

INSTRUCTIONAL DESIGN ISSUES IN DISTANCE LEARNING

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ABSTRACT

This paper reports preliminary results of research into distance learning currently being conducted by the authors. Although some of the results reported here are preliminary, the trends identified should not change significantly.

While many organizations conduct distance learning programs, there has not been much focus on issues of instructional design specifically directed towards distance learning. In this paper, current research on trends in instructional design issues pertaining to distance learning are investigated. Focus of the research was on evaluating the delivery of hands-on technical training via distance technologies. Data is presented on the impact of distance learning on the curriculum, types of student - instructor interaction, student interaction with the instructional materials, and on the preparation of faculty and staff for distance learning.

ABOUT THE AUTHORS

William J. Walsh has been involved in the design and development of training systems, and researching training technology issues for over 15 years. He has worked on and managed programs involving various implementations of training technology, including computer-based training, multimedia applications, intelligent computer-assisted training, simulations of maintenance and troubleshooting, and distance learning among others. Recently his concentration has been on technological applications to reduce instructional development time and increase instructional quality.

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INTRODUCTION

Distance Learning is defined as: *any method of presenting training that is interactive and in which the students are physically separate from the instructor* (AETC, 1991). The training environment in the Air Force is changing. Efforts to decentralize training management and export training through distance learning and other technologies have already begun, and this trend will surely continue. Previous Armstrong Laboratory research in computer-based training revealed that the Air Force had not been thoroughly prepared for implementation of computer-based training (Walsh, Yee, Grozier, Gibson & Young, 1992). This paper will report the results of a study conducted by the authors for Armstrong Laboratory to determine issues to aid the Air Force in preparing for implementation of distance learning.

Past Research Focus

Although distance learning technologies have been utilized for many years,¹ distance learning has recently come under increased scrutiny as a viable technology for technical training. From a preliminary review of the literature it appears that the bulk of research has focused on distance learning technologies employed and how various organizations have implemented these technologies (presumably successfully). Few studies have concentrated on student-related issues or instructional quality concerns.

The current study builds upon previous research work in distance learning conducted by Air Education and Training Command (AETC) to assess the state-of-the-art in distance learning technology (AETC, 1991). Using the AETC study

as a starting point, the authors surveyed organizations involved in distance learning to determine how far the technology has advanced, and to assess the organizations' experience with distance learning. Of particular interest were lessons learned concerning the impact of distance learning on the quality of the curriculum, student - instructor interaction, student interaction with instructional materials, and on unique approaches to developing instructional materials for distance learning technologies.

Selected organizations were contacted to determine how their approach to distance learning affects the preparation and training of their instructional staff, whether they employed any special techniques to select, prepare or modify old instructional materials or create new instructional materials for implementation in distance learning, to assess the effectiveness of their programs, and to gauge the organizational impact of distance learning.

Research Goals

A majority of training which takes place in the Air Force is directly related to maintenance functions. Even training which is not maintenance related is primarily task (skill) oriented. Nearly all of this training requires some kind of hands-on experience with aircraft, weapon systems or equipment. For any technology to have a significant effect on Air Force technical training it must be able to adequately address the requirements of these hands-on components. In our opinion, effective technical training requires sound instructional design strategies as its basis. Therefore, we have sought to identify distance learning programs which have addressed similar training requirements effectively.

A primary goal of this research was to determine if there are specific categories of

¹ 38.1% of respondents to our survey indicated they have had programs for 10 years or longer.

objectives, task characteristics, or instructional strategies which lend themselves to particular distance learning technologies. We have attempted to answer Miller's (1990) question: What can be done better through distance education than in a classroom? Some emphasis is placed on the use of mediated instruction, i.e., distance learning using computer-assisted instruction, to assess its applicability and effectiveness. While much distance learning tends to consist of video teletraining with an instructor presenting the learning materials to students at remote site(s) over television transmissions, the research team questioned if this method was the primary strategy for distance learning, and whether it was the best one for hands-on objectives.

APPROACH

The research approach taken was to determine the state-of-the-art in distance learning from the literature, to glean from the literature specific problems which were of interest to the Laboratory, and to design a survey of distance learning organizations to assess their approach to these issues.

