

Distance Education for Elementary and Secondary Schools in the United States

*David D. Williams, William D. Eiserman, and
D. William Quinn*

Abstract

A literature review and telephone survey of the fifty United States were conducted to identify research and evaluation studies of distance education programs for elementary and secondary school children. Four major questions were asked:

1. What needs are being addressed by distance education programs?
2. What types of technology are used in these programs?
3. What is the focus of instruction (who is served and what content and instructional design are used)? and
4. What judgements are being made about the effectiveness of distance education at elementary and secondary levels?

Answers to these questions are offered in support of the conclusion that although distance education is being used quite widely to address a variety of needs for multiple audiences in many subjects with a host of technologies, little credible evaluation data is being collected to test the quality of these programs. Suggestions are given for solving this problem.

Résumé

Un examen de la littérature et une enquête téléphonique dans les cinquante états américains ont été effectués afin de découvrir les études portant sur la recherche et sur l'évaluation des programmes d'enseignement à distance destinés aux enfants des écoles primaires et secondaires. Quatre questions principales furent posées:

1. A quels besoins répondent les programmes d'enseignement à distance?
2. Quels types de technologie ces programmes utilisent-ils?
3. Sur quels points l'enseignement se concentre-t-il (qui est desservi, quel est le contenu et quelles méthodes didactiques sont employées)? et
4. Quels sont les jugements portés à propos de l'efficacité de l'enseignement à distance aux niveaux primaires et secondaires?

Les réponses à ces questions servent à étayer la conclusion, démontrant que même si l'enseignement à distance est assez largement employé pour répondre à toute une gamme de besoins provenant d'audiences multiples, sur divers sujets et avec l'aide de nombreux moyens technologiques, bien peu d'informations valables sont recueillies dans le but d'évaluer la qualité de ces programmes. Des suggestions sont proposées pour résoudre ce problème.

Introduction

A literature review of current approaches to distance education in elementary and secondary schools was conducted to identify research or evaluation findings with implications for educational policy and development of distance education programs. Also, because most school personnel do not publish their development activities or evaluation findings for a wide audience, a survey of the fifty United States was conducted to collect such information directly from state agencies involved in distance education projects.

Four major questions were asked in this study:

1. What needs are being addressed by distance education programs?
2. What types of technology are used in school (K-12) distance education?
3. What is the focus of instruction in school distance education? (Who is served? What content and instructional design are used?) and
4. What judgements are being made about the effectiveness of distance education at elementary and secondary levels?

This article briefly outlines general characteristics of distance education and the methods used to conduct the literature review and survey of states to provide a context for discussing the findings. Then the results of the literature review and survey are summarized as they relate to the four major questions. Finally, implications for future inquiry into the nature and effectiveness of distance education processes and programs are discussed.

General Characteristics of Distance Education

Distance education has taken numerous forms over the years. Education by letter was used by Plato, Paul, and Erasmus; however informally or formally, such education exists today. Printed media, teaching kits, audio-visual aids, radio and television, programmed learning, and, more recently, computer-aided learning are in use today. Varying degrees of face-to-face communication between teachers and students are sometimes incorporated with all these approaches (Keegan, 1986). Some of the important issues addressed in this article are clarified by an examination of both the circumstances under which distance education is regularly used and two of the critical features of distance education programs: type of media used and types of students served.

Circumstances When Distance Education Is Used

Primarily found in professional programs, distance education is used to advance individuals educationally and socially in circumstances where special needs are apparent or where conventional resources are often lacking (Holmberg, 1977). For example, when teachers are unavailable or students would have to travel great distances to participate in a conventional class, distance education seems ideal.

However, a number of intrinsic characteristics of distance education make it a desirable alternative for situations not necessarily lacking educational resources:

- Distance education can be used with large groups as mass communication, a particularly attractive option for overburdened educational institutions;
- The quality of instruction can improve by employing the best subject specialists and educationists available to teach these large groups of students;
- Proponents claim (although little evidence for this claim is given) that distance education methods effectively help students acquire knowledge and skills economically through use of these large groups and the elimination (or diminution) of residential teaching;
- Study pace and (to some extent) study content can be individualized; and
- Students are often encouraged to work on their own and to develop independence, which can lead to greater autonomy than do other types of study (Holmberg, 1977, p. 18).

Thus, distance education may usefully address educational needs which result from the lack of conventional resources, as well as other circumstances where resources are not necessarily lacking. This finding suggests that distance education may be useful for large urban districts as well as the smaller rural schools typically thought to need it.

Features of Distance Education

From Keegan's (1986) stringent typology and Holmberg's (1982) discussion of characteristics, several features of distance education emerge:

- Distance education is often based on non-contiguous communication (student and instructor are physically separated throughout the learning process);
- The instruction, which frequently includes pre-produced, self-instructional materials, is often transmitted via technological media such as electronic video links, telephone, print, or computer to unite the student and instructor; and

- Some form of two-way communication between student and instructor is usually provided so students (who are often individually taught) benefit from dialogue with the instructor about assignments they submit (Holmberg, 1981). Of these features, the type of media used and the students served are useful in characterizing practices.

Types of Media. Sewart, Keegan, and Holmberg (1983) identified current uses of print-based, audio-based, video-based, and computer-based media in distance education, suggesting that while print-based instruction is most commonly used, audio-based instruction has often been found cost-effective and appropriate where literacy is a problem. Likewise, video-based and computer-based instruction have hopeful futures as home VCRs and personal computers become more available.

