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A Status Report on the Use of Distance Education in Industrial Technology

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In 1991, Brey predicted that postsecondary distance education (DE) programs would see an incredible rate of growth through the 1990s. At that time less than 100 accredited universities and four-year colleges in the United States were offering courses by distance learning. According to a December 1999 report by the National Center for Education Statistics (NCES), by 1995 this number had increased to over 600 institutions. By 1998 the number of universities and four-year colleges offering courses by distance had risen to 870, or 33% of all such institutions. As the 1990's ended it was clear that Brey's prediction was correct. DE had become a phenomenal growth industry in education during the 1990s.

While the report compiled by the NCES (1999) is an excellent indicator of the status of DE in U.S. universities in general the report did not examine the status of DE in all individual disciplines. The purpose of this paper is to examine how the use of DE has progressed among industrial technology (IT) programs in the U.S. in comparison to the general status as reported by the NCES.

Background

DE began in the 1840's as correspondence courses to allow persons living in remote areas who could not attend traditional classroom based schools the opportunity to receive an education in a field of their choice. However, since its inception there has been a continuing effort to in DE to effectively increase the level of communication and interaction between the instructor and the learner. Communication by correspondence evolved into instructional broadcasts by radio in the 1920's, and to the introduction of the telecourse in the 1950's. These technologies were lacking in immediate interaction between the instructor and student, and never rivaled the traditionally taught classroom course in popularity (Buckland & Dye, 1991). In the 1980s the emphasis in DE evolved into the use of live two-way, or real time, television, and computer based telecommunications technologies to connect the student to the instructor (Sorenson, 1994).

Interactive television is still a powerful technology for connecting student and teacher, but has the limitation of requiring students to fit a fixed class time at a pre-selected site into what may already be a busy schedule. In the 1990's this caused a shift toward computer based instruction. Courses offered by computer, using instruction accessed through the Internet, allows students to learn at their own pace and speed, and from any computer site able to access the Internet. Computer based instruction does have the disadvantage of requiring the student to demonstrate greater initiative, as there is little external pressure to perform assigned work in the allotted time. In addition, student success often depends upon access to high quality computers, reliable Internet access, and the computer usage competencies needed to use the equipment (Kerka, 1996).

Methodology

According to the NCES report (1999) larger institutions tend to be more active in offering courses by DE. This is primarily attributed to the expense of operating DE programs being cost efficient with larger student populations. To select institutions to participate in the survey the 1998

edition of the Industrial Technology Baccalaureate Program Directory was used to identify institutions offering a baccalaureate or higher degree in IT. Of 102 identified institutions, a total of 80 university level programs were considered to have enough IT majors to make operation of a DE program practicable.

The program directory was used to identify individuals at each of the selected institutions and the survey instrument was transmitted via e-mail to provide the recipients with the greatest convenience in responding to the survey. In some cases survey information and follow-up information were elicited by telephone and personal interviews. The intent was to collect information on the utilization of DE in teaching IT courses, and, if so, how was it being utilized.

The following questions appeared on the survey:

1. Does your IT program currently include any courses taught using DE?
   At what educational level are these courses taught (undergraduate, graduate, or both)?
   If your program is not offering courses by DE, are there plans to begin doing so in the near future?
2. What types of courses are being taught using DE, and do any of these include a laboratory component?
3. What types of communications technologies are being used in your DE courses?
4. What were the greatest difficulties you encountered in developing a DE program at your institution to teach IT courses?
5. What do you consider to be greatest benefit to your IT program from teaching courses at a distance?
6. In retrospect, what three considerations are most important in developing a DE program?

Results

Thirty-four usable surveys were returned yielding a 43% response rate. The responses were examined for trends in the data related to the purpose of this paper.

Question #1: How active are IT programs in offering courses by distance, and at what educational level?

Data gathered by the NCES (1999) shows that 870 or 33% of four-year institutions in the U.S. are offering some courses by DE. Responses to the survey of IT programs showed that 12 (35%) were currently offering some courses by DE.

