Many institutions are searching for a unifying vision to guide their investments to support teaching and learning technology. Some hear the insistent calls for innovations that foster "distance learning" and "learning anytime, anywhere for anyone" and wonder if their campuses even have a future. This chapter presents a conceptual model for integrating technology, both high and low, in a way that supports a transformation of teaching and learning.

Using Technology to Transform the College

Stephen C. Ehrmann

The search for a usable vision of the future is one reason why so many two- and four-year institutions are organizing teaching, learning, and technology roundtables (Gilbert, 1997) to discuss individual and institutional visions. Roundtables are usually internal advisory and coordinating bodies that bring together educational and technology leaders, including faculty leaders who are not techno-zealots, and students. This chapter describes a common vision of these institutions' future that is emerging (including a vision for distance education) and identifies the pressing policy questions facing educational leaders.

The first element of the emerging common vision of teaching, learning, and technology has to do with motive. On one end of the motivational spectrum, institutions are changing because they believe they have no choice. Today's workplace requires new intellectual skills because of the digital technologies on which it increasingly depends—for example, modern statistical techniques, computer-based music composition, and geographic information systems. In order to learn these skills, students must use the same or similar technologies during their education, that is, they must learn by doing.

At the other end of the spectrum, other pressing teaching and learning needs also compel educators and legislators to see as essential the use of computers, video, and telecommunications in the rebuilding of their educational offerings. The following are some of those needs:

- To widen and enrich educational access for a variety of currently underserved groups, such as working adults, the homebound (including homemakers), the handicapped, and others
- To draw on and share a wider range of intellectual resources than institutions can afford to acquire and maintain locally

- To implement teaching techniques that are far more feasible with the help of technology (for example, computer- and video-based airplane simulators to train pilots)

Many of these needs can be summed up as a triple challenge (Ehrmann, 1996a) that educators face in one form or another. The triple challenge is to extend access and increase the fairness of access to learning; to enrich and update what students are taught; and to control the costs for students to learn.

The Technology Tower

Institutions under these pressures are gradually rethinking their conceptual model and practices for using technology. To discuss this common vision, it is useful to use a conceptual model: a technology tower, a structure with a basement and three stories, each resting on the floor below it.

The Basement. The basement of every technology tower is a foundation of well-established technologies and the infrastructure for their use; for example, audiovisual materials, libraries, textbooks, and tutorial labs. These technologies have been around for a long time and are reliable and familiar enough that they can be used almost without any training. The buildings and facilities that house these materials are part of this foundation as well.

The First Floor. The first floor is made up of technology support for four basic dimensions of learning (Ehrmann, 1990; Ehrmann, 1996b), each made possible by the technologies in the basement.

Directed instruction. Traditional technologies in the basement that support the first-floor teaching and learning function include lecture halls and textbooks.

Learning by doing. Traditional technologies in the basement for supporting this first-floor activity include the chemistry laboratory, typewriters, the library, the internship office—all the "hardware" and "software" used in apprentice-style activities as learners acquire skills by practicing them.

Real-time conversation. Traditional technologies that support this dimension of learning include seminar facilities, faculty offices, and the campus itself. They promote both formal and informal meetings.

Time-delayed exchange. This kind of conversation, such as homework exchange, unfolds over time at a far slower and more thoughtful pace than that of a rapid-fire seminar talk. The discussion begins with the formulation of an assignment, continues when the assignment is handed in, and often ends with a grade.

The Second Floor. The second floor of the technology tower houses enhancements to teaching and learning practices that are made possible by the four types of learning support available on the first floor. Building on the basement and first-floor amenities, many institutions are reconstructing the second floor of the technology tower to include support for at least three improvements in their teaching and learning practices and associated services:

Adding content. They add content that requires student use of computers, video, or telecommunications (for example, approaches to statistics or political science that require statistical software and off-campus databases or graphic arts content created with computers and associated printers).

Creating services and structures. They create services and structures that help extend access to students who work and others who find traditional class schedule hours to be difficult or impossible to use fully (these services include, for example, on-line library catalogues, on-line registration, Internet access for staff and students).

Implementing the "Seven Principles of Good Practice in Undergraduate Education." They are implementing Chickering and Gamson's principles (Chickering and Gamson, 1987; Chickering and Ehrmann, 1996) more fully. The seven principles are active learning (that is, project-based learning), collaborative learning and other forms of student-student interaction, student-faculty interaction, rich and rapid feedback, time on task, high expectations, and respect for varied talents and learning styles.

