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Issues in Distance Learning

LORRAINE SHERRY
Graduate School of Education
University of Colorado at Denver
P.O. Box 173364, Denver, CO 80217-3364, USA

This review of literature and research into the effectiveness of distance education systems deals with a number of factors which affect their success or failure. These include the influence of distance learning theory upon instructional design and delivery, redefining the roles of partners in distance education teams, media selection, technology adoption, change implementation, methods and strategies to increase interactivity, inquiry, and active learning, learner characteristics and modes of learning, teacher mediation and learner support, operational issues, policy and management issues, and cost/benefit tradeoffs. It is intended as a companion piece to Sherry and Morse's (1994) training needs assessment.

Distance education technologies are expanding at an extremely rapid rate. Too often, instructional designers and curriculum developers have become enamoured of the latest technologies without dealing with the underlying issues of learner characteristics and needs, the influence of media upon the instructional process, equity of access to interactive delivery systems, and the new roles of teacher, site facilitator, and student in the distance learning process.

This review of literature and current information related to distance learning is an expansion and update of Schlosser and Anderson's (1994) literature review for the Iowa model of distance education. Additional reports were obtained through the Pacific Mountain Network, the ERIC database, electronic communications via Internet with administrators of open universities and open learning agencies throughout the world, collections

of manuscripts and documents in the Department of Instructional Technology and Special Education at the University of Colorado at Denver, and personal communications with distance education developers at professional conferences as well as school districts in the Greater Denver area. It is intended as a companion piece to Sherry and Morse's (1994) training needs assessment, as well as background information for other projects in telecommunications and distance learning.

The issues addressed in this report reflect some of the primary research issues covered by Schlosser and Anderson (1994), those stressed in the Far View I-IV (1994) videotape series, descriptions and evaluations of current distance education delivery systems by key administrators of open universities and learning agencies, and issues deemed important by participants in Sherry and Morse's (1994) training needs assessment. These include distance learning theory, salient characteristics of successful delivery systems, redefining the roles of distance education partners, media-based challenges and design considerations, technology selection and adoption, effective communication, strategies to increase interactivity, visual imagery, and active learning, learner characteristics, mentoring and learner support, change implementation, operational, policy, and management issues, and cost/benefit tradeoffs.

We will start with some definitions, history, theories, and systems of distance education, and then explore methods and strategies for designing and delivering instruction at a distance. Next, we will discuss the characteristics of distance learners, preferred modes of learning, learner support systems, and others factors which influence their success or failure. We will then deal with operational issues, including technology adoption and the roles of key personnel. Finally, we will address management and policy decisions.

WHAT IS DISTANCE EDUCATION?

Definitions

The terms "distance education" or "distance learning" have been applied interchangeably by many different researchers to a great variety of programs, providers, audiences, and media. Its hallmarks are the separation of teacher and learner in space and/or time (Perraton, 1988), the volitional control of learning by the student rather than the distant instructor (Jonassen, 1992), and noncontiguous communication between student and

teacher, mediated by print or some form of technology (Keegan, 1986; Garrison & Shale, 1987).

History and Media

We find a rich history as each form of instructional media evolved, from print, to instructional television, to current interactive technologies. The earliest form of distance learning took place through correspondence courses in Europe. This was the accepted norm until the middle of this century, when instructional radio and television became popular.

According to Margaret Cambre (1991), in the late 1950's and early 1960's, television production technology was largely confined to studios and live broadcasts, in which master teachers conducted widely-broadcast classes. Unfortunately, teachers who were expert in the subject matter were not necessarily the best and most captivating television talent, nor was the dull "talking head" medium the best production method for holding the interest of the audience. In the early 1970's, the emphasis turned from bringing master teachers into the classroom to taking children out of the classroom into the outside world. This had the negative effect of relegating television to the position of enrichment, which was not perceived as really related to school work. This trend was reversed later in the 1970's, as professionally designed and produced television series introduced students to new subject matter that was not being currently taught, yet was considered to be an important complement to the classroom curriculum. Then, in the 1980's, the pendulum swung back to the basics. The most recent trend has been one of multiculturalism, humanities, and world affairs.

The major drawback of radio and broadcast television for instruction was the lack of a 2-way communications channel between teacher and student. Porter (1994) links the low rates of completion and success in non-mediated correspondence-type mathematics, science, and technical courses to the difficulty that students experience with abstract concepts developed in these courses. Students need rapid feedback, concepts illustrated and clarified for them in some way, and a teacher in the loop for counseling support (p. 11).

As increasingly sophisticated interactive communications technologies became available, however, they were adopted by distance educators. Currently, the most popular media are computer-based communication including electronic mail (E-mail), bulletin board systems (BBSs), and Internet; telephone-based audioconferencing; and videoconferencing with 1- or 2-

way video and 2-way audio via broadcast, cable, telephone, fiber optics, satellite, microwave, closed-circuit or low power television. Audiographic teleconferencing using slow scan or compressed video and FAX is a low-cost solution for transmitting visuals as well as audio (see Schamber, 1988; Barron & Orwig, 1993, for a description of distance education delivery systems). Mosaic, a graphical interface to the World Wide Web, has become popular in parts of Canada, Europe, and Australia over the past year. Curtin Instutite of Technology in western Australia is teaching a course in X-Windows-based computer graphics using the Mosaic World-Wide-Web browser.