Bates (1983) found three interesting trends relevant to the use of audio-visual media in distance education:

1. There is a clear movement away from using broadcasting by distance learning systems;
2. The range of audio-visual media suitable for distance education is rapidly increasing; [and]
3. The educational potential of audio-visual media still tends to be under-exploited by distance education systems. (cited in Sewart, Keegan, & Holmberg, 1983, p. 227)

Clearly, choice of media (specifically, electronic media) is a critical area for future inquiry.

Types of Students. It is difficult to obtain a clear description of the population that participates in distance education programs because it consists of a diverse group of people in several different countries, differing in economic status, age, and social/cultural values. However, Kaye and Rumble (1981, p. 35), though focussing on post-secondary education, have identified several characteristics which tend to be fairly common across the majority of distance education students:

- They range in age from 20 to 40 years—unlike students in most post-secondary institutions.
- Most students are studying on a part-time basis.
- In many cases, men make up by far the highest proportion of the student body.
- Students study primarily at home with all the competing demands on their time and attention that home life involves.
- Most are highly motivated.
- Students tend *not* to come from wealthier, privileged strata of society.
- Concerning geographical distribution, one can identify two opposing tendencies: a widespread distribution in courses where the target popu-

lation is by definition dispersed (e.g., in-service courses for school teachers) versus a tendency for urban concentration in most other types of self-selected courses.

- Distance learning projects tend to cater to more heterogeneous groups of students than do conventional post-secondary institutions.

Keegan concluded that there are four major ways in which distance education students are different from conventional students. First, they tend to be older and come to the educational experience with more work, family, and community experience. Second, although conventional students usually go to school in the hopes of obtaining employment some day in the future, distance education students are usually employed already. Career and family are their first priority. Third, fewer educational support services, such as libraries, laboratories, and other facilities, are available to distance education students as compared with the academic environments of most conventional students. Fourth, conventional students tend to view their education as a "sure route to a pleasant and comfortable future job," whereas the distance education students view their education as extra work and an additional investment in a lifestyle which is already full of responsibilities (Keegan, 1986, p. 171).

Methods

Two basic methods were used to conduct this study: a review of literature to identify research and evaluation of distance education projects for elementary and secondary schools, and a telephone survey of the fifty United States regarding such projects.

Literature Review Methods

A literature review was made of published and unpublished documents on the effectiveness of instructional technology to enhance and extend educational programs through distance education. Two methods for conducting this literature review were used. First, a computer search of literature was conducted using the computerized data base, ERIC (Educational Resources Information Center). Second, the ancestral or branching bibliography approach was used to check references from each of the sources obtained through ERIC.

The Computer Search. In order to conduct the computer search, the following descriptors from ERIC's list of descriptors were identified as pertaining most directly to distance education:

1. **Distance education** or "education via the communication media (correspondence, radio, television, and others) with little or no classroom or other face-to-face delivery";
2. **School:** "educational institutions at all levels";

3. **Teleconferencing:** "conducting conferences between persons remote from one another by means of a telecommunication system";
4. **Telecommunications:** "long distance communication using electromagnetic systems" such as radio, television, or satellites; and
5. **Communication Satellites.**

The initial computer search, using "distance education" as the major descriptor yielded 446 documents. Three months later, another computer search was conducted, again using only the distance education descriptor, which yielded 503 documents. (This suggests that the body of literature on distance education is growing rapidly and additional reviews might be in order.)

The set of 503 documents included any literature pertaining to distance education efforts in elementary, secondary, and higher education as well as education in industrial settings. For example, one typical reference was for a long document reporting on the planning and implementation of a multimedia college program in Nebraska (State University of Nebraska, 1985). Similarly, the Rio Salado Community College in Arizona reported using the SUNDIAL network (an audio-teleconferencing system) for delivering GED instruction to adult students in Arizona (1985). These two documents are indicative of most documents found through ERIC. They focus on the implementation of specific distance education programs in higher education, often including evaluation results, problems confronted, and proposed models for distance education programs.

Because the focus of this study was on the use of distance education in schools, the "schools" descriptor was combined with "distance education" to yield 46 documents. A review of some of these items suggested that relevant literature pertaining to the use of teleconferencing, telecommunication systems, and communication satellites in schools were not always included under the distance education descriptor. Consequently, these descriptors were combined with "schools" to yield 29 documents.

After eliminating documents included in the 29 which had also been identified in the previous 46, a total of 62 documents remained from the two combinations of descriptors. Of these 62 documents, 20 were related only to higher education. Once these were excluded, 42 documents remained relating to the use of distance education and technologies in schools. These could be reviewed to answer the major inquiry questions.

Ancestral Approach. Once these documents were collected, additional searches were conducted based on references cited in them. Only 4 new documents were located by this procedure, resulting in a total of 46 documents.

Analysis of Literature. These 46 documents were obtained and classified into several categories: 5 reviews of research, 9 primary research studies, 22

position papers on distance education, 7 articles discussing various instructional materials or aids that are available for use in distance education programs, and 3 papers discussing the technical components of distance education. After categorization, the documents were reviewed and analyzed to address the major study questions.

Findings from the 14 documents in the first two categories (reviews and primary research) are discussed in this review because they address most directly the questions stated above (although they provide little convincing evidence to support their claims). Nine of the primary research studies (the review articles are not easily presented in a table format) are summarized in Table 1. References to the other 32 articles are available upon request, but because they provide even less evidence relevant to the questions guiding this inquiry, they are not presented here.

