and to adhere to the integration of standards-based curricula and high stakes testing. One of the major goals of the project is to enhance the pedagogical content knowledge of the participating teachers through a series of summer workshops, school year support, and distance learning sessions.

In the project, the *live* delivery strategy was originally proposed for the distance professional development component in order to take advantage of separate telecommunications networks already established in Missouri (T-1) and Iowa (Fiber Optics). The *video* delivery strategy emerged in the second year in response to technical problems encountered during the first year while trying to bridge the two distinctly different telecommunication systems across two states and the difficulty experienced in recruiting quality scientists. These issues will be discussed in more detail. The distance

education component in the second year became one of alternating *live* and *video* sessions in the two states. For example a scientist would present *live* during week one in Iowa and then the *video* of that presentation would play the following week for participants in Missouri and vice-versa (Figure 1).

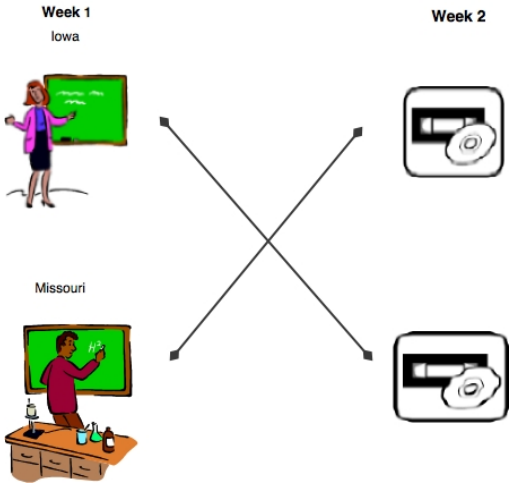

Figure 1: Strategy for using videotape presentation over teleconferencing networks in 2 states.

The third year of the project incorporated an asynchronous, web-based delivery mode due to increased pressure from both the university and T-1 communication network administrators. Using financial constraints as justification, however without research support, these two institutions asked that all distance education be done over the Internet rather than through the channels of the already established teleconference network.

Although the *video*, and *web* modes of delivery were not written into the original proposal for the project, the immense dislocation of the schools involved in the project, the lack of compatibility of the different communication carriers in these respective states, and the pressure to go online from the administration provided an opportunity to explore the 3 different avenues of science professional development from a distance.

Delivery Mode Settings

Live

The *live* sessions consisted of an origination site from which the guest expert and the session facilitator broadcast, and up to 8 remote sites where the teacher participants attended the session. At the remote sites teachers met in small groups in media rooms within their rural school district. These rooms contained television monitors on which they could see the speaker (the remote presenter) and the other teacher groups while they were speaking during the instructional session with them (teacher monitor). At the origination site there was another monitor where the instructor could see the last remote site that had spoken (student Monitor). A camera mounted on the back wall of the room at the origination site captured the presenter and a student camera mounted on the front wall moved automatically to a student in the room who was speaking. Audio was captured through microphones at the presenter table and at the student desks controlled by a single button that allowed the audio to be muted during small group discussion (see Figure 2).