Literature Review

Prior to designing a questionnaire, an extensive literature review was conducted. The purpose of the literature review was to identify current trends in distance learning, to determine what potential research issues might be, and to assess if there had been any previous research conducted which might offer solutions to the instructional design issues. Some of the literature reported success stories for individual distance learning programs (Griffin & Hodgins, 1991, Chung, 1991, Heathman & Kleiner, 1991, McKell, Hardy & Stocks, 1992, and Marshall, 1991, among others). While reviewing this large volume of literature, we found that there were unresolved problems associated with instructional effectiveness of distance learning for certain kinds of skills. This provided several topics for questionnaire development.

The literature was also a source of data regarding approaches, methods and techniques which might offer success if applied to distance learning. We examined these carefully whenever we visited one of the organizations later in the

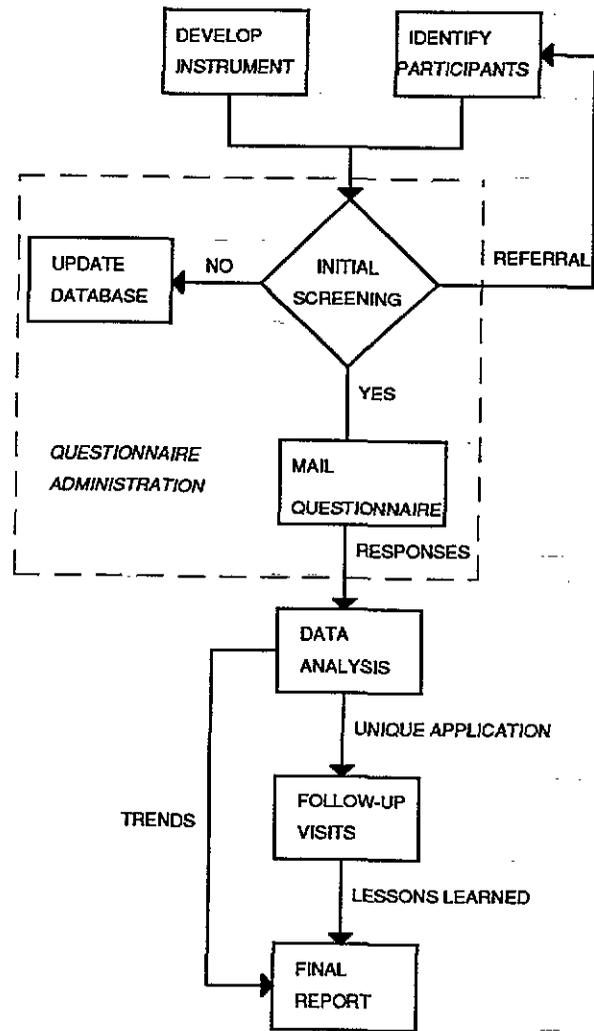


Figure 1 GENERAL APPROACH

study. Practices which could be of benefit to the Air Force in designing instructional strategies for distance learning were of primary interest to the research team during site visits.

Survey Development

After identifying potential distance learning issues and problems from the literature review, the team developed a questionnaire to be used in surveying the field. The questionnaire consisted of 65 questions organized into 5 major areas: organizational profile, student information, faculty information, instructional design and general information. Within each of these areas several topics were examined. The questionnaire was designed to provide the respondents with a

number of choices in each category, yet it did not limit them from providing specific comments to a question if the categories listed did not represent what they were doing.

Identification of Distance Learning Organizations

Since our definition of distance learning was broadly inclusive, there was no single source which provided us with a list of all or most distance learning organizations to be surveyed. We were interested in distance learning providers, but not merely instances of a school district implementing televised classes in math, science, etc., or in technology vendors interested in selling their systems. Rather, we wanted to contact as many organizations which had tailored their curriculum, did something specific to prepare their instructors, or had some unique aspect to their distance learning program. We were especially interested in organizations which might be providing hands-on technical training. The research team developed a database of distance learning organizations from various distance learning related sources such as: catalogs, networks, journal articles, the AETC study, and (probably most effective) referrals from other organizations. While we would not assert that this listing is comprehensive, it is a broad sample of organizations which are providing distance learning services.