The five reviews (Downing, 1984; Feasley, 1982; Hobbs, 1985; Holmberg, 1982; Hudson & Boyd, 1984) did not focus exclusively on distance education as it is used in elementary and secondary educational settings, but relevant issues which are addressed in these sources are included in this analysis.

Survey Methods

Realizing that most public school personnel do not publish their activities and findings to a wide audience and that distance education projects existed which we did not find reported in the literature, a survey of states was conducted. The intent was to contact the most knowledgeable persons in each of the fifty United States and gather information relevant to the four study questions listed earlier (i.e., what needs are being addressed, what types of technology are used in K-12 distance education, what the focus of instruction is in school distance education, and what judgements are being made about effectiveness).

To address these questions, a telephone survey was conducted. An instrument was developed, respondents from all fifty states were selected, interviews were conducted, associated materials were collected from some states, the data were analyzed, and a summary generated. The methods for these activities are described briefly below.

Survey Instrument Development. Based on the research questions stated above, an interview protocol was generated to gather information about the most and least successful technology-based distance education projects in each state. An interviewing process for identifying the appropriate respondents was also created. This initial draft protocol was tested on a small number of educators who were not part of the target population but who had knowledge of distance learning technologies and related applications.

After several trial surveys were completed, the protocol was revised and tested on a second set of educators to see if the process would gather the information needed. These educators were the Utah State Office of Education officials responsible for technology projects in the state. Several minor revisions were made to the interview protocol before the survey was conducted.

Sampling Respondents. A comprehensive list of representatives from the fifty states who are responsible for technology or distance learning projects in secondary and elementary schools was not available. Such a list would have been helpful in identifying respondents to the survey because it was necessary to identify one person who could summarize the distance learning projects in his or her state.

As an alternative strategy, a listing of the state offices of education was used to make initial contact. During the first call, the receptionist was given a brief description of the kinds of information to be covered in the survey interview. Several calls were then made until a person was identified who was recommended by others and who acknowledged him- or herself as the most knowledgeable in the state regarding the issues covered by the survey. This was most often a person (or persons) responsible for technology in the state department of education or a consultant to that agency. If she or he could not provide complete answers to all of the survey questions, other state office personnel or project-specific persons were called.

Response Rate and Collection of Information. Three state representatives declined to be interviewed over the telephone, asking that a copy of the survey be mailed to them. All three returned a completed interview form which was modified for ease of use as a questionnaire. The other forty-seven responded to the telephone interview questions as planned.

Length of the interviews varied dramatically, from 7 minutes with respondents who requested that the survey instrument be sent to them, to 112 minutes with persons in California. An average of 38 minutes were spent per interview for a total of well over 30 hours. It took more than twice that time (over 70 hours) to contact the appropriate respondents.

Analysis of Information. When the majority of the interviews were completed, responses to the four major evaluation questions were summarized in separate reports for each state. After all responses were received, a summary across states was prepared and is presented here with results from the literature review.

Findings

The findings from both the literature review and survey of states are organized under headings which parallel the four study questions.

What Needs are Being Addressed?

The literature reviewed did not explicitly clarify what instructional, economic, or other needs were being addressed by the distance education projects they reported. However, the nature of those projects discussed in the literature suggests they were created to solve the same kinds of needs that were identified through the survey (see Tables 1 and 2).

Results of the survey indicated that although distance education is sometimes used for staff in service, the most common needs addressed are

- *equity* between small rural schools and their large urban counterparts and
- *enrichment*.

The inability of small schools to offer courses and other educational experiences equivalent to those offered in larger schools is a significant social and economic problem in almost every state. Eighty-two percent of the states identified equity as the principal need addressed by these projects.

Nearly half (44%) of the states also reported a need to enrich or enhance the curricula they offer through the use of additional learning experiences and exposure to external information sources such as famous personalities. Declining student enrollments are increasingly restricting many schools' abilities to offer all the courses they would like. Distance learning technologies, such as educational television, are seen as one way of expanding the classroom beyond normal city or state boundaries to include such resources. The use of the technology itself is also seen as a skill today's young people need to develop.

Table 1
Summary of Literature Review Documents

Citation/Population Served	Technology and Content	Conclusions	Implications
Alaska State Department of Education (1982) Kindergarten through twelfth-grade in 25 rural villages in Alaska.	One-way and two-way audio via the ATIS-1 satellite was used as a health training aid for kindergarten through fifth-graders. System was also used for administrator, teacher, and classroom exchanges.	Evaluation results indicated gains due to the telelearning program. Students preferred the program over regular teaching systems. Teachers favored the satellite program.	An overall communication plan should be developed for Alaska.
Bamhardt, C. (1984) Rural elementary school in Alaskan "Bush Community" villages Aleuts, Eskimos, and Indians.	Computers as communication tools via electronic networking. Audio-conferencing for inter-village planning. Content was special education, math drills, and science research projects. Students interacted with students in California; teachers with teachers and administrators with administrators.	Helps to enrich diversity in the schooling process. Provides many resources previously not available. Can offer a wide variety of course-work. Access to a large educational data base and to a wide variety of resource people. Teachers can exchange information and take university courses to further their training. Computers can send and receive information faster than by telephone and are less expensive than audio-conferencing.	Potential to allow students and teachers in small rural schools to become more independent and self-sufficient. Telelearning is a useful tool for decentralization.
Hockley, R.F. (1985) Students who lived in isolated homesteads and camps scattered over an area of approximately 650,000 miles in the southern half of the Northern Territory of Australia.	Two-way radio was used in addition to written correspondence for a variety of contents including math, language, social studies, and current events.	The results indicated that information was made available to students who otherwise would have been deprived.	<i>(continued)</i>

