

BALANCING TECHNOLOGY & TRADITION

THE EXAMPLE OF COURSE MANAGEMENT SYSTEMS

By Richard N. Katz

Columbia Teacher's College President Arthur E. Levine describes a higher education future in which: (1) providers will become more numerous; (2) "brick and click" and "click" colleges and universities will assume a place alongside traditional "brick and mortar" institutions; and (3) education will become more personalized and more focused on learning. New information technologies are identified as being among the major drivers of these "inevitable" changes.¹ At the same time, University of California–Berkeley Professor Emeritus Martin Trow counsels: "Technology is embedded in and used by institutions that have a history." Trow argues that institutions' histories are likely to constrain the progress that technology can make, leading to the emergence of new institutions "where the weight of history does not condition and constrain technology's use."² These opposing forces—of technology and tradition—have long shaped the landscape of postsecondary education. The latest skirmish in this evolutionary saga involves course management systems.

Richard N. Katz is Vice-President of EDUCAUSE and Director of the EDUCAUSE Center for Applied Research (ECAR). A version of this article appears as chapter 10 in Glenda Morgan, Faculty Use of Course Management Systems, ECAR Research Study, vol. 2 (2003).



Effecting change when something is broken is hard. Those responsible for integrating new capabilities into tradition-bound activities know that introducing change to activities that are often highly effective and that in most cases have been operating effectively for decades is very hard—and occasionally even wrong-headed. Nevertheless, Levine is likely right: new technologies will inevitably alter—even revolutionize—all aspects of our lives, including the ways we communicate, conduct commerce, create communities, teach, and learn. Trow is also likely right: history matters. Understanding the place of course management systems in higher education institutions suggests a need to understand a bit of this history.

The Agrarian, Industrial, and Knowledge-Driven Eras of Higher Education

The history of higher education is one of balancing pedagogical tradition with new technologies and the mandates for increasing access (see Table 1).

Agrarian: Mobility and Student-Centricity

Before the construction of the first modern European universities, secular scholarship was organized under the auspices of students who pooled their funds in the earliest unions to attract itinerant instructors to their towns. Historical texts describe itinerant instructors traveling in bands through the countryside in search of students. Such instructors carried with them, in carts or in sacks, the books and other accoutrements of their craft. In some colorful (and perhaps apocryphal) accounts, students who had become dissatisfied with some aspect of their tuition or instruction ran their professors out of town without pay. In this early age of ecclesiastical or practical education, educational access was limited economically to the ruling elite of society (second and third sons) and geographically to those in towns and cities served by either cathedrals or itinerant instructors. The challenge of distance, in an agrarian and largely preliterate Europe, was enormous, with the slow exchange of scholarly correspondence throughout Europe being defined by the early modern systems of transport and worsened by social unrest, war, and other factors.

Table 1. The Eras of Higher Education

	DOMINANT TECHNOLOGIES	DOMINANT PEDAGOGIES	DOMINANT MARKETS
AGRARIAN Storehouse of Knowledge	<ul style="list-style-type: none"> ■ Oral ■ Limited Writings ■ Scriptoria 	<ul style="list-style-type: none"> ■ Scriptural ■ Experiential ■ Apprenticeship ■ Reflection ■ Self-Study 	<ul style="list-style-type: none"> ■ Ruling Elites ■ Local ■ Mobile Faculty
INDUSTRIAL City of Intellect	<ul style="list-style-type: none"> ■ Campuses ■ Classrooms ■ Textbooks ■ Lecture Halls ■ Operating Theaters ■ Libraries 	<ul style="list-style-type: none"> ■ Lectures ■ Seminars ■ Tutorials ■ Self-Study ■ Experiential ■ Apprenticeship in Graduate Study 	<ul style="list-style-type: none"> ■ Citizenry ■ Meritocracy ■ Community ■ State/Provincial ■ National ■ “Foreign”
KNOWLEDGE-DRIVEN E-University	<ul style="list-style-type: none"> ■ Campuses ■ Textbooks ■ Libraries ■ Computers ■ Networks ■ Multiple Media ■ Course and Learning Management Systems ■ E-Portfolios ■ Learning Objects ■ Simulators 	<ul style="list-style-type: none"> ■ Lectures ■ Seminars ■ Tutorials ■ Simulations ■ Experiential ■ Problem-Based ■ Team-Based ■ Communities of Practice ■ Apprenticeship in Graduate Study ■ Global 	<ul style="list-style-type: none"> ■ Accessible to All ■ Capable ■ Global

The “technologies” for supporting instruction in this environment were strictly limited: first, to what instructors could carry; more profoundly, to what the church allowed; and finally, to what scholarly and historical literature could be copied by hand in medieval scriptoria. The social compact between instructors and their students, the limitations of the economic and geographic marketplace for “higher education,” the restrictions on the permitted scope of scholarship, and the necessary attention on craft production in an agrarian economy conspired to shape medieval pedagogy. Notwithstanding the mercantile relationship between medieval scholars and their roving bands of instructors, the craft of education was conducted in the manner of all early modern crafts. Young students apprenticed to noted authorities and often trav-

eled with them between cities and towns. Instruction, like the times, was slow and measured, revolving largely around scriptural reading, reflection, recitation, and more infrequent discourse.