Today, political and public interest in distance education is especially high in areas where the student population is widely distributed. Each region has developed its own form of distance education in accordance with local resources, target audience, and philosophy of the organizations which provide the instruction. Many institutions, both public and private, offer university courses for self-motivated individuals through independent study programs. Students work on their own, with supplied course materials, print-based media and postal communication, some form of teleconferencing and/or electronic networking, and learner support from tutors and mentors via telephone or e-mail.

The Office of Technology Assessment states that, "...teachers have to be allowed to choose, willing to make choices, and qualified to implement their choices effectively. OTA finds that, just as there is no one best use of technology, there is no one best way of teaching with technology. Flexibility should be encouraged, allowing teachers to develop their personal teaching approach utilizing the variety of options offered by technology" (US. Congress, 1988, p. 17).

In contrast, Saettler (1990) vividly describes the failure of instructional television in Samoa, where lesson plans were developed in the studio, and the television teacher was put in charge of classroom instruction. Little role was left for the classroom teachers at the distant sites other than to reinforce what was taught by the studio teacher (p. 370).

Theories and Philosophies of Distance Education

The theoretical basis on which instructional models is based affects not only the way in which information is communicated to the student, but also the way in which the student makes sense and constructs new knowledge from the information which is presented. Currently, there are two op-

posing views which impact instructional design: Symbol-processing and situated cognition (see Bredo, 1994, for a full description and comparison of these two approaches) .

Until recently, the dominant view has been the traditional, information processing approach, based on the concept of a computer performing formal operations on symbols (Seamans, 1990). The key concept is that the teacher can transmit a fixed body of information to students via an external representation. She represents an abstract idea as a concrete image and then presents the image to the learner via a medium. The learner, in turn, perceives, decodes, and stores it.

Horton (1994) modifies this approach by adding two additional factors: The student's context (environment, current situation, other sensory input) and mind (memories, associations, emotions, inference and reasoning, curiosity and interest) to the representation. The learner then develops his own image and uses it to construct new knowledge, in context, based on his own prior knowledge and abilities.

The alternative approach is based on constructivist principles, in which a learner actively constructs an internal representation of knowledge by interacting with the material to be learned. This is the basis for both situated cognition (Streibel, 1991) and problem-based learning (Savery & Duffy, in press). According to this viewpoint, both social and physical interaction enter into both the definition of a problem and the construction of its solution. Neither the information to be learned, nor its symbolic description, is specified outside the process of inquiry and the conclusions that emerge from that process. Prawat and Floden (1994) state that, to implement constructivism in a lesson, one must shift one's focus away from the traditional transmission model to one which is much more complex, interactive, and evolving. The Far View Project (1994) has implemented this approach by creating distance learning environments in which students construct knowledge under the guidance of the site facilitator, and then report their progress back to the studio teacher via a 2-way video link.

Though these two theories are totally different in nature, effective designers usually start with empirical knowledge: Objects, events, and practices which mirror the everyday environment of their designated learners. Then, with a firm theoretical grounding, they develop a presentation which enables learners to construct appropriate new knowledge by interacting with the instruction. To quote the AI researcher, Herbert A. Simon, "Human beings are at their best when they interact with the real world and draw lessons from the bumps and bruises they get" (Simon, 1994).

Schlosser and Anderson (1994) refer to Desmond Keegan's theory of distance education, in which the distance learning system must artificially

recreate the teaching-learning interaction and reintegrate it back into the instructional process. This is the basis of their Iowa Model: To offer to the distance learner an experience as much like traditional, face-to-face instruction, via intact classrooms and live, two-way audiovisual interaction. In contrast, the Norwegian Model has a long tradition of combining mediated distance teaching with local face-to-face teaching (Rekkedal, 1994).

Hilary Perraton (1988) defines the role of the distance teacher. When, through the most effective choice of media, she meets the distance students face-to-face, she now becomes a facilitator of learning, rather than a communicator of a fixed body of information. The learning process proceeds as knowledge building among teacher and students. (See Scardamalia & Bereiter, 1994, for an example of electronic knowledge building discussions.)

Distance education systems now involve a high degree of interactivity between teacher and student, even in rural and isolated communities separated by perhaps thousands of miles. The Office of Technology Assessment stresses the importance of interactivity: Distance learning allows students to hear and perhaps see teachers, as well as allowing teachers to react to their students' comments and questions (US Congress, 1988). Moreover, virtual learning communities can be formed, in which students and researchers throughout the world who are part of the same class or study group can contact one another at any time of the day or night to share observations, information, and expertise with one another (VanderVen, 1994; Wolfe, 1994).

Systems of Distance Education

Traditionally, we think of distance learners as adults. Whole institutions of higher learning, such as the United Kingdom's Open University, Vancouver's Open Learning Agency, Norway's NKS and NKI Distance Education organizations, Florida's Nova University, and a host of others, have been dedicated to providing distance education at the post-secondary level for decades. The University of South Africa (UNISA), in Praetoria, serving both black and white students, has had a successful distance learning program for decades. The Televised Japanese Language Program, developed at North Carolina State University, provides instruction in Japanese to ten colleges and universities in five Southeastern states (Clifford, 1990). The adult learner tradition is now changing as new programs, such as the US. Federal government's Star Schools Program, come into existence to serve the K-12 student population.