Citation/Population Served	Technology and Content	Conclusions	Implications
Kelleher, K. (1983) Elementary and Secondary school in South Bend, Indiana.	Slow-scan video teleconferencing for teaching second- and third-graders reading (emphasis on consonant and vowel discrimination).	Slow-scan video conferencing was effective because it was able to serve specific, local needs without having to appeal to a large audience. It was also found that the teachers' abilities to communicate were enhanced. Evidence was also found that slow-scan video conferencing for this purpose was cost-effective.	
Kirman, J.M., & Goldberg, J. (1980) Compared fourth, fifth, and sixth-grade teachers in two types of in-service training in Edmonton and Sherwood Park, Alberta, Canada.	Edmonton teachers received training through traditional face-to-face training whereas Sherwood Park teachers received training via one-way television and telephone group conferencing.	Results indicated that the one-way television mode is at least as effective as a face-to-face mode of delivery. Teachers, however, prefer face-to-face mode of delivery. The one-way TV mode was found to be spurious on physical comfort and convenience ratings, but no significant difference was found in capabilities due to the instruction.	Future questions were raised: What type of content best lends itself to this mode of instruction? Would students instructed only by television lecture perform as well as students using TV telephone group instruction? How would students perform using this mode of instruction on an individual basis rather than being in a group?
Perraton, H. (1981) School teachers in Tanzania and Botswana, Africa	Radio was used for teacher training in health, nutrition, forestry, and politics.	Results identified the advantages of radio in education; it reaches a large audience and is the predominant medium in the third world.	<i>(continued)</i>

Citation/Population Served	Technology and Content	Conclusions	Implications
Kitt, J., et al. (1983) Isolated students in North-west Queensland, Australia	Two-way radio, via satellite was used to support home tutors in the interpretation of correspondence school papers, development, and enrichment of oral communication, motivation of children working from correspondence school papers, identification of learning and speech difficulties, and provision of an avenue for socialization through daily contact periods.	Results indicated that satellite radio is inexpensive and cost-effective. School of the air and correspondence is more effective than paper correspondence alone.	There is a possibility for using this technology as a means for uniformly strengthening educational programs on a regional level.
Robertson, W.D. (1984) Remote areas of British Columbia where elementary, middle secondary, and higher education needs were addressed.	Teleconferencing and audio-video conferencing (full scan and slow scan) were used both in a two-way and one-way fashion. Telephones were also used in conjunction with video, electronic blackboards, computer graphics, radio, and satellites. Content was not mentioned.	Effective techniques for reaching remote areas. It was also found that the techniques were cost-efficient, especially when video was not incorporated. Additionally, it was concluded that video was not a necessary component in distance learning.	These distance learning techniques help reduce teachers' loads and reduce stress. Further, children in remote areas are provided educational opportunities they would otherwise be deprived of.
Roth, E.B. (1980) Teachers in Williamsburg, Newport News, and King William Counties, Virginia were provided in-service training via distance learning technologies.	Two-way instructional television was used for in-service training for a gifted program and special education program.	Results indicated savings in energy and teacher's time.	A variety of uses of the technology are evident and the state officials are interested in exploring possibilities for further development including in-service training throughout the state.

Table 2

Summary of Results from Survey of States for States.

State ^a	Need ^b	Technology ^c	Students	Subjects ^d
Alaska	Equity	Satellite TV, audio teleconference	K-12	Many
Arkansas	Equity, Enrich	Satellite TV, audio teleconference, microcomputer	9-12	Language
California	Enrich	Computer network	7-12	Library resources
Colorado	Equity	Slow scan video, electronic chalkboard, audio teleconference	11-12	AP English, calculus
Connecticut	Equity	TV broadcast, slow scan video, audio teleconference	11-12	Language
Delaware	Enrich	Computer network	K-12	Drill & practice for core
Hawaii	Equity, Enrich	Slow scan video, audio teleconference, electronic mail	9-12	Language
Idaho	Equity	Satellite TV, computer network	11-12	AP math
Illinois	Equity, Enrich	Video teleconference, microcomputer	9-12	AP math, chemistry, Spanish, business
Iowa	Equity	Satellite TV, audio teleconference	9-12	Language, math
Kansas	Equity	Satellite TV, audio teleconference	9-12	Language, computer use
Louisiana	Equity	Electronic chalkboard, computer teleconference	9-12	AP fine arts, calculus
Maine	Equity, Enrich	Computer network	Teachers 9-12 & K-6	Info. on curriculum, computer use
Maryland	Equity	Two-way TV, audio teleconference, facsimile transmission	9-12	Many
Michigan	Equity	Two-way video, audio teleconference	9-12	German
Minnesota	Equity, Enrich, In-service	Many video, audio microcomputer configurations	K-12 Teachers	Many
Missouri	Equity	Satellite TV, audio teleconference	9-12	German

(continued)