Conduct Survey

The survey was conducted over a 3 month period. During this time all of the organizations in the database were contacted by phone. Each organization which had programs of potential interest was sent the questionnaire for completion. If respondents did not return the questionnaire within the allotted time, they were called again regarding the status of the questionnaire. Slightly more than 70% of the questionnaires were returned.²

Initial Screening -- Our approach included an initial telephone screening of potential respondents. During the screening we asked several organizational profile questions which were indicators of the kinds of programs being

² Questionnaires were sent to 182 organizations, of these 128 were returned.

conducted. Based on participants responses to these questions, they were sent a copy of the questionnaire to complete. Frequently, calls were made in the blind, i.e., we had no definite contact at the organization, and the research team was forced to track down the right person to respond to the questionnaire. Very few (2.7%) of the organizations called (n=187) refused to participate in the survey by even answering the screening questions.

Questionnaire Distribution -- The questionnaire was distributed to the participants over a three month period. Participants were given a date by which to return the completed questionnaire. If a questionnaire was not returned within 1 week of the deadline, a follow-up call was made to the point of contact. In most cases the participants indicated at that time whether or not they would return the questionnaire.

Data Analysis -- The data analysis focused on providing descriptive data and comparing relationships at the aggregate respondent level. For issues of special interest, data were collapsed and assessed for specific demographic groups. Numerous qualitative data were gathered from two open-ended questions. Whenever possible these data were reduced into a more manageable form by categorizing responses according to the same broad areas as the questionnaire.

Expected Outcomes -- We expected the data analysis to provide us with information concerning: trends in distance learning, indications of unique approaches to curricular materials, potential novel approaches to instructor - student interaction, successful use of distance learning technology for hands-on training, and other similar items which could contribute to preparing the Air Force for implementation of the technology. We also hoped to determine if relationships existed between the types of skills, tasks or objectives trained and the appropriateness of various distance learning media.

Follow-up Visits -- The data analysis was also designed to provide indications of candidate sites for follow-up visits. These sites were to be determined based on their unique or successful application of distance learning technology to

training. The research team identified the more promising organizations, ranked them according to several factors (uniqueness of the program, potential for lessons learned, willingness to host a visit, proximity to each other, etc.), and recommended the list to the Laboratory. Upon approval of the list by the Laboratory sponsor, visits were scheduled to each of the organizations.

Prior to visiting the selected organizations, the research team developed a set of visit protocols. These protocols consisted of verification of the data provided in the questionnaire, details of the specific research questions to be answered, and complete information to be gathered about the program or approach. With this in hand members of the team accompanied by a Laboratory sponsor visited the selected organizations and conducted the follow-up interviews. Most organizations were eager to demonstrate their programs to the team. These visits provided extremely useful anecdotal information about distance learning which, when coupled with the results of the questionnaire, provide some insight into distance learning implementation.

Document Research Issues

While much interesting and useful information about distance learning was acquired during this research, its purpose was not to develop definitive guidance for Air Force implementation of the technology. Rather the outcome of the research was to identify current trends and problems which will need to be overcome so that future implementations of distance learning technology can be successful. As a consequence, during the study we documented: 1) instances of successful (or partially successful) applications of distance learning, 2) methodological deviations from traditional instructional design and development techniques which may be necessary to take full advantage of the technology, 3) problems encountered in applying distance learning to specific types of skills, tasks or objectives, and 4) specific research issues which should be explored further.

Comments by Industry, Academia & Government -- As a final step in the research, the findings were scheduled to be presented to a

panel of international distance learning practitioners and researchers. Comments by this group will be used to refine the Laboratory's distance learning research agenda.

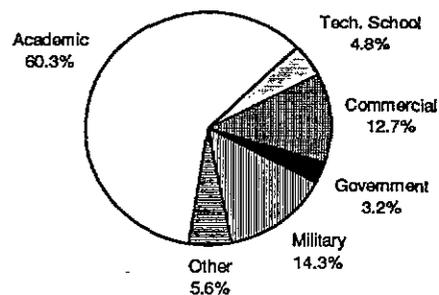
FINDINGS

Our initial findings cluster around the five major areas of the questionnaire, namely, type of organization, student, faculty, instructional design and problems encountered. We will discuss each of these areas below.

