

E-Learning Advances by Degrees

The trend by universities to engage in distance-learning programs is growing faster than most people realize. The range of courses now offered online is vast—from accounting and automotive training to Victorian literature and M.B.A.'s. About two-thirds of U.S. colleges and universities offer some kind of distance-learning program today, including classes via satellite and



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Web-based instruction.

The Massachusetts Institute of Technology will soon offer most of its courses online, although not for credit. Schools such as the University of Pennsylvania, the University of Wisconsin–Madison, and the Rochester (NY) Institute of Technology (RIT) provide a wide range of science and engineering courses on the Internet, including some degree programs. RIT, in fact, has become the third-largest online degree provider in the United States after the University of Maryland and the University of Phoenix. RIT allows students to obtain a bachelor's degree online in areas such as applied computing, electrical/mechanical engineering technology, and digital imaging and publishing, and a master's degree in fields such as applied statistics, imaging science, and microelectronics-manufacturing engineering.

Many see this trend as positive, opening up educational opportunities for numerous people, including older workers. Skeptics,

however, contend that learning without the physical presence of a teacher and students in a classroom is less effective. Many also question the quality of a technical degree obtained over the Internet.

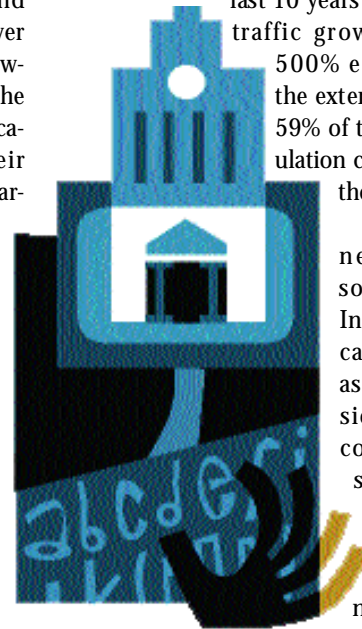
According to a recent report by the Organization for Economic Cooperation and Development (OECD), "The major driver of the knowledge economy will be a growing requirement for lifelong learning, the provision of which will give higher education institutions a major part of their income. However, competition in this market will be fierce. And while universities and other established institutions will have the advantage of reputation and recognition, if they fail to become sufficiently entrepreneurial, the necessary systems and services will come from multimedia firms or large companies with training expertise they could sell outside their own company."

The demand for distance learning clearly exists, and whether traditional academic institutions or private companies provide these services, the need must be met. A key requirement for doing so is the ability to provide varied educational services to many people at multiple locations 24 hours every day.

William Wulf has argued that, with advances in information technology (IT) and pedagogy, universities can meet the challenge of society's growing instructional needs. Wulf, professor of computer science at the University of Virginia and president of the National Academy of Engineering, believes that IT will provoke more "fundamental change" in higher education than many of the political, social, or economic forces that have traditionally acted on the university. Moreover, IT's influence on society will probably be greater than that of the industrial revolution.

"Higher education is not in danger," Wulf says. "But we would be wise to ask whether the particularly quaint way that we manufacture, distribute, and deliver that education will survive the arrival of the information railroad. It may, but I don't think so."

The rapid pace of IT development is another driver for the growth of distance learning, he adds. The speed and storage capacity of computers continue to double every 18 to 24 months. In addition, bandwidth has increased about 1,000-fold in the last 10 years and Internet traffic grows 300% to 500% each year, to the extent that about 59% of the U.S. population currently uses the Web.



Advances in networking, software, and Internet applications—such as three-dimensional teleconferencing, streaming video and audio, and peer-to-peer networks (online resource

sharing)—seem tailor-made for educational applications. Indeed, educational researchers, who have long realized the revolutionary potential of e-learning, have already customized these advances for use in teaching. The advent of the next generation of the Internet, commonly called Internet II, with its high-speed, low-loss, broadband networks, will enable teachers to present more complex materials online and interact better with students.

RIT has made a major investment in online learning programs, and it now offers 8 graduate degree programs, 3 graduate certificate programs, 5 undergraduate degree programs, and 16 undergraduate certificate programs over the Internet. Its distance-learning program, founded in 1980, registered 6,234 students in the 1999–2000 academic year. Of these students, 48% were local, 31% in-state, 20% out-of-state, and 1% international. The school makes no distinction between an

online degree and one earned on campus, and both programs share the same course numbers, faculty, and course work. Tuition, priced per credit hour, is the same for Web- and campus-based courses.

“Our online degree is identical to the one offered on campus, and the students see the same lectures via videotape,” says Jim Scudder, chair of RIT’s online and on-campus electrical/mechanical engineering technology programs. “The exam and course schedule is the same, as are the instructors. In fact, some of our best instructors teach the distance courses. We also require students to attend some live laboratories on campus for hands-on learning activities.”

Long known for its strength in optics, RIT developed an online version of its master’s program in imaging science—the only Web-based program of its kind in the United States—in response to requests from working engineers and scientists who could not attend classes in Rochester. Harvey Rhody, a professor at RIT’s Chester F. Carlson Center for Imaging Science, says that the program has thrived because of the strong demand for imaging scientists worldwide. “We teach a variety of courses, including mathematics, digital-image processing, optics, and color science, and we have students enrolled from all over the United States who are employed by many different companies,” he adds. “The success of the program was obvious to us after reading the students’ own course evaluations at the end of the semester.” Encouraged by their experience, Rhody and colleagues have expanded the program to include remote sensing.

Robert Girandola, quality-assurance laboratory manager for Estée Lauder Companies (Bristol, PA), is currently halfway through a master’s program. For him, online learning has been “more exciting and rewarding than a traditional science class.” Furthermore, he says, “It is an opportunity to pursue what I regard as one of the best programs in the country without having to give up my job and relocate

my family. Because of this, my level of motivation is heightened. I also find the professors to be highly motivated, becoming more like mentors than just lecturers laying out material. Ironically, I find the online teaching experience to be much more intimate and intense.”

What still may be missing, he adds, is the human voice conveying emphasis and tone, and the interaction with other students. He counsels anyone setting up a distance course to try to incorporate these elements into the program.

Online learning requires a self-motivated student who is willing to work with a greater degree of independence than students in a traditional setting, according to RIT’s Rhody. Preparing and teaching technical courses effectively online is not easy, he adds. Faculty must work hard at preparing and delivering their classes to produce a high-quality technical program. Good staff support and practical Internet technology are also needed. Teachers must adopt tutorial-based methods more than lecture-based methods and give students more online notes, examples, and exercises.

“The important thing is that the faculty view the online learners as independent explorers of a knowledge domain, and provide the right information, exercises, and guidance,” Rhody says. He believes that online students are more active participants in the learning process than those in a classroom, “and this can have a very positive impact on the quality of learning.”

For further reading

Education: New Economy, New Challenges. Highlights of the OECD Information Base, No. 19, December 1999 (<http://www.oecd.org/sge/au/Highlights19.htm>).

Geith, C. Viewpoints. News and Events (Rochester Institute of Technology newsletter), March 19, 1998. Available at http://www.rit.edu/~930www/Proj/news_events/1998/Mar02/viewpts.html.

Wulf, W. University Alert: The Information Railroad is Coming. *Issues in Science and Technology*, Summer 1995, 11, (4). □