State ^a	Need ^b	Technology ^c	Students	Subjects ^d
Nebraska	Equity, In-service	TV broadcast, audio tele- conference, computer mail	9-12 Teachers	Language
Nevada	Equity	Satellite TV, audio & computer teleconference, microcomputer	9-12	Many
New York	Equity	Audio & computer tele- conference, two-way TV	7-12	AP math, English, Spanish
North Carolina	Equity, In-service	Computer network	Teachers	Computer use
Oklahoma	Equity	Satellite TV, audio tele- conference, microcomputer	9-12	German, physics
Pennsylvania	Equity	Audio & computer teleconference	K-12	Computer use, physics, calculus
South Carolina	Enrich	TV broadcast, audio teleconference	K-12	Many
Texas	Equity, In-service	Satellite TV, audio tele- conference, microcomputer	K-12	Many AP
Utah	Equity	Satellite TV, audio tele- conference, computer network, microcomputer	10-12	Spanish, AP physics
Virginia	Equity, Enrich	TV broadcast, audio teleconference	10-12	AP math, English, Latin
Washington	Equity, Enrich	Satellite TV, audio teleconference	9-12	Language, English, math
West Virginia	Enrich	Two-way TV, computer network	9-12	Computer use, business
Wisconsin	Equity	Two-way TV, audio teleconference	9-12	Language, business, math

^aOnly states reporting projects involving two-way interaction between locations through electronic technologies were included in this table.

^bExtended labels for the need category:

Enrich To provide curriculum offerings that are not normally available to meet the special needs of more advanced students.

Equity To provide equal access to instructional options in smaller, rural schools where the course would not be offered without the program.

In-service Training or familiarizing teachers with curriculum offerings, such as with computer programs that may be delivered to their class, educational video programs, and so forth. Also includes networks for sharing information among sites using electronic mail.

^cExtended labels for the technology used category:

Audio Teleconference Telephone link using speaker phones.

Computer Network Linking of microcomputers together or to a main frame computer through modems and telephone lines.

Computer Teleconference Interaction of teachers, students at two sites through computer network.

Microcomputer Use of self-contained microcomputers for delivering instruction.

Regular TV One-way video and audio by broadcast or cable distribution.

Satellite TV One-way video and audio by satellite distribution.

Two-way TV Video and audio transmissions from two or more sites that can be viewed at all receiving sites. Usually video from only one site at a time is viewed, but audio from several or all sites can be heard. Typically implemented through closed circuit, cable television.

⁴Extended labels for the subjects taught category:

AP Advanced placement course.

Business Business, vocational education, or secretarial skills courses.

Computer Use Computer programming or literacy courses.

Drill & Practice in Core Drill and practice computer programs for core curriculum areas, particularly reading and math.

Info. on Curriculum Information for teachers on curricular offerings for use in classrooms, most not involving distance learning technologies.

Language Second language instruction in several languages such as German, Spanish, Russian, and Chinese. If only one language is mentioned then that language is listed.

Library Resources Database of library resources available in state region for student use.

Many Several diverse curriculum areas mentioned, such as English, math, languages, computer literacy, speed reading, and so forth. Or, respondent indicates that "all" areas of the curriculum are treated in the distance learning programs.

What Types of Technology are Used?

The reviews of distance education research conclude that the most common form of media used in distance education is print media (Feasley, 1982). However, this pattern is more apparent in higher education (often for correspondence courses) than in elementary and secondary school education applications. While the literature only implies that projects for school-age children use relatively more electronic media and fewer print-based media than do higher education applications, four of the nine primary studies which were reviewed employed the use of television technology (Kelleher, 1983; Kirman & Goldberg, 1980; Robertson, 1984; Roth, 1980) and the results of the survey confirm this finding.

All fifty states have public television stations; educational television is by far the most common technology used (in 80% of the states), with the most variety in formal educational programs offered and sheer numbers of subjects to choose from. Such programs have been used for long periods, and a high percentage of teachers report using them. For example, one state reported that over 95% of its classes used these TV programs during the school year.

One-way television transmissions utilize a variety of technologies, often in combinations. Almost half (47%) of the states reported that they used standard broadcasting systems, 31% used satellites, 18% used public broadcasting service stations only, 9% used cable, 9% used I.T.F.S. (shortwave)

television, 9% used microwave technology, and 9% reported that they used videotapes at remote sites.

Results of the survey indicated that two-way teleconferencing is added to the one-way transmissions in many states. Telephone lines (often dedicated lines) for carrying visual information (computer programs in 38% of the states) and two-way audio teleconferencing (51% of the states) is the second most frequent use of technology. Instruction using this technology can reach almost anywhere. Users may dial a number to engage the network and obtain the programming (which could be live classroom discussion or preprogrammed graphic displays).

The use of programmed instruction through computers, light pen devices, and telephone line teleconferencing allows for the transmission of prepared graphics programs and group discussions. Some parts of the instruction can be preprogrammed then modified and discussed as students and teachers interact. The resulting instruction resembles a traditional classroom where the teacher presents a lesson on the chalkboard, students ask questions, and the teacher responds by writing explanations on the board and talking to the students at the same time. The only thing missing is seeing the teacher face-to-face on a daily basis.

Other devices can be used in conjunction with phone systems to provide live audio and visual teleconferencing. For example, television equipment provides two-way pictures and sound in 20% of the states, electronic chalkboards are used in 13%, and fiber optics technology is being explored in several states.

Computer-assisted instruction is used extensively both through telecommunications networks and for non-linked programs which allow students individual instructional drill and practice at their own speed and level. This is a relatively inexpensive distance learning technology which provides considerable flexibility. Electronic mailbox networks are also used (though mainly for faculty) in about 20% of the states surveyed.