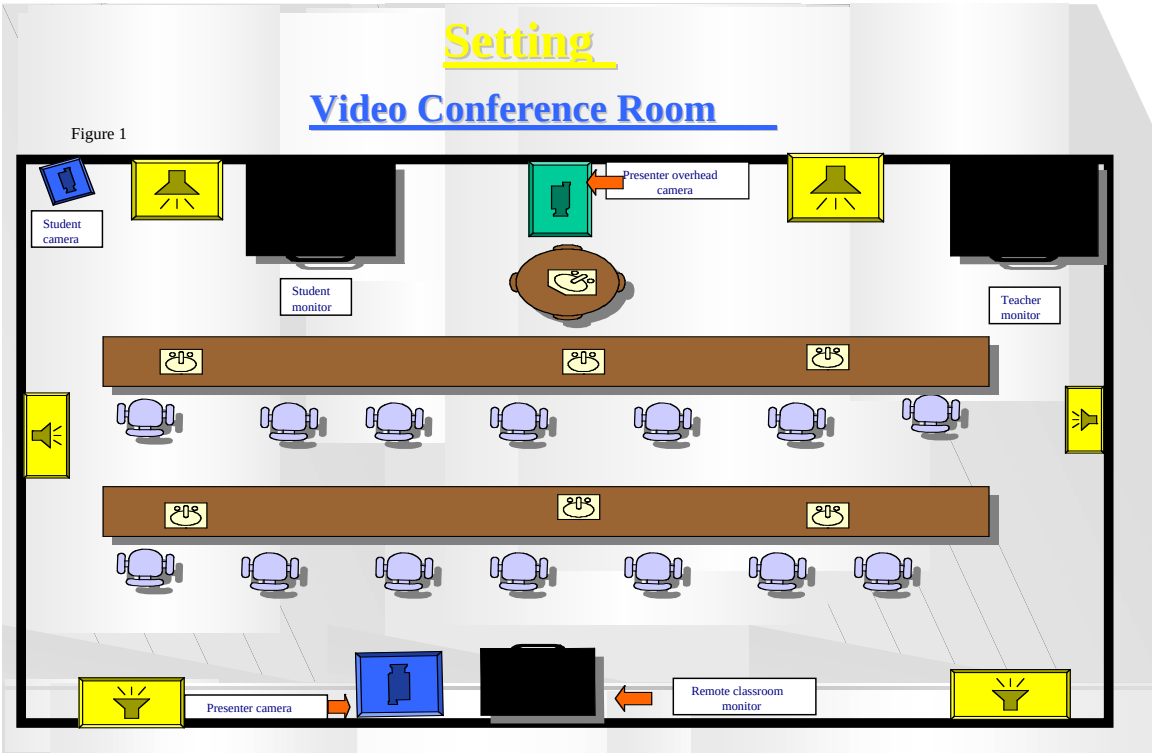

Figure 2. Example of the multimedia room used in the *live* and *video* components of this project.

Each remote site had a facilitator that was not a participant in the study. The role of the this person was to keep the participants on task during the session, gather questions they might have for the presenter and ultimately be the spokesperson for the site. The *live* sessions followed a structure of an approximately 30-minute science expert presentation, followed by 10 minutes of on-site collaboration of teachers in small groups to generate specific questions for the presenter. After circulating through each site and allowing for the presenter to respond to particular questions, the small groups again met for 10 minutes to share ideas of incorporating the new knowledge into their classrooms. These ideas were finally shared with the entire group involved in that session. The participants had one week to complete and submit a post session online survey.

Video

The videos used in the other two delivery modes were taken from the *live* 30-minute presentations that were broadcast the previous week. The *video* sessions were aired on the same telecommunications network over which the *live* sessions were broadcast. As in the *live* sessions, there was an origination site from which the video was played by a session host; again, as many as 8 remote sites were involved for any given session. At the remote sites teachers met in small groups in media rooms within their rural school district and had a facilitator in the room to gather questions and facilitate discussion. Within these sessions, the teachers viewed a presentation, and then were lead through a discussion with the other sites about what types of questions they would have from the presentation and how they might be able to integrate what they learned into their classrooms. Finally, the teachers viewed the discussion section videotaped during the *live* presentation and reformulated a list of questions because some of their own questions

might be common to what they viewed on the videotape. Specific questions were emailed to the presenter and/or posted on the project website[1]. Answers to the questions were again posted on the website and emailed to all participants who had participated in that *video* session. The participants had 1 week to complete and submit a post session online survey, which was summative to the presentation.

Web

The *web* component was distinctly different from the previous 2 modes in a number of ways. The fundamental notion of asynchronous communication is that it disregards time and place. Participants were flexible in terms of when and where they engaged in these sessions. Rather than viewing a live presenter or videotape, participants in this mode of communication viewed a streamed video of the *live* presentation. This was accomplished by digitizing the videotape of the original *live* session in *Macintosh Imovie*™. The teachers interacted with each other through a discussion board within the framework of the *Blackboard*™ web portal known as *mygateway* at the University of Missouri-St. Louis. The participants had 1 week to view the streamed video and interact in the discussion boardroom. The boardroom discussions were optional. These participants had a second week to complete the post session online survey.

Streamed video was chosen for use rather than the customary text based method for reasons suggested through the literature on computer-mediated communication (CMC). The use of video enhances the visual learner's capacity to assimilate new content (Dunston, 1992; Hannafin, 1996) but what if there is a question that has been conjured by the illustration? This is where the need for interactivity in vital. In a report that focused on distance education networks in Georgia, Missouri and California, Walsh & Reese (1995) suggest ways distance education can extend and improve the quality of a universities educational offerings, provide economic benefits, and offer a strategic advantage in piercing new markets. Furthermore the authors suggest that video is the key ingredient in all of the networks that work. "When combined with other media, video has proven to be a highly effective way of getting and holding students' attention, so real learning can take place." Hannafin (1996) embodies the theory of more is not necessarily better when presenting stimuli. The more stimuli presented, the more cognitively confused the learner becomes. When communication is one way, it is well documented that presenters of distance education use considerably more visual stimuli than do presenters in two-way and face-to-face instruction. In similar general relativity courses taught at the Arizona State and Boston University, students reported dissatisfaction with the difficulty in communicating the mathematical formulas in text.