At the elementary and middle school levels, distance learning usually takes the form of curriculum enrichment modules and ongoing telecommunications projects. Some examples of current projects are: De Orilla a Orilla, National Geographic Kids Network, Biomes Exchange Project, Earth Lab, Ask Professor Math, and Ask A Scientist (Barron, Hoffman, Ivers, & Sherry, 1994; US. Congress, 1988). These projects are popular in secondary schools, too. Other modules are television-based, with the teacher as facilitator. Students work in collaborative groups, using manipulatives and hands-on activities in a distance learning environment (Pacific Mountain Network, 1994).

At the secondary level, locally or federally funded distance education addresses the needs of small rural school districts or underserved urban school districts. Some secondary school students may enroll in courses to meet graduation requirements which their own districts are unable to offer; some take advanced placement, foreign language, or vocational classes; others may be homebound or disabled. Due to the low student enrollment at each individual high school in Chinese and German courses, Denver Public Schools, a large urban district, offers both of these courses via their 2-way audio, 1-way video link.

In many instances, talented or gifted high school students have been selected to attend distance classes because of their high academic ability and capacity for handling independent work. This makes classroom management easier, but it may disenfranchise students who lack discipline or time management skills. The resulting inequity of access then becomes a policy problem, not a technology problem.

Although technology is an integral part of distance education, any successful program must focus on the instructional needs of the students, rather than on the technology itself. It is essential to consider their ages, cultural and socioeconomic backgrounds, interests and experiences, educational levels, and familiarity with distance education methods and delivery systems (Schamber, 1988). Students usually adapt more quickly than their teachers to new technology. On the other hand, teachers who have begun to feel comfortable with the equipment don't mind having their students teach them new tips and tricks (Apple Classrooms of Tomorrow, 1992). The most important factor for successful distance learning is a caring, concerned teacher who is confident, experienced, at ease with the equipment, uses the media creatively, and maintains a high level of interactivity with the students.

DESIGN CONSIDERATIONS

Systematic Design and Development

Willis (1992) describes the instructional development process for distance education, consisting of the customary stages of design, development, evaluation, and revision. In designing effective distance instruction, one must consider not only the goals, needs, and characteristics of teachers and students, but also content requirements and technical constraints. If unusual delivery systems are required, they must be made accessible to all participants.

Revision based on feedback from instructors, content specialists, and learners is an ongoing process. Provisions must be made for continually updating courses which depend on volatile information, to keep the subject matter current and relevant (Porter, 1994).

Interactivity

Successful distance education systems involve interactivity between teacher and students, between students and the learning environment, and among students themselves, as well as active learning in the classroom. McNabb (1994) noted that, though students felt that the accessibility of distance learning courses far outweighs the lack of dialogue, there is still a considerable lack of dialogue in telecourses when compared to face-to-face classes.

Millbank (1994) studied the effectiveness of a mix of audio plus video in corporate training. When he introduced real-time interactivity, the retention rate of the trainees was raised from about 20 percent (using ordinary classroom methods) to about 75 percent (p. 75). A key element in Porter's (1994) New Directions in Distance Learning (NDDL) project is the enhancement of independent learning materials through the use of interactive communications technologies and teacher mediation. He projects a completion/success rate of around 60 percent over the life span of the pilot project (p. 26).

Interactivity takes many forms; it is not just limited to audio and video, nor solely to teacher-student interactions. It represents the connectivity the students feel with the distance teacher, the local teachers, aides, and facilitators, and their peers.

Garrison (1990) argued that the quality and integrity of the educational process depends upon sustained, two-way communication. Without con-

nectivity, distance learning degenerates into the old correspondence course model of independent study. The student becomes autonomous and isolated, procrastinates, and eventually drops out. Effective distance education should not be an independent and isolated form of learning; it should approach Keegan's ideal of an authentic learning experience.

Active Learning

As active participants in the learning process, students affect the manner in which they deal with the material to be learned. Learners must have a sense of ownership of the learning goals (Savery & Duffy, in press). They must be both willing and able to receive instructional messages. Salomon's study (as cited in Saettler, 1990), found that the mental effort which a learner will invest in a learning task depends on his own perception of two factors:

- the relevance of both the medium and the message which it contains
- his ability to make something meaningful out of the material presented.

Interestingly enough, Salomon found that television proved to be mentally less demanding than printed text when comparable content was employed. By giving students some expectations about the purpose of their viewing, he was able to influence the effort that students invested in processing the content of television instruction (Saettler, 1990, p. 487).

Willis (1992) suggests that teachers use pre-class study questions and advance organizers before presenting a distance learning module. These techniques encourage critical thinking and informed participation on the part of the learners.

Visual Imagery

Researchers have consistently found that instructional television can motivate and captivate students, and stimulate an interest in the learning process. Ravitch (1987), however, cautions us against the unintended side effects of educational television in particular as well as "edutainment" in general. Reliance on exciting visuals may distort the curriculum by focusing students' attention on the entertaining and provocative features of the presentation rather than encouraging thoughtful analysis of their underlying meaning.

White (1987) adds that if complex issues are presented in short units, through powerful images which may occur in any order, the end result may be oversimplification and superficiality. Students must learn to discriminate between "junk" information and quality information, to judge its reliability or bias, to identify distortions and sensationalism, to distinguish facts from persuasion, and to understand how the technology itself shapes the information it carries (p. 60).