Although very few of the survey respondents mentioned two-way radio as the best or the worst of their projects, there may be considerable use of it. Three of the primary studies reviewed from the literature employed two-way radio for distance education (Alaska State Department of Education, 1982; Kitt et al., 1983; Perraton, 1981).

What is the Focus of the Instruction?

To clarify the focus of instruction using distance education technology, both the audiences served and the content of the lessons used were examined.

Audiences Served. Results of the literature review indicated general usage of distance education technology for kindergarten through twelfth-grade

ers (Alaska State Department of Education, 1982), for exceptional populations (Roth, 1980), as well as for in-service training of teachers (Kirman & Goldberg, 1980; Perraton, 1981; Roth, 1980).

Respondents to the survey of states reported that students need to be mature and self-disciplined to participate effectively in distance education programs. Frequently only the most motivated students are targeted for the classes offered. Although there are distance education programs for all ages, courses for high school students are most frequent (45% of the states), apparently because these students need such offerings for equal opportunity to prepare for higher education. Further, in states where more costly technologies are used (about 60% of the states reporting), high school students are more frequently targeted (in 85% of these states).

In about 20% of the states, where the only distance education programs are those that are presented through the PBS TV networks, the majority of such programs are produced for elementary level students.

Content Used. Barnhardt (1984), Hockley (1985), and the Alaska State Department of Education (1982) report using distance education to transmit a variety of curricula whereas others report using technology only for specific subject matters. For example, Kelleher (1983) reported using slow-scan video teleconferencing for reading instruction whereas Perraton (1981) used radio instruction for health, nutrition, forestry, and politics instruction.

Likewise, the survey indicated that nearly every subject imaginable is taught via technology-based distance education projects. Advanced placement courses are popular (45% of the states mentioned this application) because it is more difficult to obtain qualified teachers for the small numbers of students able to take them, and because those students are usually mature and independent enough that school officials are willing to enroll them.

What Judgements Have Been Made About Effectiveness?

Generally speaking, few credible studies have been done to evaluate the effectiveness of distance education programs. The few inquiries reported present essentially positive reactions by participants. Studies comparing effectiveness of various technologies have begun to appear and a few address the critical issue of cost-effectiveness, but most evaluations do little more than note the numbers of students served by distance education who would otherwise lack access to particular types of education. Much more rigorous forms of evaluation are needed.

Participants' Perceptions. Although all the primary studies which were reviewed claimed success (however vaguely defined) for distance education, they provided little empirical evidence documenting effects. For example, the Alaska State Department of Education (1982) reported gains in English,

history, mathematics, and developmental reading yet only implied that these were actually the areas in which the students were instructed via distance education. This lack of literature reporting evaluation or research findings suggests that few efficacy data have been collected.

Few of the programs reported on in the survey interviews had been formally evaluated. About 11% of the respondents said they were aware of no programs in their state to evaluate; 38% reported no evaluation results for the programs they described; and, although 51% said evaluations had been conducted, only 20% provided any evidence. Unfortunately, only a handful of *those* studies actually gathered data in a disciplined way. Most of these "evaluations" simply noted that programs were being used, that students who would not otherwise receive critical instruction were being exposed to it, and that participants seemed to enjoy the experience.

In nearly all the evaluations mentioned by respondents, they reported that the technologies used satisfied the needs the projects were designed to address and were well accepted by students, parents, and teachers alike. In most cases, respondents were happy just to be receiving programs for students who had gone without such classes before the new distance learning programs were available. However, the majority of respondents to the telephone survey did not have data regarding participants' perspectives. They could only speculate that participants must like their programs because of increased enrollments in them or other such evidence. Clearly, as with most educational programs, there is a great need for more systematic evaluative information regarding the impact of distance education programs.

The strongest evaluations reported were for programs in Utah and Nevada. These results indicated that distance education enhanced equity without the costly expansion of staff and that the students enjoyed the program and seemed to learn as well as they do by other instructional means. There was also evidence, however, that technical difficulties frequently interrupted learning, and interpersonal interactions between the teacher and students were more difficult to maintain than in traditional learning situations. Further, these evaluations suggested that because the instructional strategies used are typically limited to lectures, the greatest potential of the technologies is not being exploited. Additionally, there is not much sharing of curriculum or lessons learned among people within or across sites regarding how to use distance education systems.

Effectiveness of Technologies. With respect to the effectiveness of specific media, Kitt et al. (1983) concluded that radio instruction used in conjunction with written correspondence is more effective than written correspondence alone, while Perraton's (1981) main conclusion was that radio instruction was "effective" because it reaches a large audience. Only the

Alaska Department of Education reported academic gains; however, their report did not adequately present details about the size, statistical significance, or meaning of these gains, reducing the confidence one can place in their findings.

Two-way television instruction has also been used and reported as being generally effective (Kelleher, 1983; Robertson, 1984; Roth, 1980). Again, researchers report that television is effective because it serves a large population and deals with specific, local needs rather than general needs; they do not provide evidence about how well students learned when they were "served" by these programs. Kelleher reported that the teachers' abilities to communicate were enhanced by this medium, although the reason for this conclusion is not adequately described. Roth reported the use of two-way television in teacher in-service training and highlighted the time savings for teachers who did not have to travel to attend the in-service. Robertson concluded that the video portion is not necessarily needed; if it were eliminated (reducing the medium to two-way radio), in-service training at a distance would be more cost-efficient. But no empirical evidence supporting this conclusion was given.

