Chapter VII

e-Learning: Impacts of IT on Education

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Understanding IT's role in the economy can be facilitated by a careful examination of varied industry-level effects. The effects of IT in health care, for example, are quite different from the effects of IT in manufacturing. This year's report begins an analytical approach we hope to continue in future reports—examination of important industry cases. The current chapter assesses the role of IT in the education industry, the relative importance of this industry, and the current and potential effects of IT on the way we learn.

The use of information technology in education is not new and it has not always been successful. From the integration of audio and visual equipment, such as educational filmstrips and audiotapes of 50 years ago, to the more recent use of videocassettes and computers, we see examples of past attempts to improve education delivery through IT. The latest generation of technology, including better Internet connections, education-related web sites, and sophisticated teaching software, promises also to have an impact on teaching. The latest software can be used as a teaching aid in conjunction with classroom instruction. And Web-based learning has the potential to allow students to receive education without ever setting foot inside a classroom.

Many observers expect IT to have a profound impact on the delivery and quality of education at every level, from preschool and elementary school to higher education and corporate training. At the primary and secondary levels, they point out, computers can be powerful teaching tools, allowing instructors to be more effective in reaching students if discipline and motivation issues can be addressed. At the postsecondary and corporate training levels, the Internet and the World Wide Web provide students with access to countless resources, including remote instructors and electronic libraries that can enhance learning in ways never before possible. More skeptical observers, however, argue that technology can be a distraction, adding an unnecessary cost to education and even impeding the learning process.

This chapter looks at the current applications of IT in each level of education—primary and secondary, higher education, and corporate learning. In each case, the chapter finds exciting developments but also problems. It is too early to say where the final balance between traditional and technology-based education is likely to be. However, IT's greatest impact so far is as a complement rather than a substitute for traditional education.

THE EDUCATION INDUSTRY

The education sector (i.e. total U.S. expenditure for schools and universities) accounts for 7 percent of GDP[1] and roughly 20 percent of all government expenditures.[2] For school year 1999-2000, estimated public school expenditures were $389 billion and higher education expenditures $258 billion.

In the fall of 2000, education employed 8.4 million people, including elementary and secondary school teachers, college faculty, and other profes-

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[1] U.S. Department of Education, National Center for Education Statistics, Digest of Education Statistics 2000, *NCES 2001-034, January 2001.*

[2] U.S. Department of Commerce, Bureau of the Census, unpublished data.

sional, administrative, and support staff. Of these, 3.3 million (18 percent more than a decade earlier) were elementary and secondary schoolteachers. In addition, in 1997[3] there were nearly a million full- and part-time faculty members in degree-granting institutions.

In the fall of 1998,[4] approximately 52.5 million students were enrolled in elementary and secondary schools, continuing a steady upward trend in U.S. school enrollment that began in 1985. According to the U.S. Department of Education's National Center for Education Statistics, enrollment will continue to rise each year for the next several years before gradually declining later in the decade.

In 1998, college enrollment also hit a record level (14.5 million), with expectations of a continued rise in the current decade. This growth in enrollment reflects an increase in the number of college age students, a greater incidence of high school graduates, a higher share of these graduates going on to college, and a higher enrollment rate for older women. Collectively, these changes more than offset the drop in traditional college-age enrollment that occurred during the 1980s and early 1990s. Between 1990 and 1998, while the enrollment rate of part-time students held steady, college enrollment of full-time students grew by 10 percent.

Employee training is also a factor in the growth of the education sector. U.S. corporations spent an estimated $60 billion on employee training in 2000,[5] including job-specific training, general education, and skills upgrading. Workforce training has become particularly important as employees update their skills in order to keep pace with rapidly changing technologies. Although estimates of skill obsolescence vary, one study estimates that half of all employees' skills become outdated within 3 to 5 years.[6] This ongoing skill decay may help explain why corporate training budgets increased by an estimated 24 percent between 1994 and 1999.[7]

IMPACTS OF IT ON EDUCATION

Primary and Secondary Education

The Federal Government now spends an estimated $1.5 billion[8] per year on technology investment in schools, directly through targeted programs for technology (such as the Technology Literacy Challenge Fund and Technology Innovation Challenge Grants) and indirectly through general federal education programs. The remainder of a school's technology budget comes from state and local governments and private institutions, including parents' groups and private and corporate donors. According to a 1998 survey[9], schools in 29 large urban school districts spent an average of $120 to $130 per student on technology during the 1998-99 school year. However, the amount that individual schools spent on technology and Internet access varied widely—from $22 to $584 per student.