Characteristics of Organizations Involved in Distance Learning

We surveyed a broad range of distance learning providers from academic institutions to commercial firms providing employee training via distance learning. The various types of organizations responding to our survey are indicated in Figure 2.

Figure 2. Organizations Conducting Distance Learning



The distance learning providers we surveyed did not restrict their programs to a single medium. Nearly all (99.2%) report using several media in their distance learning programs with 73.8% reporting using five or more. While computer-based training is popular (58.7%), video broadcast, either live or taped, is even more frequently used (73.8%). 84.6% of respondents indicated that special equipment is necessary for students taking distance learning courses. Of those courses requiring special equipment, 48.8% of respondents said that they provide it to the students.

Organizations involved in distance learning tend to have large programs with 51.2% reporting

21 or more courses offered, and 88.9% with more than 100 students. Courses range from very small, 1-10 students (20%), to very large, over 100 students (15%). While many organizations reported that there were course enrollment limitations, 38.9% said that there weren't any limitations on enrollment. Many organizations (63.7%) indicated that their distance learning courses were substantially the same as the conventional courses they offered. In spite of this, only 7.1% indicated there was no need to modify the approach for distance learning.

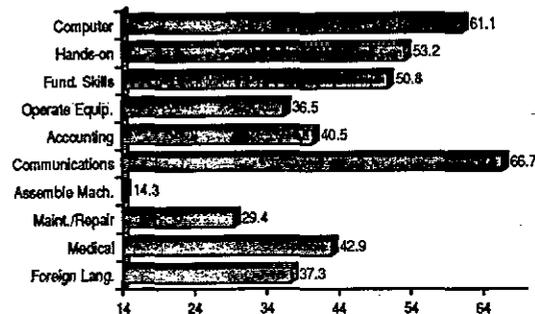
The tendency to use multiple media appears to be reflected in the wide variety of skills trained. Distance learning programs appear to be used for everything from teaching hands-on skills such as assembling machinery (14.3%) to communications (66.7%). Figure 3 displays some of the broad spectrum of skills taught via distance learning technology.³ The research team was surprised at the high numbers for hands-on skills (53.2%), equipment related training (36.5%) and maintenance and repair training (29.4%). These indicated to us that distance learning technology has at least some capability to deliver the same kind of training as Air Force technical schools. While some of the distance learning programs were conducted in a conventional classroom setting (44.4%), many take place on-the-job or at the worksite (55.6%). While the largest percentage of respondents indicated they trained problem solving skills (73.8%), in fact, the same percentage indicated that they trained job related skills.

In general, a thumbnail sketch of the typical distance learning provider is one with several courses taught by conventional means as well as distance technology. In addition, this typical organization also offers several unique courses via distance learning. No restrictions are placed on the type of skills taught by distance learning. In fact, it appears that hands-on skills are as likely a candidate for distance learning as cognitive skills.

Characteristics of Distance Learning Students -- Distance learning programs are

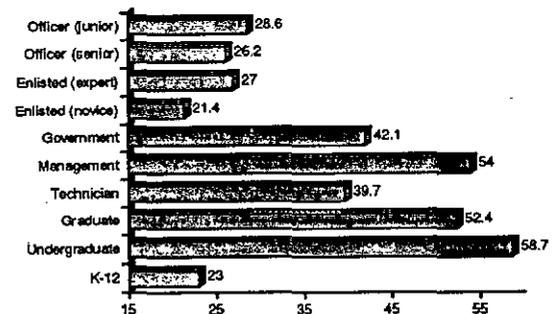
³ In this example and throughout this paper some percentages will add up to more than 100%. This is due to the fact that a respondent could check several options for some questions.

Figure 3. Type of Skills Trained



available to a wide variety of students (see Figure 4). In general, students have the option of selecting either distance learning or a conventional course (69%). Our respondents indicated that the primary reason students had for selecting distance learning was that it was more convenient (77.5%).