Effective Communication

Ben Shneiderman (1992) cautions all instructional designers to begin with an understanding of their intended users, and to recognize them as individuals whose outlook is different from the designer's own.

Horton (1994) states the golden rule for designers of instructional visuals: "communicate unto others as they would communicate unto themselves" (p. 32). In other words, if you want the learner to construct an idea which is similar to yours, then use an image for your presentation which will trigger a similar idea in the learner's mind, in the context of the learning environment and the learner's prior experiences.

Needless to say, no two learners will form the same idea, nor is it likely that their idea will be the same as that of the designer. How can this problem be solved? The key to good instructional design lies in the image presented. To quote Marshall McLuhan, "the medium is the message." Horton (1994) notes that it is up to the designer to

- use advance organizers to create an appropriate context for instruction, and
- select effective images, using appropriate objects with relevant attributes, that will convey the same idea to the user as they did to the designer.

METHODS AND STRATEGIES

Guided Practice

The more familiar teachers are with the instructional design and delivery process, the more effective their presentations will be. On a practical note, they need training in instructional message design, strategies for de-

livering instruction on-camera, methods of diversifying types of presentation, selecting various mixes of student-teacher activities and interactions, choosing situations and examples which are relevant to their students, and assessing the level of learning by distant students. They also need plenty of guided, hands-on practice developing and delivering courseware using audio, full-motion video, graphics, and text, in front of a live audience—yet still in a nonthreatening situation.

Strategies such as using fewer overheads and more moving video, interspersing "talking heads" with videos of sites, using hands-on experiments, incorporating text and graphic art, and other guidelines for effective video production are also valuable (see Willis, 1993, for a synopsis of distance education strategies).

Site facilitators, too, benefit from training programs which emphasize hands-on practice with the equipment they are expected to use. Sherry and Morse (1994) found that those who had participated in structured training programs felt comfortable using the equipment, were able to engage their students in the learning process, and had mastered classroom management in a high-tech classroom.

MEDIA-BASED CHALLENGES

Foreign language instruction presents special instructional challenges, not only because of the lack of immediate 2-way interaction that characterizes many distance education programs, but also because of the loss of visual detail in videoconferences due to signal compression—especially detailed lip movements. This can be overcome by providing students with oral practice and feedback through telephone conversations with the instructor, and by instructional strategies that encourage frequent student-teacher and teacher-student dialogue (Clifford, 1990; see also Bruce & Shade, 1994).

Effective distance learning requires extensive preparation, as well as adapting traditional teaching strategies to a new learning environment which often lacks visual cues. Porter (1994) speaks of the triad consisting of the student, the teacher, and the site facilitator, all of whom must function as a team. Students must quickly become aware of and comfortable with new patterns of communication, learn to manage their time, and take responsibility for their own learning. Teachers must enable students to establish contact with them, as well as interact among themselves. Site facilitators can act as the on-site "eyes" and "ears" of the teacher, stimulating

interaction when distant students are hesitant to ask questions or participate in discussions.

Willis (1993) describes the strategies which are effective in distance learning: Namely, developing appropriate methods of feedback and reinforcement, optimizing content and pace, adapting to different student learning styles, using case studies and examples which are relevant to the target audience, being concise, supplementing courseware with print information, and personalizing instruction.

The variety of available media, too, presents a formidable research problem. One cannot compare print-based independent study courses, electronic projects on the Internet, classroom BBS postings, audioconferences, and live, two-way interactive television, and expect that these comparisons will be valid. To add to this dilemma, media selection is often a question of media assignment. Teachers and site facilitators need training in those technologies which they are expected to use (Sherry & Morse, 1994).

One important aspect of media selection is that though more than one medium may deliver the same message effectively, different media present different learning stimuli and accept different types of student responses. Willis (1992) stresses that teachers should analyze the strengths and weaknesses of the various possible approaches to delivering instruction. He also suggests that teachers integrate a variety of delivery systems into their courses for interactivity and feedback. Grabowski (1991) states that media attributes may inherently determine how message design strategies are ultimately implemented, especially regarding the manner in which they either facilitate or detract from the message (p. 205).

McNabb (1994) notes that more experimental studies are needed in the area of media selection, where researchers can compare the effectiveness of different technologies which deliver similar content to similar audiences. It would be useful to analyze the content of a learning module, the goals of the students, teacher, and the school itself, implement some different technologies, and determine what factors influence successful delivery.

Inquiry Learning

Inquiry learning is a new technique to many teachers. No longer is the teacher "the sage on the stage"—the deliverer of a fixed body of information; she becomes the facilitator of discovery learning for her students, through progressive discourse. Thus, even if a teacher is well-practiced and at ease with the equipment in the classroom, she still requires training in order to integrate new teaching strategies with the technology.

The Office of Technology Assessment (US. Congress, 1988) notes that inquiry teaching promotes an environment that tolerates ambiguity and encourages students' questions. In their studies of classrooms using the "Voyage of the Mimi" multimedia program, OTA researchers observed that teachers tended to ask the majority of the questions, rewarded students for guessing correctly, and required continual help in maintaining a classroom climate that emphasized reasoning rather than right answers. Only those teachers who had experience in inquiry-based instruction used the materials in open-ended ways. They found that it was important not only to provide training in the scientific concepts covered in the materials, but also to give participating teachers rich and varied suggestions for classroom activities (p. 58).