Aided by lower connectivity cost and government assistance, schools have been improving the quality and speed of their Internet connections. In 1996, nearly three-quarters of public schools with Internet connections used dial-up network connections. By 1999, however, 86 percent were using faster and better dedicated lines or other (non dial-up) network connection approaches, such as ISDN, cable modem, and wireless connections.[10]

According to the U.S. Department of Education, 98 percent of all public schools had an Internet connection in 2000, up from 35 percent in 1994. Classroom connectivity, considered more important for instructional purposes, has increased from 3 percent in 1994 to 77 percent in 2000. Differences remain among schools with regard to classroom connectivity. Only 60 percent of the classrooms in schools with high concentrations of poverty (as measured by the percentage of students eligible for free and reduced lunch programs) are connected to the Internet, compared with 82 percent of classrooms in schools with the lowest concentrations of poverty. Similarly, the ratio of students

[3] *Latest year for which data are available.*

[4] *Latest year for which data are available.*

[5] *Rob Eure, "On the Job,"* The Wall Street Journal, *March 12, 2001.*

[6] *Michael Moe and Henry Blodgett,* The Knowledge Web*, Merrill Lynch & Co., Global Services Research & Economics Group, Global Foundation Equity Research Department, 2000, p. 229.*

[7] *Gregory Cappelli, Scott Wilson, and Michael Husman,* e-Learning: Power for the Knowledge Economy*, Credit* Suisse *First Boston Corporation, 2000, p.127.*

[8] The Power of the Internet for Learning, *Report of the Web-based Education Commission to the President and the Congress of the United States, December 2000, p. 117.*

[9] *Consortium for School Networking,* Taking TCO to the Classroom: A School Administrator's Guide to Planning or the Total Cost of New Technology*, Washington, D.C., 1999.*

[10] *U.S. Department of Education, National Center for Education Statistics,* Internet Access in U.S. Public Schools and Classrooms: 1994-2000*, NCES 2001-071, May 2001.*

to Internet-linked computers is 6 to 1 in schools with the lowest percentage of students in poverty, while the ratio is 9 to 1 in higher poverty schools.[11]

It is difficult to identify or measure the level of improvement in student achievement resulting from the use of web-based and other IT-enhanced learning. While educators and policymakers acknowledge that more research is needed to understand IT's impact on education, however, there is broad agreement that computers *alone* do not teach children. Two problems frequently identified by educators are the scarcity of applicable instructional technology, including software and online content material, and the lack of sufficient technical support and teacher training.

Instructional technology. Today, only a fraction of the $4 billion educational content market, including textbooks as well as instructional technology such as software and online course material, is comprised of online content material.[12]

The educational software market is highly fragmented. Products and services must be targeted according to grade and subject matter, and then marketed to over 15,000 school districts. Demand is limited to the number of students taking any given class at any given time.[13] Since the average cost of supplying product in these specialized sub-markets is high, many producers have reacted by generalizing their products and services into less-specific content, geared toward a wider audience, such as K-6.

Limited availability of online content is a particular problem in specialized areas of the curriculum, including foreign language studies and higher-level math and science courses. Moreover, producers of online content are not yet addressing the interests of cultural or ethnic groups. One survey reports that only 2 percent of Web sites target Americans who speak English as a second language.[14]

Technical support and training. Computers and the Internet can do little to enhance the quality of education without sufficient technical support. Technology expenditures must balance the need for investments in infrastructure, such as hardware, networking, and software, and the training and technical support required to maintain systems. In addition, teachers must be trained in the pedagogical uses of computers and the Internet. Simply knowing how to surf the Web is not enough. A 1999 study found that two-thirds of all teachers felt that they were not at all or only somewhat prepared to use technology in their teaching.[15] Another study found that even younger teachers with experience using computers felt unprepared to integrate their skills into their teaching because training in educational technology is not part of the curriculum in most schools of education.[16] Some universities have begun to address this deficiency. The University of Texas System offers a Master of Education in Educational Technology.

Higher Education

In higher education, IT's greatest impact has been to increase the flexibility of the learning experience, affording more people participation in advanced education through distance learning. Distance learning differs from other computer-assisted learning technologies by accepting the fundamentals of classroom teaching, reproducing them over the Internet, and making them available at anytime from anywhere.[17]

Since nearly half of all postsecondary students are now over the age of 25, colleges and universities are recognizing the need to make it easier for working adults to continue their education by offering distance-learning programs and, thereby, ensuring continuation of their role as education providers in the future. According to a the Department of Education, 44 percent of two-year and four-year institutions offered online courses in 1997-98, a 72 percent increase from 1994-95. And approximately 84 percent of four-year colleges are expected to offer distance-learning courses in 2002.[18]

The Sloan ALN[19] Consortium, an association of 95 accredited institutions of higher education offering associate, undergraduate, and masters de-

[11] Ibid.