Figure 4. Distance Learning Students



One issue of importance to the Laboratory was the amount and kind of interaction between students and instructors in distance learning. Although many programs (62.4%) indicated that this interaction took the form of written correspondence, e.g., homework, tests, exercises, etc., several other means were also used such as questions and answers from the distant classroom (60%), telephone calls during conference hours (58.4%) and computer link, e.g., via modem (43.2%). It is interesting to note that 82.2% of the respondents indicated that students had at least two or more ways to interact with instructors. While interaction intervals may vary from course to course, 42% of the

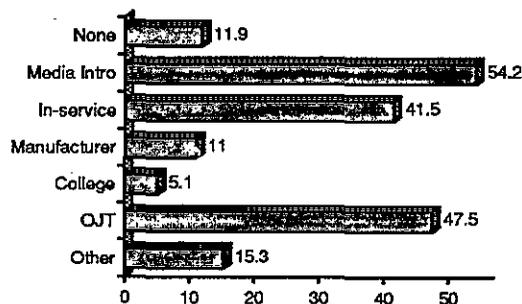
respondents indicated that it was frequent, i.e., daily or weekly.

Another point of interest for the research team was whether distance learning offered some efficiency in achieving learning goals over conventional instruction. Our data did not indicate that such efficiency was being achieved on a large scale with 8.9% of respondents reporting that distance learning courses are longer and 12.9% reporting that distance learning courses are shorter than conventional courses. The majority of respondents (55.6%) reported that the distance learning course is a fixed length; 47.1% said it is the same length as the conventional course. When we asked if students took longer to complete the distance learning course, many respondents indicated that they take the same time in either course (47.1%).

We were also interested in finding out if novel approaches to performance assessment were being used in distance learning courses. Many respondents (42.7%) indicated that course materials included self-assessments. However, 74.2% of respondents indicated that written tests were used for student assessment. Only 16.1% indicated that performance tests were administered on-the-job or elsewhere (12.9%). In general, other than written tests, performance assessment is substantially the same as conventional classroom with 56.5% using periodic work assignments, 54.8% relying on instructors monitoring student work and 34.7% relying on verbal examination of the knowledge.

Characteristics of Distance Learning Instructors -- Most respondents reported the distance learning faculty is the same as for conventional courses (72.6%). Only a few respondents (12.9%) indicated that they used a special group of instructors from their own staff for distance learning courses or specialists from outside the organization (21.8%). Most of the instructors were chosen because of their teaching experience (60.3%) or their experience with the media (36.4%), although 50% indicated that the faculty had no special background, rather they were selected from those available. Several respondents indicated the kind of training which distance learning instructors receive (see Figure 5.).

Figure 5. Instructor Training



We also asked what was included in the instructor training programs. As expected most said that they provided an introduction to distance learning technology (68.9%). Equally important were how to make use of media in a distance learning environment (63%), communications skills (63%), and how to deliver the subject matter via distance learning (59.7%). What we thought might be two of the more critical skills also received treatment: how to operate the distance learning equipment (52.1%), and how to promote distance learning interaction (56.3%). Apparently it was less important to provide training in how to evaluate distance learning students (33.6%). Many programs also provided training in instructional development skills for distance learning (49.8%).

While various reasons were offered as the reason for training distance learning instructors, the one cited most often was that untrained instructors were not effective (44.9%). The training programs appear to be effective since respondents reported that instructors made better use of media (53.8%) and interaction strategies (52.1%). Most respondents (59.8%) felt that instructors were better able to utilize features of distance learning technology after training.

Characteristics of Distance Learning Curriculum -- Many programs appear to rely on conventional courses as the source for their distance learning curriculum. In fact, the distance learning curriculum is frequently the same as conventional courses (58.1%), or the conventional curriculum is specially adapted for distance learning (49.2%). Less frequently (36.3%) is a

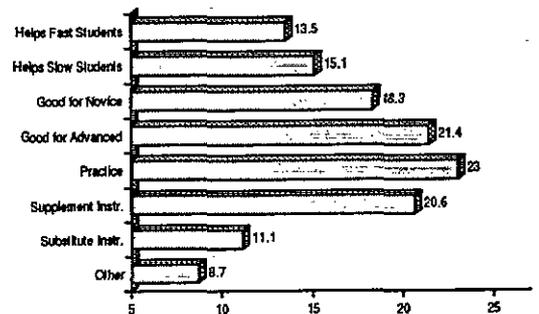
course developed specifically for distance learning. While distance learning courses may be derived from conventional courses they are far from stable; only 12.9% of respondents report that the distance learning curriculum is very stable. Rather, the distance learning curriculum evolves every time it is taught (30.6%). Perhaps this may be due to the fact that it is based on a conventional course which does not take full advantage of distance learning capabilities.