Where to begin

It is important to note that the process of setting up a distance education environment is a time intensive process. For example if hands-on activities are part of the presenter's lesson, it is important that all of the sites have the manipulatives available well in advance of the scheduled date. Through this professional development project the recruitment of quality presenters began almost 6 months before the first presentation was to broadcast. It has been argued that the only effective distance education is one that has the leader in the field as the presenter for which the presentation topic is about. Attracting the presenters who were leaders in their field or who are doing cutting-edge research is not an easy task and thus required considerable planning.

[1] www.umsl.edu/~scicoop

Getting a support system in place for the participants was another important consideration before commencing this special program from a distance. It was discovered that when using multiple sites, regardless of the delivery mode, it was critical to have a facilitator at each site along with a facilitator at the origination site to filter questions and address technical difficulties. If there were too many or too few participants involved at any one time, the frustration level of the participants rose considerably. Many participants in conferencing have expressed frustration and disappointment with the difficulty they have had in sorting out relevant from irrelevant information, because there are so many participants contributing messages on a variety of different topics (Romiszowski, 1996).

Along with a support system, there needs to be an outline that supports both large group and small group discussion, activities and question/answer periods. The format followed in this project was one that encompassed 2-hour blocks. Sessions followed a structure of an approximately 30-minute presentation, followed by 10 minutes of on-site collaboration of teachers in small groups to generate specific questions for the presenter. After facilitating through each site and having the presenter answer those questions, the small groups again met for 10 minutes to share ideas of incorporating the new knowledge into their classrooms. These ideas were finally shared with the entire group involved in that session.

Planning an asynchronous session in the manner it was done in our project entailed much of the same methods as the *live* and *video* session. Digitizing the video and setting up the discussion board was the vital part in planning for a successful session. Using the native Macintosh application *Imovie*™, the videotape of the live presentation was imported into the program and edited to allow for the participants to view either the presentation only, or the entire session. The digitized *Imovie*™ was streamed as *QuickTime*™ and uploaded to a designated site in *Blackboard*™ (a popular course management application). The streamed video automatically played in the assigned window when the participants visited the site and selected the presentation.

In designing the asynchronous session, all of the participants had to be entered into the *Blackboard*™ database for access privileges in advance of the desired time allocated for the presentation to be viewed and the discussion to occur. Not only did the participants need to know how to access the site, but also what to do once they logged in. A practice asynchronous session had to be designed to allow the teachers the opportunity for finding the host website, logging in, viewing the video and creating a thread in the discussion board. This circumvented many logistical problems before they might have occurred.

Possible Challenges

The use of video over ISDN or fiber optics lines lends itself to an array of potential problems. Issues of getting disconnected during a presentation, losing audio but having video, losing video while having audio or simply the inability to connect to the bridge that unites all of the sites are just a few road blocks encountered. Moreover, the use of *codecs* (compression-decompression) on video and audio need to be established and agreed upon by the engineers at the origination and remote sites early in the planning stages to be sure there is compatibility.

Cheng and Reynolds (1991) express concern for the instructors as well. It is often too time-consuming to provide occasion for every student to join discussion-except where everyone's input is critical. Although facilitators were in place, classroom

management has been a slight problem for the presenters who weren't firm in their delivery or in following the format of the session. Attendance also was a slight problem that was quickly rectified once the participants understood their grade/incentives (as project participants) depended on their attendance.

The presenters themselves were, at times, problem areas that needed to be addressed. In some instances they did not live up to the level of quality that was expected of them. Moreover, they sometimes did not focus on the proposed topic, used more time than was allocated for the presentation or struggled with the technology. Using visuals became a problem as well. Slideshow presentations created without contrasting colors and/or using small fonts made it difficult to see at the remote sites. Presenters who used overheads with small fonts ran into the similar issues. In one case, the presenter spent half of the allocated two hours referring to where she received her degree and instructed content that was well above the audience of elementary school teachers. All of this came even after meeting with each presenter prior to their presentation and going through the procedure with them, explaining the audience, evaluation process, and the technological capabilities of the delivery system and the teacher participants. Hence, it is critical you know the presentation ability of your presenters well in advance and to not recruit instructors by word-of-mouth only. It is important to note that in this project these issues were not surprising and difficult to control since the presenters were not paid for their efforts. They were recruited strictly on a volunteer basis. Problems with the presenters were very limited as the majority of the presenters were well received by the participants and followed the structure precisely.