As can be noted in Table 1, there is a variety of combinations of media, each of which has some intuitive appeal for various audiences. All of these warrant intense examination and comparison with other combinations of media. Computers, audio conferencing, slow-scan video teleconferencing, electronic blackboards, one-way and two-way radio, satellites, one-way and two-way television, and traditional face-to-face instruction are all forms of instructional media which could be empirically and systematically compared in disciplined evaluations.

Only one of the studies reviewed included such a comparison. Kirman and Goldberg (1980) compared instruction via one-way television and telephone group conferencing with conventional face-to-face in-service instruction of teachers. They concluded that the one-way television and telephone group conferencing media combination was at least as "effective" as face-to-face instruction. The television/telephone combination scored better on physical comfort and convenience ratings, although no significant group differences were found in teachers' subsequent capability to impart instruction. Subsequent performance of the students taught by the two groups of teachers was essentially equivalent.

Cost-Effectiveness. Although most of the studies reviewed drew rather general conclusions about the effectiveness of their programs, three sets of inquirers (Kelleher, 1983; Kitt et al., 1983; Robertson, 1984) attempted to address the issue of cost-effectiveness, the most specific criterion of effectiveness addressed by any of these studies. Unfortunately, it is difficult to

determine what valid procedures, if any, they used to draw conclusions about the cost-effectiveness of their programs. Kitt et al. concluded that satellite radio is cost-effective because it is so inexpensive. This conclusion is too general and fails to capitalize on the more sophisticated methods for conducting cost-effectiveness analyses. Similarly, Kelleher and Robertson do not provide adequate evidence leading to their claims of cost-effectiveness. Nevertheless, the attempts made by these studies set the stage for an evaluative component which must be included in future evaluations of distance education programs.

Results of the survey of states reported that costs for setting up and servicing all the technologies included in distance education programs are high. However, the reaction of most of the interviewees to these high costs was that distance learning programs cost less than trying to set up and maintain a traditional classroom when very few students are involved. Often there is no qualified teacher available in rural areas, even if the school wanted to hold classes with only a few students. For the most part, the use of distance learning programs is seen as the only option a school district has for some needed curriculum offerings.

Conclusions. Although many of the findings reported in the literature seem rather vague and little evaluation was reported by respondents to the survey of states, several firm conclusions can be drawn. First, current programs are at various stages of implementation. Second, those who have had experience beyond the initial stages have found that distance education courses have been accredited and have provided instruction in several curriculum areas where schools had previously been experiencing deficits (Downing, 1984). Finally, much more sophisticated and frequent evaluation and research needs to be conducted.

Implications

In addition to the finding that there is a need for better evaluation of distance education programs, this study demonstrates that the criteria for judging such programs need to be clarified and negotiated by the audiences for such evaluations.

Need for Evaluation

It is obvious that understanding the effects of distance education would be of value to program implementors as well as to the larger community of distance educators. However, the conclusions drawn about effectiveness are not well substantiated and, in fact, might be self-serving. Hudson and Boyd (1984) suggest that it is vital that old mistakes not be repeated by simply using distance education technology because it is a new and interesting means by which to educate. Rather, it is important to assess carefully which

technologies are most appropriate and effective enough to justify the additional costs involved.

Likewise, although the distance learning concept continues to develop and the recommended components are integrated into programs using it, evaluation should be used to improve, as well as test the idea. Thus, formative evaluations, which begin with needs and input assessments as suggested by Stufflebeam et al. (1971), are imperative.

Hobbs identified one such critical component in his review of two of the most comprehensive distance-education programs, one implemented by Oklahoma State University and one by the Utah Department of Education. He cites these two programs as exemplary because of their use of multiple media as the primary way to address problems in rural education. However, he offers a caution: to develop and implement systems involving multiple media (using satellite transmission of instructional material, advanced computer-assisted instruction, and teacher/student interaction both in and out of the classroom), it is necessary that individual schools collaborate with other institutions such as universities, state departments of education, other schools, and private funding sources. The true effectiveness of such programs lies in the number of students served, which depends on how well their institutions coordinate their distance education programs (Feasley, 1982; Hobbs, 1985).

Even in exemplary programs, such as Oklahoma's and Utah's, cost-effectiveness of distance education is still limited because of the lack of collaboration and, therefore, should not be assessed until this and other weaknesses are identified and improvements are made through formative evaluations.

Evaluation Criteria

In order to conduct meaningful formative and summative evaluations, we need sets of criteria which are agreed upon by the various stakeholders in evaluations of distance education. Once collaborative and cooperative arrangements are in place, it will be easier to assess more comprehensively (summatively) the effectiveness of distance education.

Meeting Needs. What makes a distance education program effective is alluded to by most of the studies reviewed here, although none has addressed the issue adequately. Some imply that effectiveness is the degree to which a predetermined need has been met. Specifically, if students in remote areas are provided instruction of which they otherwise would be deprived (Barnhardt, 1984; Hockley, 1985; Robertson, 1984) or if teachers' loads are eased by the use of distance education, the program would be judged effective. Although each of these criteria reflects the nature of some of the findings reported in this inquiry, information is still lacking with respect to how needs such as these are substantiated, to what degree the needs are felt in the

society and by whom, and at what point of severity such needs warrant the investments of distance education programs.