The Third Floor. The third floor of the metaphorical technology tower represents the large-scale structures of education. Until recently there were two basic ways to think about education for adults: campusbound programs and distance teaching programs. Now each of those concepts is undergoing profound changes while the system that includes them both is becoming larger and more complex, as shown in Table 3.1.

We are seeing the emergence of campus-based education (not just campusbound education) and distributed learning (not just distance teaching) and, with these two, the creation of larger-scale structures in higher education. These trends not only challenge an institution's traditional mode of operations but also offer it unprecedented opportunities to transform itself.

The campusbound paradigm assumes that the only resources of value are those found within the walls of an educational institution and that education happens only when the learner is on-site. In contrast, the campus-based paradigm assumes that some of the resources and some of the learning are off-site. In other words, the campus is an important part of, but only a part of, the learning environment.

Earlier distance teaching programs relied mainly on directed instruction often provided by mass media, for example, textbooks, television and radio broadcasts, videocassettes and audiocassettes. The other three forms of learner support—learning by doing, real-time conversation, and time-delayed exchange—could only be supported to a modest extent. In contrast, the distributed learning paradigm assumes that each learner and educator is within physical or electronic reach of substantial bodies of resources, including other educators and learners. Directed instruction is not dominant in this paradigm, and the idea of a broadcasting hub is not as central to the program as it was earlier.

A third set of top-floor challenges to institutional leadership relates to the scale of the enterprise. One of the most obvious issues of scale in distributed

Table 3.1. The Four Dimensions of Learning Support

Third Floor: Large-scale structures	Campus-based (evolving from campusbound) program. Campusbound and distributed learning programs share much of the same basement, first, and second floors.		Distributed learning programs (evolving from distance teaching). Distributed learning and campusbound programs share much of the same basement, first, and second floors.	
Second Floor: Improvements in practice enabled by the new dimensions of support	1. Content that requires student use of information technology (for example, modern statistics) 2. Structures that increase access (for example, on-line library services and counseling) 3. Better implementation of the Seven Principles of Good Practice in Undergraduate Education, for example, active (project-based) learning, collaborative learning, student-faculty interaction, rich and rapid feedback, more time on task, and so on			
First Floor: Four dimensions of support for learning	Real-time conversation (for example, seminars, brainstorming)	Time-delayed exchange (for example, homework exchange, on-line seminars)	Learning by doing, using the tools and resources of the field	Directed instruction (explanation of facts, ideas, skills, and so on)
Basement: Technologies for each of the four dimensions that progress incrementally	Traditional, for example, seminar rooms, campus to foster easy meetings. Today, also phone, audioconferencing, "chat rooms" on Internet.	Traditional, for example, campus, postal service. Today, also electronic mail, computer conferencing, fax machines.	Traditional, for example, pen, research library, laboratories, studios. Today, also word processing, statistical packages, databases, on-line library.	Traditional, for example, lecture hall, textbook. Today, also video of lecture, presentation software, computer tutorial, simulator, Web-based instructional materials.

learning arises from a simple question: "How are distant learners and distant providers supposed to find each other and work together successfully?" Many regions are beginning to create new organizations whose role is to mediate between distant learners and large numbers of distant providers of education. These organizations may be seen as the infrastructure for integrated access (Ehrmann, 1996a). Examples in the United States include the National Technological University, Education Network of Maine, Oregon EdNet, JEC Col-

lege Connection (formerly known as Mind Extension University), and the proposed Western Governors University.

Supporting the Rebuilding of the Technology Tower

Obviously, rebuilding a technology tower while living and working in it costs money and causes confusion and frustration. We note briefly that rebuilding this new technology tower encompasses some special needs of its own in addition to some of the more conventional physical needs. Three of those special needs are staff and program development, coordination and collaboration, and better information for decision making.

Staff and Program Development. Better means to support and reward relatively fast-paced program and staff development are needed. Many elements of the job world are on a "digital treadmill." Rapid improvements and changes in technology require these technology-dependent fields to make rapid and sometimes unpredictable changes in the nature of their work and in the nature of their thinking. New fields pop into existence frequently and they too must be served. Thus, the faculty members, departments, and institutions serving these fast-changing job markets must change rapidly too. That takes money and rewards to support staff members and departments that take risks. It seems apparent that institutions need to take some unusual steps internally while also collaborating with one another. The INnovative Programs Using Technology (INPUT) awards program in mathematics is one example of interinstitutional sharing of ideas for rethinking courses. Run by Professor Susan Lenker of Central Michigan University with funding from the Annenberg/CPB Project and the National Science Foundation, INPUT sought mathematics courses that had been restructured in ways made possible by graphing calculators, computers, and other forms of information technologies. Suffolk Community College (New York) led the team that won the national prize for rethinking an algebra course. INPUT distributes a handbook and video designed to help other faculty and institutions profit from the experience of these pioneering programs.