Distance educators in the Far View Project have developed several inquiry learning modules. Collaborative groups of young distance learners participated in self-discovery activities, using manipulatives and conducting experiments under the guidance of the site facilitator, and then discussed their experiences with the studio teacher. Evidence of success is shown in the PMN video series (Pacific Mountain Network, 1994) through the enthusiastic responses of both teachers and students during and after the instructional sessions.

Teamwork

Progressive teachers who are early adaptors of technology can become change agents for their peers (Pacific Mountain Network, 1994). They can support other teachers by planning ahead as a group, and by working with the learning modules and equipment before using them in the classroom. Facilitators can try out learning modules as videotapes, building in interactivity as it suits the learning styles of their particular students, and then integrate real-time satellite programs into their schedule later on.

Technology providers, too, are available to answer questions from new users. The Satellite Educational Resource Consortium (SERC), for example, provides a contact person who visits the site, answers telephone calls, or provides printed support material. Studio teachers are available between sessions to reply to FAX messages or telephone calls.

The process of adapting new learning resources to the classroom, such as instructional television and videoconferencing, is not immediately transparent. Administrators cannot expect teachers to feel comfortable with the technology, to use it effectively, and to maintain it as well, without giving

them extra resources and time. Instructors need access to data links and E-mail, as well as video links. They need to download and upload resources and lesson plans, consult with other teachers, and try out new learning modules.

Apple Computer (Apple Classrooms of Tomorrow, 1992) has found that it takes up to two years for instructors to adjust to and work with the tools, to implement them successfully, and to integrate them into their curriculum.

DISTANCE LEARNERS

Many important issues stem from the characteristics of distance learners, whose aims and goals may be quite different from those of traditional students. As we have already mentioned, distance education systems were originally developed at the post-secondary level, and are only recently being used at the K-12 level.

Aims and Goals

Adult learners have a wide variety of reasons for pursuing learning at a distance: Constraints of time, distance, and finances, the opportunity to take courses or hear outside speakers who would otherwise be unavailable, and the ability to come in contact with other students from different social, cultural, economic, and experiential backgrounds (Willis, 1993). As a result, they gain not only new knowledge but also new social skills, including the ability to communicate and collaborate with widely dispersed colleagues and peers whom they may never have seen.

Modes of Learning

Another important variable in learning effectiveness is the preference of the student for a particular mode of learning, i.e., cooperative, competitive, or individualized (Johnson & Johnson, 1974). Many current distance education projects incorporate cooperative learning, collaborative projects, and interactivity within groups of students as well as between sites.

Scardamalia and Bereiter's (1994) CSILE Project relies on distribution of knowledge among students. Knowledge-building is accomplished

through student-initiated interactions and reflections, in real-time in class, and in delayed-time using an electronic bulletin board system (BBS). Pea's (1994) distributed multimedia learning environments involve a dialectical opposition between the symbol-processing and constructivist viewpoints, to enable students to construct and transform knowledge through progressive discourse.

Effective learning, however, requires both knowledge of learner styles and advance preparation on the part of the teacher and site facilitator. Teachers and site facilitators are better able to make curriculum decisions to suit the preferences of their students, such as grouping certain students productively for project work, or assigning particular students to individual research projects, if they can determine the students' prevalent learning modes. Site facilitators have the advantage of eye-to-eye contact and personal contact with students in their classrooms, whereas studio teachers must often rely on televised images, telephone conversations, or electronic messaging for feedback on student preferences.

If a teacher recognizes the existence of these alternate learning styles, and if he attempts to make a match between these modes and the content to be learned, then he can develop a local instructional theory. As with most distance learning situations, a localized theory has a greater prospect of success than a general instructional theory intended to function satisfactorily in variety of settings, with a variety of practitioners (Owens & Straton, 1980, p. 160).

Factors Which Influence Success

Sylvia Charp (1994) notes that with greater autonomy, student characteristics such as active listening and the ability to work independently in the absence of a live instructor become crucial for success. David Godfrey (personal communication, June 17, 1994) found that at most 80 percent of his former students at the University of Victoria may possess such characteristics. As a result, frequent, supportive teacher-student interaction and student-student networking take on increased importance for the remaining 20 percent, as well as facilitating the learning process for all students involved in the program.

Bernt and Bugbee's study (as cited in Schlosser & Anderson, 1994), examined two types of study strategies used by distance students: Primary, cognitive strategies, such as active listening, and secondary, affective strategies, such as ability to work independently of the instructor. As expected,

the researchers found that students who passed their courses differed significantly in primary strategies from those who failed: In testwiseness, concentration, and time management skills. In contrast to Charp, they found little difference among them in secondary strategies: Active learning, diligence, and positive attitude.

Instructors tend to blame the high dropout rate among post-secondary students on poor time management and procrastination. However, in a study of the effectiveness of university-level audioconference courses in Alaska, Sponder (1990) found that climate, geography, the efficiency of the postal system, the university support network, telecommunications facilities, students' hearing problems, and other factors also come into play. Miscommunication between students and teachers, and lack of course relevance to students, may also have negative repercussions.

Like Charp and Godfrey, Porter (1994) found that teacher mediation increases the completion rate for distance education courses. Neither can we assume that all students have sharpened their primary study skills to the same extent, nor that a positive attitude will make the difference between success and failure. Students need support and direction to enable them to make the transition from traditional classroom environments to self-directed learning—particularly tools to help them monitor their progress and obtain timely feedback on their activities.

