The Application and Implications of Information Technologies in Postsecondary Distance Education: An Initial Bibliography

Special Report

Division of Science Resources Statistics
Directorate for Social, Behavioral, and Economic Sciences

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Introduction

Although distance education has been around in various forms for over a century, the revolution in information and communications technologies (ICT) that began in the 1980s has sparked significant expansion and renewed interest in distance education. The combination of widespread use of personal computers, the growth of the Internet and the World Wide Web, and reductions in telecommunications costs have facilitated new ways of designing, delivering, and administering distance education. As these new ICT-enabled forms of distance education become more prevalent and widespread, questions have arisen about their effects for example on learning, students, faculty, and the organization and administration of higher education. These and other questions about the application of ICT in distance education are active subjects for research and analysis.

This report provides a brief overview of postsecondary distance education, some descriptive statistics about its size and scope, illustrative findings from existing research about the implications of ICT in postsecondary distance education, and an initial bibliography of this research.

In this report, distance education is defined as education where learning occurs all or most of the time in a different place from teaching, and the principal means of communication between learners and teachers is through technology.

Overview of Postsecondary Distance Education

Distance education has evolved continually since correspondence schools developed in the late 19th century. These correspondence schools, which were sometimes private for-profit businesses and sometimes extension units of publicly funded universities, originally presented instruction through printed materials—as many still do. Educational content also began to be delivered by radio in the 1930s and by television in the 1950s, and through recorded programs on audio- and videocassettes in the 1970s. Material was sent back to the school by students through the mail and later by fax. The 1970s also saw the establishment of "open universities"—i.e., institutions that are open to a broad segment of the population, offer a variety of traditional academic and nontraditional (e.g. career development and personal growth) courses, and make extensive use of distance education. The British Open University, which is one of the oldest and best known of these institutions, has approximately 200,000 students and is often considered the model for open universities. More than 20 similar systems have been set up in other nations.

From the mid-1980s to the mid-1990s, computers and videoconferencing were added to the suite of distance education technologies. Computer programs and resources were packaged on disks and CDs, and electronic mail and bulletin boards began to be used for two-way communication between educators and students. Audio- and videoconferencing via satellite, cable, and phone technologies became widely used. One leader in satellite delivery of distance education is the National Technological University, a consortium of some 50 universities. It offers master's degree programs in 19 fields, over 1,400 academic courses specializing in continuing education for engineers and scientists, and some 200 courses and programs available via the World Wide Web.[1]

Since 1995, Internet technologies—and especially the World Wide Web—have become widely used throughout higher education. Their use has allowed both synchronous and asynchronous communication among students and between faculty and students.[2] High-bandwidth connections permit more video and multimedia to be presented over the Internet. These and other devices and technologies have stimulated renewed interest in distance education.

Size and Scope of Postsecondary Distance Education

The most comprehensive data on the size and scope of postsecondary distance education come from the National Center for Education Statistics (NCES) 1997–98

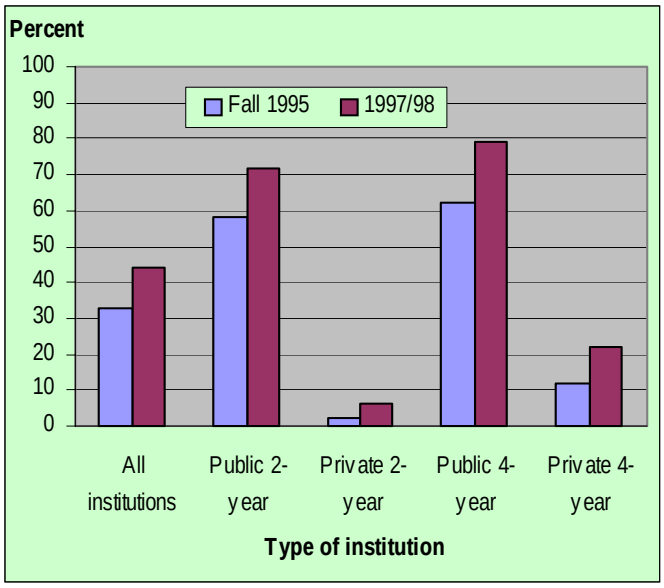
[1]In February 2002, the National Technological University was acquired by Sylvan Learning Systems, Inc, a large, for-profit provider of education services.

[2]In synchronous communication, such as classroom instruction or videoconferences, all parties participate at the same time; in asynchronous communication (such as e-mail), participants do not need to be available at the same time.

survey and are reported in NCES 1999a.[3] This NCES study found that 44 percent of higher education institutions in the United States offered distance education courses during the 1997/98 academic year, compared with 33 percent in fall 1995.[4] (See figure 1.)