Bandwidth considerations, connection speed of the participants to the Internet, the participant's computer familiarity and storage capacity on the University server proved to be a challenge in developing these sessions asynchronously. For obvious reasons, downloading a 30-minute presentation over a 28.8 mbps connection would take hours not to mention losing information if the participant happened to get disconnected from the Internet. However, high bandwidth also is limited to cost, availability of the technology in the geographic area of the learner, and reliability of the technology during peak usage hours. This also leads to costs and insufficient technical support for the audio-video equipment maintenance (Wong, 1989).

The issue of attendance was easily rectified through asynchronous communication using *Blackboard's*™ system. There is a "Tracking" option within the application that allows the facilitator of the site to track the amount of time each participant spends at a given subsection of the site. For example, a student may not even watch the video or they are accounted for spending 15-mintues on the video page when in fact the video was 30-minutes in length. The facilitator knows immediately that participant hadn't completed the task correctly.

A common roadblock in all 3 modes was the notion of evaluation/assessment of sessions. In the digital age it is easy for a student, or inservice teacher in our case, to claim they sent an evaluation form although the evaluator hadn't received it. One can easily justify missing assignments as downed servers, improperly working email accounts or claims of misplacing it once downloaded by the evaluator.

Rationale

Anglin and Morrison (2000)suggested that well designed research on effective strategies and the lessons learned while using these technologies is inexplicably missing

from the literature; particularly in science education. Jackson (1998) said, “Computers are only a tool to assist learning; useful in the hands of a skilled artisan, the teacher, otherwise functioning as an expensive desk ornament.” There is a need for distance education administrators to learn from the experiences of others who attempted to pioneer a path for delivery of important information. Futhermore, digital learning is critical if we are dedicated to preparing students with the necessary technology and critical thinking skills that are needed in the present and future workforce (CEO Forum, 2000, June June).

Legislation has forced institutions into moving courses from the classroom to the chat room. On January 8, 2002 the current president of the United States, George W. Bush, signed into law the Elementary and Secondary Education Act (ESEA), also known as the “No Child Left Behind Act of 2001”, with hopes to ensure educational quality through standards-based curricula. The U.S. Department of Education guides and regulates the structure of ESEA for standards, assessment and school improvement. More than $700 million was available in 2002 for schools to enhance education through technology. Federal funding from ESEA will only go to programs that are supported by researched evidence.

In 1996, the Telecommunications Act was passed and subsequently the e-rate initiative became the driving force for funding electronic networking. The e-rate initiative was a major component of this act, which provides schools and libraries with discounts, which range from 20-90 percent, for establishing Internet and telecommunication infrastructures. Overseen by the Federal Communications Commission (FCC) and contracted through a nonprofit group called the Universal Service Administration Company (USAC), currently 86 percent of public schools, 21 percent of private schools and 65 percent of libraries have received discount (National Center for Educational Statistics, 2003). It might be concluded by the passing of recent legislation, any successful effort at school reform and restructuring must include an adequate amount of information technologies.

Conclusion

Distance education is here and possibly here to stay. It is vitally important that there be a common delivery method that is cost effective to the university and the student but more importantly operational so to provide a channel for meaningful learning to occur. Prior planning and foresight is the critical component for a successful distance education presentation regardless of the mode of delivery. A distance education session that is not thoroughly thought through prior to going live is a session that will find pitfalls. The adage, “If you fail to plan, you are planning to fail” rings loudly when creating a positive distance education environment.

Although these methods of delivering science teacher professional development was used for reaching isolated, rural teachers, the same strategy could be incorporated into reaching any teacher in any area. Teachers who are across the country, or even the world, could gain invaluable professional development from science education experts who are not able to provide the resources in person. The cost effectiveness of such a concept would be both extrinsic and intrinsic. Why shouldn’t teachers be able to receive quality of professional development because of where they live? The answer is simple- they should be able to receive any resource that will make them a better educator.

With the current reform movements and *No Child Left behind* looming over the field of education, teacher professional development is the key component to meeting

these demands. Whether professional development comes in the form of the traditional workshop or it is promoted through cyberspace, the gains the teachers will acquire will ultimately affect the students and the field of science education as a whole.

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