[12] The Power of the Internet for Learning, op. cit., *n. 8, p. 69.*

[13] *Ibid. p. 70.*

[14] *The Children's Partnership,* Online Content for Low Income and Underserved Americans: A Strategic Audit of Activities and Opportunities, *2000.*

[15] *U.S. Department of Education, National Center for Economic Statistics. Fast Response Survey System,* Public School Teachers Use of Computers and the Internet, *FRSS 70, Washington, D.C., 1999.*

[16] *Market Data Retrieval.* New Teachers and Technology. *Shelton, CT, 2000.*

[17] *Ralph E. Gomory, "Internet Learning: Is it real and what does it mean for Universities?" Sheffield Lecture, Yale University, January 11, 2000.*

[18] The Power of the Internet for Learning, op. cit., *n. 8, p. 77.*

[19] *ALN is the acronym for asynchronous learning network, or*

gree programs partially or fully through online education, estimated that online course enrollments in member schools exceeded 300,000 during the 2000-2001 academic year and that nearly 50 full degree programs were offered. Members of the Consortium are required to offer degree or certificate programs that are at least as high quality as corresponding face-to-face programs.[20] Membership has steadily increased since the Consortium's inception in 1993. In addition, many of the distance learning projects initiated with Sloan grants have expanded over time, with or without further funding—an indication that distance learning can be a viable alternative or complement to traditional classroom learning.

One member of the Sloan Consortium, The University of Texas System's UT TeleCampus, is an example of a university that has incorporated accredited distance education into its curriculum delivery system. The UT TeleCampus was established in 1998 as the central support unit for online and distance education within the university system's 15 component campuses. Students apply to the participating UT campus of their choice and receive courses from other UT campuses participating in that degree plan. The same UT faculty members who teach the campus-based class also teach the online course. The UT TeleCampus currently offers seven online graduate programs and an expanding choice of undergraduate curricula.[21]

Other universities have formed partnerships with Internet education companies to bring their courses online. For example, Stanford University partnered with Unext.com to offer courses through the Stanford Center for Professional Development. The Center caters to working students, particularly engineers. To matriculate into the program, a prospective student must already be working in the field.[22]

Aside from traditional universities, a new type of for-profit institution for higher education has emerged to offer distance-learning opportunities—"virtual universities." Unlike traditional colleges and universities, virtual universities offer undergraduate and graduate degrees fully online. Although traditional universities have begun offering courses online, virtual universities still supply the majority of the demand for accredited online education from nontraditional and working students who cannot get to a physical campus. Four leading virtual universities—University of Phoenix Online, Jones International University, Cardean University, and Capella University—currently offer accredited bachelor and graduate degree programs to an enrolled student body of 27,500.[23] As of Spring 2001, the University of Phoenix is the only one of the four earning a profit, but with rising enrollments, the others expect to become profitable within the next few years.

Tuition at a virtual university can be up to 20 percent higher than for a physical one, due to the cost of building and maintaining computer networks and developing Web-based curricula.[24] Once these courses are developed, the costs of keeping them up to date should fall and their repeated use should lower average costs. However, other costs associated with providing online courses are less subject to economies of scale. These include the costs of technical and administrative support services as well as faculty and staff to answer e-mail and monitor student achievement.

In addition to higher costs, students who wish to enroll in virtual universities must be willing to bear the risk of making a two- or four-year commitment to a for-profit institution with a short record of accomplishment and/or virtually no physical presence. In March 2001, Masters Institute, a San Jose-based trade school offering computer classes and degrees online, closed its doors in mid-semester.

Still, by the end of 2000, even after much of the New Economy shakeout, virtual universities have not had problems in obtaining venture capital. Investors appear to like the revenue predictability of virtual universities—once students are enrolled and working on degrees, the university expects to receive a flow of income in the form of tuition.[25] And

"people networks for anytime-anywhere learning." See http://www.sloan-c.org/whatisaln.htm for more information.

[20] For example, the student-teacher ratio of the online program must be equivalent to that of the classroom program.

[21] The UT TeleCampus has won five national and seven regional awards, including the U.S. Distance Learning Association's Excellence in Distance Learning Programming for its MBA Online. More information can be found on their website at http://www.telecampus.utsystem.edu/.

[22] Telephone interview with Carleen Wayne, Customer Service Coordinator, Stanford Center for Professional Development, September 13, 2001.

[23] Jennifer Rewick, "Off Campus," The Wall Street Journal, *March 12, 2001.*

[24] Ibid.

[25] Danielle Sessa, "Business Plan", The Wall Street Journal, *March 12, 2001.*

in the face of an economic slow-down, demand for education typically rises as workers look to update their skills in a more competitive labor market.

Corporate training

Corporate training is the fastest growing market for distance learning, a market that has grown from $558 million in 1998 to $2.3 billion in 2000.[26] Currently, only about one-third of the corporate training dollar spent on external training goes to e-training, but this is expected to increase. The appeal of e-training is that it provides tailor-made training to employees at exactly the time that they want and need it.