The total number of distance education courses offered by 2- and 4-year higher education institutions more than doubled over the period covered, rising from 25,730 in 1994/95 academic year to 52,270 in 1997/98.[5]

Figure 1. **Percentage of U.S. higher education institutions offering distance education**



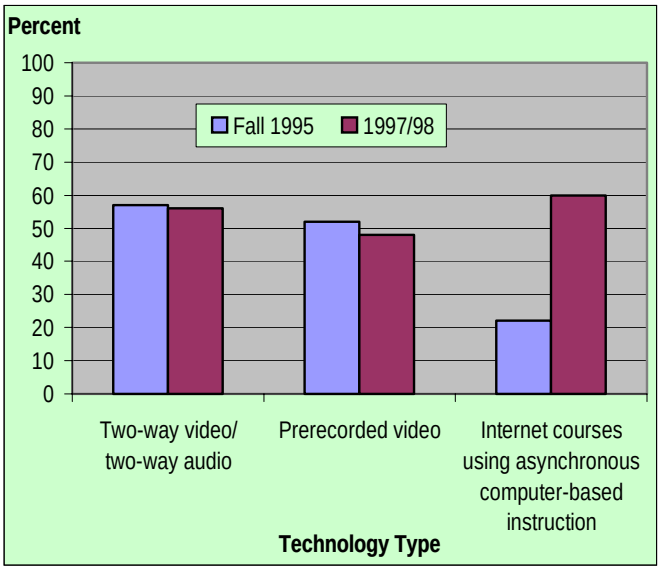
NOTE: All institutions include public and private 2- and 4-year institutions. Percentages for 1995 are based on an estimated 3,460 higher education institutions, and for 1997/98 on an estimated 3,580 higher education institutions.

SOURCE: National Center for Education Statistics, *Distance Education at Postsecondary Education Institutions: 1997–98* (Washington, DC: U.S. Department of Education, 1999), p. 48, table 21.

Similarly, the total number of enrollments in all distance education courses by 2- and 4-year higher education institutions more than doubled, increasing from 753,640 in 1994/95 to 1,632,350 in 1997/98.

These figures include distance education delivered with a variety of audio, video, computer, and Internet technologies. The three most prevalent distance education delivery methods used by higher education institutions for distance education in 1997/98 were Internet courses using asynchronous computer-based instruction, two-way video with two-way audio, and one-way prerecorded video. The use of the first of these methods—asynchronous Internet-based technologies—increased substantially during the period under study. In fall 1995, only 22 percent of higher education institutions offering distance education used this method; this percentage increased to 60 in 1997/1998. The percentage of institutions using the other two technologies stayed approximately constant. (See figure 2.)

Figure 2. **Percentage of higher education institutions that offer distance education courses using selected types of technologies**



NOTE: Data for 1995 are based on the estimated 1,130 higher education institutions that offered distance education courses in fall 1995; 1997/98 data are based on the estimated 1,590 higher education institutions that offered any distance education courses in 1997/98.

SOURCE: National Center for Education Statistics, *Distance Education at Postsecondary Education Institutions: 1997–98* (Washington, DC: U.S. Department of Education, 1999), p. 52.

[3]These surveys were conducted in fall 1995 (gathering both then-current data as well as some data on the 1994/95 academic year) and winter 1998–99 (collecting data on the 1997/98 academic year). NCES plans to release a new study, based on 2000–01 data, in late 2002.

[4]The 1997/98 NCES data cover postsecondary educations institutions, which include both higher education institutions (e.g. traditional colleges and universities) and other postsecondary institutions (e.g., allied health and vocational-technical schools). The 1995 NCES study, and thus the 1995 to 1997/98 comparisons cited here, cover only higher education institutions. The 1995 data cover an estimated 3,460 higher education institutions; the 1997/98 figures are based on an estimated 3,580 higher education institutions.

[5]These data are based on an estimated 1,130 higher education institutions offering distance education courses in fall 1995 and an estimated 1,590 in 1997/98.

Selection Criteria for the Bibliography

This document provides an initial bibliography for readers who may wish to explore what the literature says about the implications of IT for postsecondary distance education. Criteria for selecting studies for inclusion in the bibliography were that they

- focus on formal (leading, or potentially leading, to a degree) higher education and continuing education;
- focus on the use of the Web and Internet as the principal delivery technology;
- were published in the United States between 1996 and mid-2001;[6] and
- address the topic from an empirical base.