As pointed out earlier, one of the Laboratory's research goals was to determine if specific types of tasks or objectives fit distance learning better than others. Few respondents (11.4%) said that there was a certain category of objectives which was best for distance learning. Some (13.8%) indicated that they developed objectives especially for distance learning. In general, objectives were no different than conventional course objectives (69.1%), or were simply conventional course objectives adapted for distance learning technology (33.3%). Nor did organizations appear to have an accepted methodology for selecting distance learning media for objectives. When asked why they selected distance learning for certain objectives respondents tended to use objectives from existing courses (70.3%). Only some indicated that they performed some kind of media analysis (16.1%), based the selection on research (11%), or had a previous model (11%).

Computer-Based Training in Distance Learning -- Many respondents (56.6%) indicated that they used computer-based training as part of their distance learning curriculum. However, 39% of respondents found computer-based training to be an effective distance learning tool. Various reasons were provided as to why it is effective (see Figure 6). Only 17.2% of respondents used it as the primary method for delivering of instruction.

Curriculum Development -- Curriculum development for distance learning is not easily classified. Organizations most frequently report using approaches such as instructional systems development (ISD) (33%), or their own development process (35.1%). According to the respondents they use a specific curriculum development process because there is a preference for it among the faculty/instructional

Figure 6. Why CBT is Effective Tool



development staff (49.5%), or it takes distance learning requirements and capabilities into account (57%).

When a special curriculum is developed for distance learning it has definite characteristics such as including additional graphic media (70.4%), and increased opportunities for student interaction (64.3%). Frequently some materials are provided to students in advance (62.2%). There is generally, more independent student work (43.9%) and more frequent assessment of student performance (40.8%).

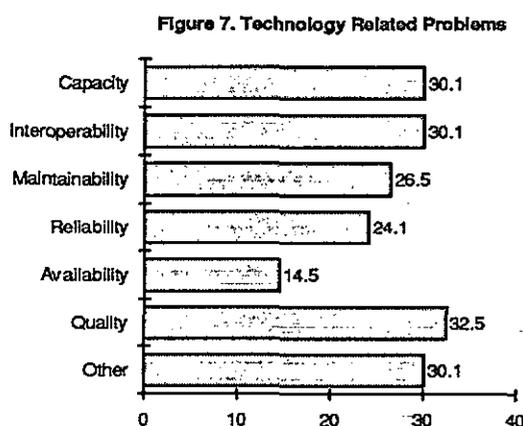
In an overwhelming number of cases (73%) the course instructor develops the distance learning curriculum. Far fewer organizations rely on a staff instructional designer specially trained in distance learning (38.5%), and even fewer rely on outside organizations (13.1%) or consultants and contractors (14.8%). In general, the majority of respondents (52.5%) reported staff with more than 3 years experience in distance learning. However, some (18%) indicated staff members with no experience or less than 6 months. Just as for distance learning instructors, most organizations also provided training for curriculum developers (68.8%). While a few seemed to pick up training from other sources, college courses account for the bulk of the outside training (46.4%). Again, just as for the instructors, the training was effective. 43% of respondents reported developers made better use of media. Developers were better able to design interaction strategies (48.6%), and utilize features of distance learning technology (54.2%). 76.8% of respondents reported using a combination of professionals in developing the distance learning

curriculum including instructor (84%), instructional developer (63%), media specialist (56%), distance learning technician (48%), or some other (23%).