Industrial: The Modern University in Europe and the United States

The twelfth century witnessed the emergence of the University of Paris, the University of Bologna, and Oxford University, among other modern and extant universities. These new and important social institutions served both secular and ecclesiastical purposes, operating under charters from both kings and popes. The creation of learning venues provided a safe haven for instructors and compelled students to show up at these institutions, where teaching and learning took place. Like monasteries, abbeys, and

scriptoria, the universities created environments for the collection of the world's recorded scholarship. In a very positive way, the emergent universities created specialized facilities—including lecture theaters for demonstrating surgical and anatomical studies—where teaching and learning could occur without interruption. These institutions also weakened the influence of the student unions and strengthened the role of the instructors, who themselves organized into disciplinary guilds. Indeed, the well-documented fourteenth-century student riots over these painful transitions led to the emergence of residential colleges at the universities of Oxford, Cambridge, and elsewhere. The modern university was on its way to becoming what Clark Kerr described as the “city of intellect,” removed and protected from the broader

societies in which they operated.³

The invention of the printing press in the fifteenth century, the Protestant Reformation of the sixteenth century, and the Industrial Revolution of the eighteenth century contributed to a proliferation of European universities and to the broadening of the university's purposes. In the Age of Enlightenment, the mission of the modern European (and colonial) university came to embrace not only the transmission and amplification of religious scripture but also the pursuit and dissemination of knowledge in the physical sciences, philosophy, and political economy. In the United States, colonial colleges and universities were established and soon charged (under independent charter) with the Jeffersonian ideal of preparing young men to become enlightened citizens in a democratic society.

Higher education, in the service of an emerging industrial economy, became characterized by the “technologies” of books (including textbooks that captured and standardized leading professors' lecture notes), classrooms, laboratories, lecture halls, and social spaces. In England and Scotland in particular, and also in the United States, universities were regarded as fuel pumps for the Industrial Revolution, and comparative advantage among nations was defined in part by the quality and quantity of university-educated engineers. Furthering this trend in the United States, the Morrill Act of 1862 established one “land-grant university” in each state to educate the masses and serve as a source of applied knowledge in support of the agrarian and industrial economy of the day. This shift in the purpose of higher education—from the education of social elites in the fields of religion, natural philosophy, and liberal philosophy to the preparation of ordinary citizens in “the practical and mechanical arts” to improve agriculture, foster industrialization and urbanization, and develop and transfer practical technologies—was profound.

In its attempt to accomplish the emerging missions of the land-grant university and its European equivalents, higher education for the first time encountered the problem of instructional scale. Access to higher education was certainly not a birthright and remained largely a province of white men, with only 24 coeducational colleges in the United States at the end of the Civil War. By 1880, there were more than 150 such institutions. In this environment, important modern concepts such as course credits and a variety of credentials (most notably, graduate degrees) emerged as important markers of educational attainment and as mechanisms for regulating and augmenting the flow of graduates through the postsecondary education system. The lecture hall became a fixture at land-grant universities as one means of leveraging the time of scarce experts in the professoriate. Craft-based pedagogies yielded to standardization and to more highly leveraged teaching techniques, namely the textbook (the course management software of its day) and the lecture hall. Higher education moved from serving educational elites to serving large numbers

Introducing change to activities that are often highly effective and that in most cases have been operating effectively for decades is very hard—and occasionally even wrongheaded.



of citizens across a spectrum of educational goals—in local, state, regional, national, and even international markets. By the twentieth century, U.S. universities like Johns Hopkins and the University of Chicago and German universities like Humboldt University had integrated research purposes, technology transfer, and graduate education into their missions in important and enduring ways.

It is important to recognize that although the history of higher education in part involves links with the societies served (agrarian, industrial) and an increase in educational access, this history is not characterized by the replacement of one pedagogical paradigm (craft apprenticeship) with another or of one institutional purpose (preparation of enlightened citizens) with another. Higher education's history in many ways can be summarized by two dominant forces: educational access and institutional tradition. Whereas instructors at land-grant universities have struggled to preserve the craft of instruction and to nurture apprentices, these practices have had to yield, in undergraduate contexts, to the use of teaching assistants and other scaling techniques in order to preserve the intimate face-to-face opportunity for upper-division courses.⁴ In particular, the cultural precepts of personal mediation of instruction, craft, academic mentorship, and preparation of civic leaders remain vibrant in both graduate instruction and in the mission of liberal arts colleges. Academic tradition has been able to occupy (or perhaps retreat to) ecological niches in the broader context of higher education's increasing "massification."