Utility of Technologies. Another set of criteria, used implicitly at least, pertains to the degree to which technology is used effectively. Although literature pertaining to distance education in higher education indicates that print is the predominant form of media used in distance education, this is not the case in lower level distance education. Rather, a wide variety of technologies and combinations of technology are being used: computers, audio conferencing, slow-scan video teleconferencing, electronic blackboards, one-way and two-way radio, satellites, and one-way and two-way television.

Although many studies report the use of these technologies in distance education, they provide little information about their actual implementation. Consequently, it is difficult to determine exactly what is involved in the use of the various technologies. Although it is likely that they possess specific strengths and weaknesses with respect to distance education applications, these have not been adequately documented. Further, comparative considerations regarding combinations of technologies with different curricula and students are needed.

Student Characteristics. The literature pertaining to the origins of distance education indicated that distance education students in higher education are adults who are furthering their education while continuing to work; but children from kindergarten through twelfth grade are also enrolled in distance learning experiences. Unfortunately, hardly any information is given with respect to the characteristics of these children. It is possible that distance education students, because of the circumstances which lead to the availability of distance education, are different from other students enrolled in conventional elementary and secondary schools. It is also possible that within the population of distance education students, there are some who are more successful or who like it more than others. Understanding these characteristics should be instrumental in planning future distance education endeavors at the elementary and secondary levels.

Appropriate Curriculum and Instruction. The findings of this inquiry suggest that a wide variety of instructional curricula have been addressed by distance education programs, although little data is available regarding what instructional designs are being used in distance education at the elementary and secondary levels. No studies offer insights into the comparative advantages and disadvantages of various course contents or other issues associated with the appropriate curricula for distance education programs. Further, it is not clear which instructional design approaches are most appropriate in the transmission of the content. At best, the studies report what types of content

were used in their studies, as though content and instructional design strategies were only a tangential variable of interest.

Koul (1984) warns against the assumption that a teacher brought up in conventional face-to-face instruction will automatically be an effective distance educator. Thus there is a need to evaluate the effectiveness of instructional design strategies, especially involving teachers who have not been trained as distance educators. None of these studies has systematically compared the effectiveness of instruction using different instructional designs.

Cognitive and Skill Gains. This inquiry suggests that outcomes pertaining to cognitive or skill gains are appropriate evaluative criteria to use in judging distance education programs. Although several studies have examined cognitive or skill gains, there is little empirical evidence which leads to conclusions about effectiveness based on these criteria. It is possible that the nature of cognitive or skill gains made as a result of distance education are different from those made as a result of conventional educational methods. How do the gains compare? Why are cognitive and skill gains not the primary criteria of effectiveness? Detailed information about these gains and the length of time required to affect observable differences, as well as clear descriptions of the methods used in reaching conclusions, is lacking.

Cost-Benefits. Although cost-effectiveness is reported by several researchers, it is questionable whether the positive conclusions which were drawn are justified. The results reported represent unsubstantiated claims pertaining to cost-effectiveness. Therefore, future efforts are needed to assess cost-effectiveness. Ideally, cost-benefit analyses rather than cost-effectiveness studies should be conducted. According to Barnett (1986), "cost-benefit analysis seeks to estimate the economic values measured in monetary terms of both the resources consumed and the outcomes produced by a program. Cost-effectiveness analysis seeks to estimate the monetary value of the resources consumed by a program but does not do so for the program's outcomes" (p. 252). Thus, cost-effectiveness analysis yields less information than cost-benefit analysis. However, either would be an important criterion to use in evaluating distance education programs.

Overall. By not addressing these criteria, program developers seem to have given little regard to the appropriateness of the match between the technology, content, instructional design, type of students, associated cognitive or skills to be gained, or costs. It seems likely that some content areas are better suited to distance education than others, that some instructional designs and/or teaching techniques are more effective than others, and certainly that kindergarteners' experience with distance education is qualitatively different from twelfth-graders' experience.

All of the criteria mentioned above are important indicators of the effectiveness of distance education, but none is sufficient alone. Future studies should combine these criteria and others identified by relevant audiences of the evaluation to establish a comprehensive set of standards against which distance education programs can be judged.

Summary

Even though little data is being collected on the efficacy of distance education via technologies, distance education is being used rather widely to address rural education needs, teacher shortages, and general lack of resources (Hudsen & Boyd, 1984). For those engaged in planning or implementing distance education programs, a variety of information is available which can assist in program development, teacher training in distance education, and other practical assistance pertaining to implementation. As Hudsen and Boyd suggest, of key importance are careful management and the designing and planning of distance education programs that draw on the experience of others. This study suggests several ways formative and disciplined evaluation can improve this process.

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The research reported here was funded by the Utah State Office of Education through a contract with the Wasatch Institute for Research and Evaluation. Appreciation to Robert Quinn for assistance on the survey is extended.

David D. Williams is an Associate Professor of Secondary and Higher Education at Brigham Young University, Provo, Utah, USA. He specializes in naturalistic and qualitative approaches to research and evaluation, particularly in applied educational settings.

Mailing Address: Box 29 MCKB BYU
 Provo, UT 84602
 USA

William D. Eiserman is a Research Assistant Professor in the Early Intervention Research Institute at Utah State University, Logan, Utah, USA. He conducts research on many educational topics, most recently on the costs and effects of early intervention for handicapped children and their families.

D. William Quinn is a Quality Assurance Manager at Applied Learning in Naperville, Illinois, USA. He conducts evaluations for governments, schools, and private agencies. He specializes in adult learning, quantitative data analysis, and cost/benefit evaluations.