Of all higher education institutions not currently offering any courses by DE, the NCES (1999) report showed that 20% intend to become active to some degree in offering courses by DE within the next three years. Of the respondents to the survey of IT programs which indicated they are not currently offering any courses by DE, 19 (86%) of these indicated that they were planning to begin offering DE courses in the near future, usually within the next two years.

Of those IT programs offering DE courses, 6 (50%) offered courses at both the undergraduate and graduate level, 5 (42%) offered courses only at undergraduate level, and 1 (8%) offered courses only at the graduate level. The number and variety of courses offered by distance varied widely from only two or three courses being offered by DE due to a single instructor's initiative, to entire degree curricula.

Question #2: What types of IT courses are being offered by distance, and do they include a laboratory requirement?

Although a wide variety of course titles were reported as being taught, course content could be generalized by area. The types of IT courses most frequently offered are given in Table 1.

Only 3 (25%) of respondents reported that there was a laboratory component included in the requirements of their courses, however this requirement was sometimes met by field projects at local sites. Depending upon the technology used to deliver the course content, instructor demonstrations were performed using either multimedia computer simulations, recorded video, or performed by the instructor as a part of the transmitted instruction using interactive television.

Question #3: What Technologies are being used to deliver DE courses in IT?

The NCES (1999) report shows that there are two primary technologies being used to deliver DE courses. Two-way interactive video at 497 (57%) of institutions, and asynchronous computer based instruction (CBI) available through the Internet at 59% of institutions. The number of these institutions using both technologies in course delivery was not specified. These primary technologies are often supplemented with other technologies such as e-mail, CD-ROM, and videotape.

Table 1. Types of IT courses that are being offered by DE.

Course Category	Number	Percent
Industrial Management	9	75
Quality Assurance	7	58
Occupational Safety and Health	6	50
Vocational/Industrial Teacher Education	5	42
Computer Proficiency	3	25
CAD/CAM	3	25

(N = 12)

Responses to the survey of IT program showed that the primary technologies currently in use are also two-way interactive television and CBI through the Internet. Two-way interactive television was used exclusively by 5 (42%) of responding programs, Internet CBI was used exclusively by 1 (8%), and both were used by 6 (50%). In addition, 11 (92%) of the respondents indicated that the primary technology was supplemented by one or more supporting technologies such as CD-ROM, videotapes, telephone conferences, and email.

Question #4: What were the greatest difficulties you encountered in developing and implementing a DE program for IT?

This question was not addressed by the NCES (1999) study, but a review of the literature shows some of the difficulties encountered in developing DE programs. One difficulty often mentioned is lack of time and adequate resources to develop DE courses. Willis (1992) states that while courses taught using DE utilize the same basic teaching strategies used in traditional classroom teaching, the proper development of a DE program is time consuming, especially if the faculty and administrators involved are not familiar with DE program development.

Gaud (1999) found during the development of undergraduate biology courses for the Internet that each course required an average of 15 minutes of instructor time per student per week if the instructor had the assistance of support personnel. Without support personnel, the time demand for each course rose to 30 minutes of instructor time per student per week.

Faculty reluctance to undertake development of DE courses is another difficulty that appears in the literature. Meyer (1998) reported that the results of faculty workload studies conducted in over 15 states, as well as three national studies, showed that the majority of university faculty are already working an average of 40 to 50 hours per week. Despite this, political and administrative pressures are being brought to bear on faculty to produce greater results without an equivalent increase in resources. Therefore, it is understandable that some faculty members might be reluctant to take on new responsibilities such as developing DE courses. This is especially so if they believe it will increase their workload without a concomitant reduction in their existing workload, or increased compensation for their additional efforts.

Another problem in offering DE courses is higher than expected student dropout rates. Reports from interviewed faculty members involved in DE courses sometimes attributed this to students who put off completion of assignments until they are too far behind to complete the work in the remaining course time.