To locate empirically based studies, special attention was given to doctoral dissertations and to two key journals, the *American Journal of Distance Education* (the principal hard-copy research journal in the field) and the *Journal of Asynchronous Learning Networks* (the principal online journal). A search of Dissertation Abstracts International focused on keywords distance + learning, distance + education, distance + policy, distance + administration, and distance + digital divide. A search was also made of Periodical Abstracts, ERIC, ABI Inform, and principal distance education books.

Illustrative Findings from the Literature

Although the literature about distance education is large and expanding, there is no universally accepted and comprehensive theoretical framework (McIsaac and Gunawardena 1996) for integrating and understanding research results. There is even disagreement about the extent to which distance education represents a cohesive concept for study.

The absence of a clear-cut integrating framework is due to a number of factors. Many variables influence the form and outcomes of distance education, including the degree of independence of students, the degree of interaction with teachers, the social environment, and how technology is used. There are differences in these variables among particular classroom instruction programs and particular distance education programs, as well as between distance education and traditional classroom instruction. Moreover, there are differences in the terms and concepts used to capture important features of distance education. Some of these ("tele-learning," "asynchronous learning," and "e-learning") emphasize a particular communications technology; others ("distributed learning" and "distant learning") emphasize the location of learners; still others ("open learning," "flexible learning") emphasize the relative freedom of learners to exercise a greater degree of control than in conventional education. In addition, distance education programs have a range of goals, including promoting access and convenience for diverse kinds of students, improving the cost effectiveness of education, and increasing student achievement.

The multiplicity of distance education programs and concepts and the absence of a widely accepted integrating framework make it difficult to aggregate conclusions from the diverse and developing literature. However, some illustrative findings can be gleaned. Following are highlighted points about the implications of ICT in postsecondary distance education for institutions, learners, courses, and faculty. The list is intended to suggest what can be found in the literature; it is not intended to be comprehensive or definitive.

Institutions

Many traditional universities are offering distance (increasingly online, Web-based) courses (NCES 1999a). These institutions are increasingly in competition with for-profit schools (Knight 1998). Universities are also offering online courses for on-campus students, who find their convenience attractive. Accrediting agencies are developing procedures to strengthen distance education online (Carnavale 2000b). A variety of forms of interinstitutional collaboration also have emerged, including consortia of distance learning providers and distance education portals (Carnavale 2000a, Johnstone 1996, Olcott 1999).

New companies have been established to sell online training services, learning tools, and environments for colleges and universities to help them go online. Online certification and testing firms are also developing rapidly (Adelman 1997). Corporate "universities" have also increased in number and increasingly gone online, and some

[6]The bibliography does, however, include a few entries from July through mid-September 2001 and some earlier literature that is especially relevant to contemporary issues.

have offered courses not only to their own personnel but also to suppliers, customers, and the public at large (Gallagher 2000, Meister 1998). A number of universities have established for-profit online affiliates, although some of the for-profits subsequently failed.

Economic, demographic, technological, and other factors are prompting American educational institutions to re-examine aspects of their educational mission, such as how to increase student access, improve the quality of education, become more cost efficient, and speed up the learning process for learners whose time is scarce and expensive (Kouki and Wright 1999, Morris et al. 1998).

Learners

Research about learners has produced what might seem to be paradoxical results. On the one hand, successful distance learners tend to be self-sufficient, autonomous, and self-directed adults (Biner and Dean 1997; Gibson, ed., 1998; Guglielmino and Guglielmino 2001; Ozen 2000). On the other hand, students who are normally reserved and shy in classrooms are likely to participate more actively in computer-mediated education because they have time to think about what they express (Hillman 1999). Skilled online facilitation can help break down isolation. Student and faculty competency in the necessary computer skills is also important (Guglielmino and Guglielmino 2001, Lim 2000).

Dropout rates may be higher in distance education than in traditional courses (Carr 2000a). Strategies that can help reduce dropout rates include increasing instructor-student contact, especially at the beginning of a course (Curry, Baldwin, and Sharpe 1998); stimulating interaction among students; improving student support (Wilferth 1997); and providing better financial support (Young 2000a).

The cost of computers and lack of Internet access are barriers to distance education among poor and disadvantaged populations (Gladieux and Swail 1999, Morabito 1999).