Learner Support

There are many ways of facilitating learner support. Studio teachers may visit the distant site, or students may take a trip to the studio. This has worked well in the Denver area where sites are few in number and not widely scattered. Audio and video teleconferences or interactive chats with mentors and other students are two real-time alternatives to site visitation, office hours or telephone calls.

Interaction and support may also take place by delayed time. Students may E-mail or FAX questions to their instructors or fellow students, or post them on electronic BBSs. Teachers and peers, in turn, may respond at their convenience. Frequent teacher-student interaction enables the teachers to get to know the students better than if their only contact were via a televised image from a distant classroom.

Porter's (1994) NDDL study incorporated insights from the site facilitators concerning their students' experiences in adapting to distance education technologies. Students need guidance in putting information together,

reaching their tutors, and completing and submitting assignments. They also need tools to help them monitor their progress and obtain timely feedback on their activities.

Teachers also need support when they are learning about new technology, regardless of their level of classroom experience. As they begin their hands-on training with new technologies, some feel intimidated by the equipment, even in a nonthreatening environment. At this point, they need to be able to communicate with other teachers who have gone through this process themselves, and who are competent to advise them and serve as role models. For example, the University of South Florida has set up a mentoring system and an on-line discussion for participants in the telecommunications course. Athabasca University assigns ten students to one mentor in the Master of Distance Education program. The University of Wisconsin uses audioconference seminars to link instructors together. The University of British Columbia uses teleconferences with other students and tutors, as well as a telephone tutoring system. Georgia College has an electronic BBS with on-line resources, electronic conferencing, and a Teacher Clearinghouse for contacting other teachers interested in telecommunications (Barron, Ivers, & Sherry, 1994).

OPERATIONAL ISSUES

These involve planning, administration, management, and economics, all of which are crucial for a successful distance education program. In particular, we must consider the roles of the teacher-facilitator-student triad, training of teachers and staff, implementation and adoption of new technology, and policy issues such as facilities, cost, and scheduling.

The Teacher-Facilitator-Student Triad

In traditional education, teachers interact directly with their students. They prepare their own support materials, lecture notes, and tests, and are autonomous within their classroom. In contrast, distance learning teachers are not in direct classroom contact with their students. Communication is mediated not only by the technology, but also by a host of team partners which may include editors, designers, producers, technicians, media specialists, local tutors, aides, site facilitators, and service providers. Since many people must collaborate to produce and disseminate quality distance

educational programming, the need to plan and coordinate staff activity is essential. In particular, we must define the roles of two key people: the teacher and the site facilitator.

The teacher. The distance learning teacher, or studio teacher, is the common thread throughout the distance learning process. She must be certified for the appropriate grade level, knowledgeable in her subject area, and trained in effective distance education strategies. She is responsible for knowing the subject matter, preparing lesson plans and producing an instructional module or course, selecting support materials, delivering the instruction effectively on-camera, determining the degree of student interaction, and selecting the form of distance evaluation or assessment.

A studio teacher must be better organized than an ordinary classroom teacher. Additionally, she must be at ease with the equipment, and not let the technology get in the way of her presentation. This requires ongoing training in the form of regular observation of a master teacher, training in the use of carefully selected print, audio, graphics, and video materials, hands-on hardware training, and the chance to network with other teachers and facilitators on course progress (Talab & Newhouse, 1993). For example, the Iowa Department of Education requires a teacher, who is appropriately licensed and endorsed for the educational level and content being taught, to receive training regarding effective practices which enhance learning by telecommunications (Schlosser & Anderson, 1993, p. 40).

Currently, few teachers have had sufficient training or field experience to enable them either to be effective distant teachers or to use technology successfully in their classrooms. Proper training would help distance learning teachers to change their method of teaching and give more attention to advanced preparation, student interaction, visual materials, activities for independent study, and follow-up activities (US. Congress, 1989, p. 11).

Schlosser and Anderson (1993) identify the new skills which teachers must learn as they assume the role of distance educators:

- understanding the nature and philosophy of distance education;
- identifying learner characteristics at distant sites;
- designing and developing interactive courseware to suit each new technology;
- adapting teaching strategies to deliver instruction at a distance;
- organizing instructional resources in a format suitable for independent study;
- training and practice in the use of telecommunications systems;

- becoming involved in organization, collaborative planning, and decision-making;
- evaluating student achievement, attitudes, and perceptions at distant sites; and
- dealing with copyright issues.

(pp. 32-37). (See Sherry and Morse, 1994, for rankings of these skills by Denver educators.)

The site facilitator. The site facilitator is an extension of the studio teacher, though he need not be a teacher himself. His responsibilities are to motivate and encourage the remote site students, keep up their enthusiasm, and maintain discipline in the classroom. He is also responsible for smooth running of equipment, helping students with interaction, handing out, collecting, and grading papers, guiding collaborative groups who are working with manipulatives, answering questions when necessary, and assisting the studio teacher when asked. The site facilitator also carries out the assessment procedure defined by the teacher, via print, portfolios, on-line communications, or FAX.

