Innovation and Technology for 21st Century Education

Murray Turoff
New Jersey Institute of Technology, USA

Caroline Howard
Touro University International, USA

Richard Discenza
University of Colorado at Colorado Springs, USA

INTRODUCTION

What is happening to higher education? There is a search for increasing the effectiveness of learning and expanding educational opportunities by using a combination of information technology and distance education. Teaching with technology takes time. There is the challenge of choosing equipment, redesigning courses, learning software, and building new protocols for projects, quizzes, course administration, feedback routines, lectures, and course administration. Today, these efforts must be somehow carried out in addition to continuing to teach and update current courses via the traditional means. The challenge of each innovation is that it must be carefully measured against the successes of the traditional approaches. In addition, when dealing with technology, methods and techniques mastered last year or even last semester are often upstaged by new products that involve new time-consuming "re-learning" needs. Technology makes it easier for instructors to respond to students individually, even between classes and after the course is over. It also gives access to more course material, more media, more simulations, and more powerful indexing and search protocols. This article will review common tools and technologies used in distance education and demonstrate why they can facilitate learning and expand the educational opportunities for both distance and traditional students.

BACKGROUND

For many years, technologies have been used to facilitate learning. In the early 1980s a group of researchers at the New Jersey Institute of Technology (NJIT) realized the enormous potential of technology to enhance learning when they used a computer-mediated system to facilitate a regular face-to-face class. The system was introduced to students in a number of Computer Science and Information System courses. Due to the amount of material covered in lectures, there was not much time for dialogue and only a few students participated when there was a class discussion. The instructors introduced asynchronous group communication technologies to communicate discussion questions and assigned grade-point credits for student participation. One-hundred percent of the students participated in these discussions outside of regular classroom hours. The extent and depth of the discussions changed the nature of the classes. Most important, because students had the time to reflect on the ongoing discussion before participating, their contributions were comprehensive, with more well-thought-out comments. Also very significant was the equal participation by students for whom English was a second language. They could reread the online discussion as many times as needed before replying. The computer-based activity monitoring and transcripts, electronic recordings of the discussions, showed that foreign students spent

two to three times more in a reading mode and reread many discussions far more often than the American students.

In addition, professors now have the ability to monitor activities and review the electronic transcripts of student involvement, which gives the instructor insights into how students are learning. By reviewing the transcripts of the online discussions, it becomes obvious what and how students are learning. For courses with a high pragmatic content, such as upper-level and graduate courses in topics like the design and management of computer applications, students are required to utilize problem-solving approaches to evaluate the trade-offs between conflicting objectives. In a traditional classroom environment, especially in large classes, it is very difficult to detect whether students are accurately incorporating the problem-solving mental models that the instructor is attempting to convey. When instructors review the transcripts of class discussions, they are given insights into the approaches students are taking to master the material. Unfortunately, in the early 1980s few wanted to hear about a revolution in normal classroom teaching or were willing to expend the effort to dramatically improve classroom education. It was only the rise of distance education that generated interest in learning about the educational potential of the technology.

Starr Roxanne Hiltz (1994) performed quasi-experimental studies that compared a population of NJIT students (only familiar with face-to-face classroom education) to a population of students taking the same courses in pure face-to-face sections with pure distance sections using only Computer-Mediated Communication (CMC) technology. The students in the matched sections had the same material, the same assignments, the same exams, and the same instructor. No significant difference was found in the amount of learning or the rate of student satisfaction. This finding is much more significant than a determination based on a study that included a population of distance learners already familiar with traditional correspondence classes.

Two critical underlying variables driving the success of this approach were identified by Hiltz (1994). First, the role the instructor needed to take was different from the traditional classroom role. The instructor acted more as an active and dedicated facilitator than a traditional teacher and a consulting expert on the content of the course. Second, collaborative learning and student teamwork were the educational methodology that was shown in later studies to be a key factor in making distance courses as good as or better than face-to-face courses (Hiltz & Wellman, 1997). These results show that distance courses can be as effective as face-to-face courses when using any of the traditional measures, such as exams and grades.

Creative, interactive software programs accompanied by background tutoring can effectively teach students to master the skills currently taught in many undergraduate courses. When these courses are automated, the costs incurred are far below typical college tuition. In the future, colleges and universities will not be able to continue to charge current tuition costs for introductory courses that are largely skill oriented. For example, there are many stand-alone and Web-based software programs that offer introductory programming courses, as well as skills in many other areas. These courses are comparable to college courses, and some are even based upon a textbook used on some college campuses. They are available for a few hundred dollars. The major difference is that they do not carry college credits.

The technology allows senior professors or department chairs to effectively evaluate and mentor all instructors of particular courses, whether they are teaching traditional classroom courses or distance courses. The ability to review whole class discussions after the class is over gives senior faculty the ability to evaluate distance instructors hired to teach previously developed courses, as well as to review on-site instructors and junior faculty. Thus, they can improve and extend their mentorship and apprenticing relationships.

Today's technology for distance education allows faculty members to live anywhere they want. Unique benefits will be available to outstanding teaching faculty. For example, one of the best full-time instructors for NJIT, which is located in beautiful downtown Newark, is a mother with two small children who never has to be on campus. She is teaching other instructors how to teach remotely. Similarly, a University of Colorado accounting professor, on sabbatical in Thailand, is able to teach a course in the Distance MBA program. There have been a few master's programs where some or all of the instructors are located anywhere in the world. It is technically feasible for those wanting to escape winter cold to teach in places that we could previously only