More than 200 companies now compete in offering e-training consulting services to businesses.[27] These providers include both conventional training companies going online and dot.com startups converting traditional training courses to the web. Colleges and universities are also entering the profitable corporate training market. New York University's for-profit entity, NYUonline, is marketing itself to corporations to offer classes to their employees. NYUonline uses New York University faculty and is providing 55 different classes to nearly 500 of its clients' employees. In addition, Harvard and Stanford have announced a plan to jointly design and deliver traditional and online executive education programs to companies around the world.[28]

The Federal Government is also using technology to enhance its public job training system. The U.S. Department of Labor's "America's Career Kit" uses the Internet to coach job seeking skills and help match unemployed workers with potential employers. One part of the Kit, America's Learning Exchange, is an electronic marketplace for training and education resources.[29] The Exchange currently lists 6,500 registered training providers offering 263,000 programs, seminars, and courses—roughly 7,000 of them accessible online.

IMPEDIMENTS TO E-LEARNING

Aside from uncertainty about the effectiveness of web-based learning, at least three aspects of distance-learning programs concern students and faculty participating in these programs—quality assurance, financial aid, and intellectual property rights.

Quality assurance. Traditional accreditation standards such as the number of books housed in the campus library or the number of Ph.D.s on the faculty are not meaningful for a web-based course or a virtual university.[30] Moreover, many public and private distance education institutions do not receive accreditation from the regional accreditation agencies that certify traditional colleges and universities. Rather their accreditation is from The Distance Education and Training Council.[31] Coordination among accrediting agencies to develop meaningful quality standards for both types of educational environments could help in reducing the skepticism many educators and policymakers feel toward distance learning.

Financial aid. A 1992 amendment to the Higher Education Act of 1965 barred federal student loans and grants to students enrolled in correspondence schools. Written before web-based learning became viable, this law responded to perceived problems in program quality. Congress also set limits on the amount of distance education an institution may offer if it is to retain its eligibility to participate in the federal student aid program. As a result, aid to traditional colleges and universities was threatened as schools offered more classes online. In 1999, to determine the feasibility of changing the 1992 provisions, Congress waived the financial aid limits for a small number of online schools and traditional universities with a heavy online presence. The U.S. Department of Education is monitoring a five-year demonstration project designed to provide guidance to the Congress on the quality and viability of expanded distance education.

Intellectual property rights. Traditionally, the course material a professor designed for the courses he taught (e.g., syllabi and lecture notes) was the professor's intellectual property. However, ownership of an online course costing the university several thousand dollars to produce is not as clear. Once developed, a course can be repeated, even with another faculty member in charge. The issue is who owns the online product. Cornell University's e-Cornell venture, deals with this prob-

[26] *Telephone interview with Cushing Anderson, lead e-learning analyst, International Data Corporation, January 25, 2002.*

[27] *"Lessons of a Virtual Timetable,"* The Economist*, February 15, 2001.*

[28] *"When Harvard Met Stanford,"* Business Week*, April 30, 2001.*

[29] Economic Report of the President*, February 2000, p. 163.*

[30] The Power of the Internet for Learning, op. cit.*, n. 8, p. 78.*

[31] *Ibid.*

lem by creating a three-way contract among the school, the online spin-off, and the Cornell faculty. The University and e-Cornell co-own the courseware, while the faculty member(s) owns the intellectual content behind the course.[32]

Professors at other universities are still grappling with intellectual property rights issues and considering in particular whether a university has the right to alter curricula. Faculty ownership proponents contend that the university's right to alter the curricula interferes with the professor's distribution rights. In view of online education's profit potential, this has become a major concern.[33]

In a related event, MIT announced that it would make the materials for nearly all of its courses freely available on the Internet over the next ten years. According to MIT, the purpose of the program, known as MIT Open Course Ware (OCW), is knowledge sharing. Given the necessary levels of motivation and discipline, anyone with an Internet connection can access an education previously available to only an elite few. Faculty participation is voluntary. And since the MIT OCW program is not revenue generating, property rights issues have not yet been a serious concern. [34]

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[32] *Michael Totty, "The Old College Try,"* The Wall Street Journal*, March 12, 2001.*

[33] *Mark Anderson, "Professors Had Better Pay Attention,"* The Standard*, September 12, 2000. Pure online schools do not have this problem. They use an unambiguous work-for-hire arrangement and the content designers hold no stake in the courses they create.*

[34] *Policies toward the intellectual property created for MIT OCW are to be: "...clear and consistent with other policies for scholarly material used in education. Faculty will retain ownership of most materials prepared for MIT OCW, following the MIT policy on textbook authorship. MIT will retain ownership only when significant use has been made of the Institute's resources." For further information, see http://web.mit.edu/newsoffice/nr/2001/ocw-facts.html.*