Most studies that compare the achievement of learners in distance education (online and previous methods) with those in traditional classroom learning environments show that there is no significant difference (Kuntz 1999, Moore and Thompson 1997, Russell 1999, Sansoucie 1999). Some studies do find a positive advantage for distance learners (Day, Raven, and Newman 1998; Navarro and Shoemaker 2000). However, Phipps and Merisotis (1999) argue that much of this body of research is suspect, since many studies do not control for extraneous variables, and the validity and reliability of many of the instruments used to measure student outcomes and attitudes are questionable. As a result, they urge that the findings be approached skeptically.

It has also been noted that the quality of human interaction is more critical than the technology as a predictor of success (Kelsey 2000, White and Weight 2000). Further, institutions need to provide variety in their programs to meet the needs of learners with a wide range of characteristics (Gibson, ed., 1998; Grimes 1999; Scheer 2000). Some studies suggest the Web is superior to earlier distance education technologies because it allows teachers to build collaborative and team-oriented communities rather than either the passive classes of the conventional academy or the individual study of traditional correspondence courses (Gibson, ed., 1998; Hiltz 1997; Shneiderman et al. 1998).

Courses

NCES (1999a) reports that the two large disciplines in which the most postsecondary education institutions offered distance education courses were English, the humanities, and the social and behavioral sciences (70 percent of institutions) and business and management (55 percent of institutions). (See table 1 for more detail.)

NCES (1999a) notes that, in general, institutions offer for-credit distance education courses more at the undergraduate level than at the graduate/first-professional level. The exceptions to this finding are in the fields of education, engineering, and library and information sciences, where institutions offered more college-level, credit-granting distance education courses at the graduate/first-professional level than at the undergraduate level.

These figures do not represent the curriculum in nondegree training courses, where information technology-related training is especially widespread.

A concern that has been expressed about Web-based distance learning systems is that the resulting high-volume, highly standardized courses may be predominantly English-based, and that this might expand the use of the English language in education and reduce cultural diversity worldwide (Collis and Remmers 1997). On the other hand, the perceived tenacity of cultural affiliation of many

Table 1. **Fields of study covered by distance education courses offered by higher education institutions in 1997/98, by course level and field**

Discipline	Percentage of institutions offering: Undergrad/grad courses[1]	Undergrad courses[2]	Grad/first-professional courses[3]
English, humanities, social and behavioral sciences	70	71	22
Business and management	55	51	30
Health professions	36	31	24
Physical and biological/life sciences	33	32	8
Mathematics	32	32	7
Education	29	19	40
Computer science	26	25	10
Vocational/technical	17	17	3
Engineering	12	9	16
Agriculture and natural resources	7	7	3
Library and information sciences	6	4	7
Other	16	13	13

[1]Based on the estimated 1,680 institutions that offered any distance education courses in 1997/98.

[2]Based on the estimated 1,620 institutions that had undergraduate programs and offered any distance education courses in 1997/98.

[3]Based on the estimated 750 institutions that had graduate or first-professional programs and offered any distance education courses in 1997/98.

SOURCE: National Center for Education Statistics, *Distance Education at Postsecondary Education Institutions: 1997–98* (Washington, DC: U.S. Department of Education, 1999), p. 23, table 7.

groups and countries (Collis and Remmers 1997, Odasz 1997) and the potential for high-quality automatic translation (Silberman 2000) may weaken this effect. Moreover, there are trends toward increased use of English in education, with or without distance education.

Faculty

Many faculty members have welcomed new distance education technologies but have expressed concerns about the following, among others:

- the larger workload occasioned by increased preparation time and the need to deal with distance learners who can interact any time of day or night and expect quick responses (Bebko 1998, Ndahi 1998, Waldrop 2000);
- intellectual property—that is, who owns a course and instructional material and who derives income from them (Colyer 1997, Lipinski 1999, Noble 1998, Smith et al. 2000); and
- the need for specialized training for faculty to be effective in this new environment (Boehler 1999, Rockwell et al. 1999).

There are also economic, legal, institutional, and status issues associated with the unbundling of services traditionally performed by faculty (Noble 1998). For example, if online courses were prepared by a team of subject matter experts, performers, and Web designers and are subsequently taught by instructors, would the value and status of individual faculty members be diminished?

Concluding Comment

The initial bibliography collected for this project demonstrates that there is a substantial body of research about distance education. As noted above, there is no universally accepted integrating framework for this work; and there are limitations to existing data and research. Available statistics do not yet capture the full range of distance education applications and implications, and some studies cannot be generalized beyond their particular research setting. In addition, distance education is continually changing, as new technologies are developed, and new educational, organizational, and business approaches are tried (or abandoned). Research findings from one year may need to be reconsidered the next. This leaves a large agenda for future research to enhance and extend existing work.

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