We asked the respondents how long it took them to develop distance learning courses. Generally, they spent varying amounts of time performing the various activities associated with curriculum development. Although some (43.6%) indicated that it took as long as conventional courses, many (55.4%) said that media preparation took longer. 14.3% of respondents have formulas they use in developing distance learning courses and provided them to us.

Problems Associated with Distance Learning

Surprisingly, 73% of respondents said they were conducting research in distance learning. The areas investigated range from the effectiveness of distance learning (58.2%), use of various distance learning technologies (54.9%), distance learning multimedia applications (41%), role of the instructor (40.2%), and curriculum development for distance learning (36.1%). Their research was reflected in the answers to questions we posed about distance learning problems. Nearly all (91.8%) reported some kind of problem. The principal ones were the availability of trained personnel (50%), and reluctance of the faculty to use the technology (54.9%). While there was some resistance to distance learning on the part of students (27%) and administration (32%), the real resistance came from the faculty (47.5%). The respondents were also able to categorize their technology related problems (see Figure 7).



The reason most cited for the problems which the organization was having was inadequate funding (41.2%). Several other potential causes were reported such as lack of experienced or trained personnel (31.9%), limited or inadequate facilities (27.7%), inadequate time to plan and prepare (24.4%), and technological problems (25.2%). As one might expect, in the opinion of the respondents the solution which could have prevented or diminished the problem was additional funding (46.2%). Although several other solutions were suggested such as training for personnel (41%), management support (36.8%), public relations to overcome biases (35.9%), better facilities (26.5%), and additional time (28.2%).

Future Plans for Distance Learning

In spite of the fact that there are problems associated with distance learning, a majority of respondents (76.2%) indicated that they had plans to increase the number of courses. Other responses indicated similar positive attitudes toward distance learning. 72.1% of respondents plan to increase the scope of their distance learning programs and add or improve distance learning equipment. Many organizations plan to increase funding for distance learning (55.7%), train faculty in distance learning technology (44.3%), and improve distance learning facilities (54.9%). Only 1.6% said that they have plans to reduce or eliminate distance learning courses. Only 31.9% said they planned to add faculty. This corresponds with some responses we got which indicated that distance learning was cost effective because it could reach more students with fewer faculty. However, only 27.3% reported that the reason they are planning to make more use of distance learning was that it was cheaper than conventional courses. Respondents seemed to be impressed with distance learning course effectiveness (53.7%), and that students like distance learning (38.8%).

CONCLUSIONS

Obviously, from the problems reported training is needed for instructors in the use of distance learning technology. In particular how to provide for student interaction, methods of assessing student performance at a distance, and general communications skills. Currently, successful instructors tend to do more and less

successful ones drop out of the program. Curriculum developers also need to be prepared for distance learning. They must learn new ways of increasing student interaction with training materials, and how to make effective use of graphic materials to support distance learning. Some organizations have begun to develop guidelines for curricular materials based on their experience implementing programs. However, for the majority it appears that curriculum development for distance learning is a highly personal thing with each developer using and refining techniques which have worked in the past.

Costs do not appear to be out of line with other technologies or conventional instruction. While most organizations indicated that funding was a problem, it was not for the development of materials as is the case with computer-based training. Rather, distance learning costs are associated with equipment, satellite time, etc. In fact, the organizations we contacted indicated that distance learning was potentially a cost saver because it allowed more students to be taught by fewer staff, and delivered the instruction where the student was rather than on a central campus.

When we began this study we had the notion that we would find organizations that used a single distance learning technology exclusively or much more than others. In general, that is not the case. Distance learning programs tend to be eclectic in their approach to technology. In other words, they tend to use several complementary technologies together in their programs. This puts more emphasis on having a trained and experienced staff of curriculum developers and instructors so that they can take full advantage of the capabilities of various technologies.

Finally, there does not appear to be any systematic media selection process in use to identify what distance learning can do better than other forms of instruction. Still further, distance learning appears to be selected based on factors other than the kinds of skills to be trained. The ability to reach many students in dispersed locations is one factor which tends to be considered in selecting distance learning for a curriculum rather than characteristics of the training objective, the domain of knowledge to be learned, or the type of tasks to be performed. Further research needs to be done to determine

just what distance learning is better for than other forms of instructional delivery.

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