Schlosser and Anderson (1994) have found that, in general, site facilitators have an average of four classes, are mid-career staff rather than beginning teachers, are anxious about using new technology, and are selected by their principals because of their subject background, availability, and general teaching ability, rather than volunteering to be assigned as facilitators (p. 4).

Talab and Newhouse (1993) identified a number of concerns about instructional design and classroom management which were voiced by site facilitators, including:

- facilitating vs. traditional teaching;
- preparation;
- timing and scheduling;
- classroom logistics; and
- other responsibilities.

ACOT researchers (Apple Classrooms of Tomorrow, 1992) identified four concerns:

- student misbehavior and attitudes;
- physical environment;

- technical problems; and
- classroom dynamics.

ACOT notes that classroom management, like technology expertise, is not a skill that is mastered once and for all by instructors in high-tech classrooms. They progress through a three-stage model of survival, mastery, and impact. It may take them at least two years to change their focus from being anxious about themselves, their new physical environment, equipment malfunctions, and student misbehavior, to anticipating problems and developing alternate strategies, exploring software more aggressively, sharing ideas more freely, increasing student motivation and interest, and using technology to their advantage.

As classroom contexts change, so do classroom management issues. Educational change takes time, a great deal of support, and peer networking and guidance. In general, teachers tend to focus on the increased workload and drawbacks associated with an innovation before the benefits of change emerge and the innovation takes hold.

Since their activities are closely related to those of the teacher, facilitators need similar training. However, some site facilitators perceive themselves as end users, rather than designers, of distance instruction, so they feel that they require less emphasis on instructional systems design. Typical comments of site facilitators about the teaching/learning experience are that they have benefited from

- hands-on training and practice with assigned equipment;
- a technical support team who can install, troubleshoot, and maintain classroom equipment and outside resources;
- their own experiences anticipating equipment problems and working around them; and
- site visitation by studio teachers (Sherry & Morse, 1994).

Technology Adoption

Purchasing and maintaining appropriate equipment, and training teachers and facilitators to use it effectively, are necessary conditions, but are not sufficient in themselves to assure a school district of an excellent distance education program. There are other factors involved, many of which are affective rather than cognitive, such as user-friendliness and the ability to implement learner support. Ravitch (1993) notes that school organization has been traditionally hierarchical and bureaucratic, whereas new technologies challenge this model.

Talab and Newhouse (1993) have found that many teachers are slow to incorporate new technologies into their classrooms because they are now seen as workers, rather than as instructional leaders or motivating forces within their classrooms. On the other hand, the technological innovations that have been adopted by teachers are those which solved problems that the teachers themselves identified as important, regardless of outside change agents, the school administration, or the opinions of non-teachers. Successful technological innovations must take into consideration the social and political climate of the school, and must also reinforce the authority of the teacher, rather than undermine it.

The Office of Technology Assessment has found many powerful examples of creative teachers using computers and other learning technologies to enhance and enrich their teaching. But first, four interrelated conditions must be met:

- training in the skills needed to work with technology;
- education providing vision and understanding of state-of-the-art developments and applications;
- support for experimentation and innovation; and
- sufficient time for learning and practice.

(US Congress, 1988, p. 16).

Kell and others (1990) reinforced this view by naming five conditions that are conducive to change in the classroom:

- a shared vision of teaching and learning;
- leadership and support for new technology from school administrators;
- organizational conditions allowing flexibility, time, and incentives to experiment with new instructional methods;
- opportunities for communication, interaction, and peer support among teachers; and
- training and personalized support over time for teachers.

Holloway and Ohler (1991) found that a widely accepted technology is most often defined by a single characteristic: It makes a task rewarding for the user, where the "user" includes the student first, and the faculty second. If it does not make performance of a task rewarding, there is little motivation to accept the technology. Conversely, if it simplifies or expedites accomplishment of a goal, the probability of acceptance is high (p. 263).

Talab and Newhouse (1993) cite Bichelmeyer's (1991) doctoral dissertation. Bichelmeyer found that teachers and facilitators adopt technology innovations in a hierarchy of needs, with the most basic needs generally being fulfilled before the higher ones. From basic needs to higher level ones, these are:

- time and accessibility;
- dependability;
- ownership and authority;
- control (influence on design); and
- integration.

Talab and Newhouse (1993) have found that those site facilitators who believe in their own abilities to design instruction using satellite technology, and who are willing and able to continue in their role as teaching partners, have successfully incorporated technology into their classrooms. These site facilitators:

- are committed to the concept of equality of education that satellite-based education provides;
- see opportunities for professional advancement through learning new skills and networking;
- seem revitalized by the observation of a master teacher and exceptional instructional design;
- realize that the program will not work without their participation; and
- receive training in satellite-based instruction, either live or on tape, professional troubleshooting, and program feedback.

Talab and Newhouse (1993) conclude that this success is based upon a match between the identified needs of the facilitators and the resources which are available to them:

- they are given time and accessible equipment;
- they are given assistance with equipment operation and troubleshooting;
- they take part in training and program planning, and they control the grading, classroom management, and classroom activities;
- they influence the program through feedback; and
- they see the need for technology integration in order to take part in the program.

MANAGEMENT AND POLICY ISSUES

Distance education changes the learning relationship from the common, centralized school model to a more decentralized, flexible model. It also reverses social dynamics by bringing school to students, rather than students to school. This leads to a host of new issues for administrators to debate, including:

- the impact of electronic education on tenured teaching;
- balancing the budget with potentially low-cost electronic learning options;
- redefining what it means to have a teacher present in the classroom; and
- revising teacher certification requirements to accommodate those teachers who electronically cross service area boundaries.