In a review of research conducted on DE programs, Phipps and Merisotis (1999) reported that students participating in DE courses had significantly higher non-completion rates than students taking the same course on campus. In one of the studies reviewed only 40% of the enrolled students successfully completed the course. Results obtained from the survey showed that the perceived difficulties to offering IT courses by DE followed similar themes expressed in the literature. These are given in Table 2. Totals shown in Table 2 exceed 100% as some respondents reported more than one difficulty encountered in offering IT courses at a distance.

Question #5: What are perceived as being the greatest benefits to an IT program from teaching courses at a distance?

The NCES (1999) report cites several studies (Sherron & Boettcher, 1997; Turoff, 1997, & Willis, 1995) that have examined this point. The most frequent response is that DE offers the potential of increased enrollments by giving access to a student population that could not otherwise attend courses offered by that institution. Another frequent response was that it helps nontraditional students who often must juggle education with family and job responsibilities to stay in school.

Responses to the survey of IT programs echoed the studies cited in the NCES (1999) report. While some respondents reported several benefits of DE, 11 (92%) gave increased enrollments as a reason to offer courses by DE. To provide greater convenience to students in scheduling courses was reported as a benefit by 6 (50%) of respondents. Follow-up interviews showed that some respondents believed that distance learning courses were

Table 2. Difficulties encountered by offering IT courses by DE.

Difficulty	Number	Percent
Lack of faculty time to develop courses.	6	43
Problems learning to operate or maintain the technology medium at the host & remote sites.	5	35
Administrative support/resource allocation of operating funds and equipment.	3	21
Getting faculty interested/involved in the development of DE courses	3	21
Students who are not self disciplined enough to manage their time properly and drop the course.	3	21
Providing laboratory exercises at a distance	2	14

(N = 14)

particularly attractive to non-traditional students who needed flexibility in their education schedule to allow them to balance educational demands with other responsibilities such as work schedule and family needs. Economical delivery of instruction was reported as a benefit by 3 (25%) of the respondents, and 1 (8%) reported the ability to access adjunct faculty and qualified industry experts who might not have been available to teach on-campus classes as a benefit.

Question #6: What are the most important considerations for developing a successful distance learning program for IT?

The responses to this question were grouped into similar themes and are given in Table 3. Survey responses and comments from interviews point to well trained and motivated instructors as being major players in developing a successful DE program. Follow-up interviews found that successful strategies to stimulate faculty involvement included providing release time from other duties, and providing the instructor additional compensation for teaching DE courses.

Follow-up interviews concerning technology support showed that it was important in two aspects: first, in providing instructors with help in adapting instructional techniques and materials for the technology to be used in the DE course. Second, ongoing support is needed to keep the system operational and to update instructional materials.

Administrative support was considered important in two aspects: first in supplying the financial resources and incentives necessary to develop and deliver DE courses. This included the providing of release time for material development and funding for the training of faculty. Second, administrative support was considered important in the development of institutional policies governing the offering of DE courses and providing for course accreditation.

Summary

DE has become a major force shaping the future of higher education in the United States, and all indications are that its influence will increase well into the 21st century. At the present time, DE is not widely used in the delivery of IT courses, but its use will increase in the next few years. Major obstacles appear to be lack of faculty time and involvement, problems with the technology, and the difficulty of providing hands-on experiences using existing DE technologies.

In conclusion, these problems are not insurmountable, but can be overcome through thought, preparation, and training. DE today is best described as cooperative education. It is successfully accomplished through a team effort consisting of motivated faculty, understanding administrators, knowledgeable technical support personnel, and students with a need to learn. DE is the wave of the educational future, and IT must be a part of that wave to be a part of the future.

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Table 3. Important considerations in successful DE program development.

Consideration	Number	Percent
Motivating faculty to participate in the program	9	75
Proper program organization & curriculum development	6	50
Ensuring reliable operation of the technology.	6	50
Administrative support to provide resources for program development.	5	42
Training for faculty and technical support staff.	3	25
Maintain student interaction with the instructor	1	9
Development of proper assessment procedures.	1	9

(N = 12)

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