Coordination and Collaboration. In some institutions, the people who share responsibility for guiding the use of technology for teaching and learning do not even know one another. It is not uncommon to observe disjointed efforts going in different directions in the same institution. Information technology requires collaboration from some unusual "bedfellows," including faculty members who are zealous about technology, faculty members with little use for technology, distance learning advocates, librarians, academic computing specialists, the bookstore personnel, the provost, the chief financial officer, and so on.

The American Association for Higher Education has been helping colleges and universities organize teaching, learning, and technology roundtables. At this writing approximately three hundred such roundtables have begun work in various universities. Roundtables bring together this disparate group of individuals

to work on diverse problems, such as the support service crisis, improvement of student writing using technology, redesign of distance learning programs, and the financing of new information technologies (Gilbert, 1997).

Better Information for Decision Making. Institutions desperately need better information in order to make decisions regarding investment in technology to enhance teaching and learning. In the not-so-distant past, educational institutions changed rather slowly and deliberately. Truly novel change was unusual, which made it relatively easy to anticipate the consequences of one's actions. Today, educators need to step into the dark more often than not. Ordinarily, it is almost impossible to tell whether the kinds of anticipated changes are happening, even when they are happening on a large scale. Is an institution's investment in technology enabling its curriculum to become more up to date? Is it helping the institution to implement Chickering and Gamson's seven principles of good practice? How can one tell when answers are hidden behind hundreds of classroom walls and in the myriad places where students do homework? Because the evidence of even dramatic success or failure is likely to be subtle and because so much is at stake, educators need to spend more of their time and resources using surveys and other forms of inquiry to detect what's going on inside and outside those classroom walls. The Flashlight Project at the American Association for Higher Education is developing survey item banks and other evaluative tools that can be used to gauge progress and problems (Ehrmann, 1997).

Policy Issues for Decision Makers

As educational leaders engage in rebuilding and renovating their technology tower, it will be prudent to consider certain policy issues for the benefit of their own institutions as well as for the whole educational community.

Five Questions. Should the institution make it a general rule to invest only in technologies that are likely to be stable over long periods of time as opposed to newer and riskier technologies?

Should the institution invest in a large range of technologies or should it specialize in certain ones? Each technology has its own requirements for maintenance, training, support, and replacement.

Should the institution invest in technology to transform a few courses of study? Focusing resources to transform one or two courses of study is a far greater intellectual, political, and financial challenge than spreading resources thin so that every department gets a little.

Should the institution redirect some of its resources to improve organizational structure and operational procedures to maintain the coherence of academic programs at a time when its resources, teachers, and students are all becoming more geographically scattered and working on different time schedules?

Should the institution contribute its fair share to the networked "commons" of intellectual resources? The whole idea of distributed learning may

stand or fall on the issue of whether institutions contribute to the commons or just take from it.

Wise Investment. All but the last policy issue direct attention to the question of wise investment of scarce dollars. Each institution needs to discuss these issues, taking into consideration its own vision and circumstances. The last policy issue of contributing to the commons of intellectual resources refers to the moral obligation of all institutions to add to the resources that are needed to furnish the technology tower.

References

Chickering, A., and Ehrmann, S. C. "Implementing the Seven Principles: Technology as Lever." ***AAHE Bulletin,*** Oct. 1996, pp. 3–6. [Also available at http://www.aahe.org/technology/ehrmann.htm.]

Chickering, A., and Gamson, Z. "Seven Principles of Good Practice in Undergraduate Education." ***AAHE Bulletin,*** Mar. 1987, pp. 3–7.

Ehrmann, S. C. "Reaching Students, Reaching Resources: Using Technology to Open the College." ***Academic Computing,*** 1990, ***4*** (7), 10–14, 32–34.

Ehrmann, S. C. ***Information Technology and the Future of Post-Secondary Education.*** Paris and Washington, D.C.: Organization for Economic Cooperation and Development, 1996a.

Ehrmann, S. C. ***Adult Learning in a New Technological Era.*** Paris and Washington, D.C.: Organization for Economic Cooperation and Development, 1996b. (ED 408 442)

Ehrmann, S. C. "The Flashlight Project: Spotting an Elephant in the Dark." [http://www.aahe.org/technology/elephant.htm]. Nov. 1997.

Gilbert, S. W. "Levers for Change." ***TLTR Workbook.*** Washington, D.C.: American Association for Higher Education, 1997.

STEPHEN C. EHRMANN is director of the Flashlight Project at the American Association of Higher Education.