(Holloway & Ohler, 1991, p. 259).

Distance education enterprises are partnerships; they are characterized by the integration of a great many parts working toward a common goal (Schlosser & Anderson, 1994, p. 39; Pacific Mountain Network, 1994). Each school has its own aims, goals, and objectives, both stated and unstated. Each school also has its own culture, urban or rural, as well as its own perceived value of student learning. There are personnel issues, with clerical, technical, and educational support staff forming a vital link between teacher and student. Many facets of the project must be considered, especially linking student needs within the particular school district with current and projected technology resources. As opportunities arise, so do problems which must be dealt with.

New policy issues must be addressed, as well. Items for further consideration include:

- new forms of assessment and evaluation, including means to insure that the student's work is original and authentic;
- a set of nationally accepted institutional accreditation standards to insure the quality of distance education;
- a nationally accepted set of teacher certification standards which meet a minimum criterion, including training in distance education theory, methods, and strategies;

- the need for cooperation among business, government, and education sectors; and
- technology training and accessibility for all, not just for progressive students and teachers.

Team Personnel

A distance education delivery team requires well-trained individuals in addition to teachers, site facilitators, and administrators. Old roles are redefined, and new roles emerge.

- The principal or district administrator handles logistics, acquires equipment, and provides training and support.
- Some school districts have funds for a media specialist or technology coordinator.
- Certain technologies, like microwave videoconferencing, require a technician to run specialized equipment in a control room.
- Technical support staff install, maintain, and upgrade equipment.
- Clerical personnel process requests for equipment acquisition and repair, as well as reproduction and distribution of course material.
- Technologically astute students often assist teachers with new hardware and software and serve as peer tutors for slower students.

Instructional development and production is also a team effort. A development team should include subject matter experts, instructional designers, writers and editors, audio and video production staff, and curriculum developers. It is important to identify these "people resources," and assign appropriate tasks, responsibilities, and timelines, so that quality control can be maintained. Moreover, it is important that learning modules be delivered on time to mesh with both the school schedule and that of the service provider.

Scheduling and Cost/Benefit Trade-Offs

One indicator of the need for distance learning teams to cooperate is the continuously rising costs of production. According to Margaret Cambre (1991), local productions in 1962 cost about $165 per 15-minute program. Today, the estimate for high-quality instructional television programs is approximately $3000 per minute (p. 269).

Implementation of distance education is resource-intensive. Sufficient

money and time must be allocated to deliver whatever courseware was promised.

Schlosser and Anderson (1994) note that because funds come from the district, not from individual schools, distance education enterprises need to show a high degree of fiscal accountability. And, although prices for technology are declining, taxpayers, school boards, and state legislatures, as well as both government and non-government funding agencies, expect to get the most for their funds.

If money is short, then there are two options: Either downsize the project or extend the time frame. Holloway and Ohler (1991) note that many proposals are written without regard for the time it takes to resolve development and delivery problems. People also require resources and time to build an effective team, to start and maintain the instructional development project, to develop a plan for formative evaluation, and to obtain a commitment on compensation issues (p. 262).

Once developed, the program schedule may not fit in with the school schedule. Programs may be too long, too short, or broadcast at the wrong time, resulting in a loss of real-time interactivity. One may always videotape the program and show it later. However, it is important to realize that interactivity costs a lot more than a videotape.

The cost/benefit of technology can vary significantly with the specific characteristics of schools and students. A successful program in one location may be less successful elsewhere. Jerry Pournelle (1994) notes that, while technology often improves educational quality, it is not necessarily cost-efficient. Citing a report by Danish researcher Hans Siggard Jensen of the Copenhagen Business School, Pournelle comments that teacher productivity can be raised only if the instructors behave as if they are in a virtual classroom (i.e., facilitate knowledge building among all distant sites simultaneously), rather than deal with point-to-point or one-on-one communication situations. He notes that, though videoconferencing is effective, many classrooms lack access to dedicated telephone lines and modems, much less several thousand dollars worth of software and proprietary hardware.

In the formative evaluation of Vancouver's New Directions in Distance Learning pilot project, David Porter (1994) shifts the focus from the relative difference in the dollar cost per student to the increase in completion/success rate of distance education programs by students.

> As completion and success rates improve, as students continue with their education, gain access to courses previously unavailable to them, and as they increase their chances of going on to post-secondary edu-

> cation or workplace training, the benefits to the system and to society as a whole can begin to be factored in to the policy options and decision making equations (p. 26).

We will conclude with this insight by Holloway and Ohler (1991):

> Little happens of any magnitude without administration buy-in, and the best way to achieve that is to succeed on a small level first. Put most of your effort into finding the right people rather than the most exciting technology....Some teachers work well on camera, behind a microphone, or running a computer conference, and others do not. Find teachers who feel comfortable and work well with the media, then give them all of the technical support you can afford. Their job is to teach, not splice cords together or figure out why their conferencing software is misbehaving. The more transparent the media are to them, the better service they will deliver. This has a financial payoff too: The better a teacher works with media, the less necessary the expensive elements of distance delivery coursework (like graphics and sophisticated editing) become to the creation of a quality product (p. 264).

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