The American Association of Community Colleges (AACC) has noted: "During the same period, the country's rapidly growing public high schools were seeking new ways to serve their communities. It was common for them to add a teacher institute, manual learning (vocational education) division or citizenship school to the diploma program. The high school-based community college, as first developed at Central High School in Joliet, Ill. was the most successful type of addition. Meanwhile, small, private colleges such as Indiana's Vincennes University had fashioned an effective model of

higher education grounded on the principles of small classes, close student-faculty relations and a program that included both academics and extracurricular activities."⁵

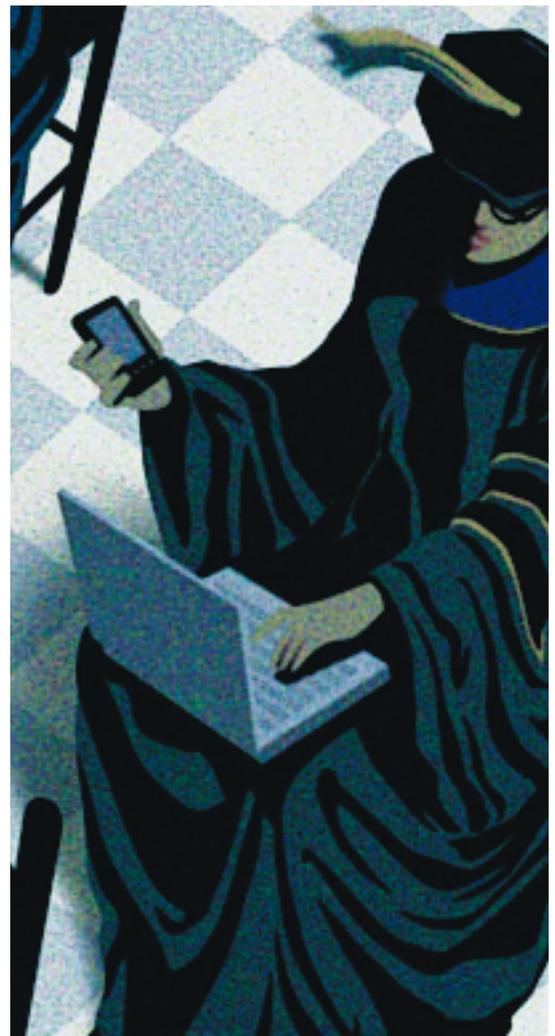
Finally, the emergence of "big science" during World War II through the establishment of national wartime laboratories at Cambridge (Lincoln), Berkeley (Lawrence Radiation), Los Alamos, and Oak Ridge accented even more the importance of education in the wealth and security of nations, furthering the notion of a postsecondary education as a public good, if not a public right.

the creation of and market for textbooks. This burgeoning public policy of promoting the growth of higher education in the United States was aided both by the Supreme Court's decision in *Brown vs. Board of Education* (1954) and by the rapid growth of community colleges in the 1960s. Today, more than 1,100 community colleges educate nearly one-half (45%) of all freshmen in the United States, reflecting the growing shift in U.S. public policy to making access to a postsecondary education a public right. The shift has been furthered in waves of financial aid legislation designed to lower economic

Course management systems automate and standardize those elements of the higher education mission that have been the subject of refinement and protection for nearly a millennium.

Knowledge-Driven: The G.I. Bill and Beyond

The passage of the Servicemen's Readjustment Act on June 22, 1944, marked the beginning of the next wave of massification of higher education. The classrooms of U.S. colleges and universities swelled by more than two million students in the years immediately following the end of World War II. Lecture halls got bigger, residence halls became more crowded, "temporary" structures dotted many campuses, and the United States graduated unprecedented numbers of degree-holders as Europe rebuilt from the devastation of war. In 1950, the U.S. National Science Foundation (NSF) was established, and in 1958, the National (U.S.) Defense Education Act (NDEA) pumped nearly \$500 million into colleges and universities to promote the study of strategic foreign languages and to stimulate



barriers to educational participation.

The efforts to balance the public policy of enlarging access to education with the traditions of the professoriate have, in the main, been successful. In fact, today 43 percent of all U.S. high school graduates enroll in a college or university. Until recently, this balancing act has been achieved through some combination of economic rationing (private education versus public education), programmatic bifurcation (large lower-division courses taught by teaching assistants versus small upper-division seminars taught by ladder-rank faculty), or other largely traditional (undergraduate versus graduate) means.

After 1970, four major events or trends furthered higher education's evolution and challenged its traditions. These events or trends promote increasing access to higher education and also break with traditional higher education modes and methods. First, in 1971, the British Open University was established, building on a small but time-tested correspondence-school movement. The Open University (OU) was designed to provide access to higher education for Britain's working-class students without requiring the commensurate growth of Britain's residential educational infrastructure. At the time, the OU was the first and largest attempt to standardize a curriculum and its delivery across multiple professors and tutors. Instead of honoring higher education's long-standing tradition of treating each professor as the inventor, producer, and distributor of every course, the OU invests massively in the design of a standard course and in the training of those empowered to deliver it. The model has been a historic success, and today more than 150,000 learners compose the OU's enrollment, including more than 25,000 learners outside the United Kingdom.

Next, in 1976, Dr. John Sperling founded the University of Phoenix. The University of Phoenix has achieved nearly unprecedented scale by breaking with a number of traditions:

- Capitalizing its education efforts through private-market equity offerings
- Standardizing and centralizing curriculum wherever possible
- Focusing on the underserved market of working adults

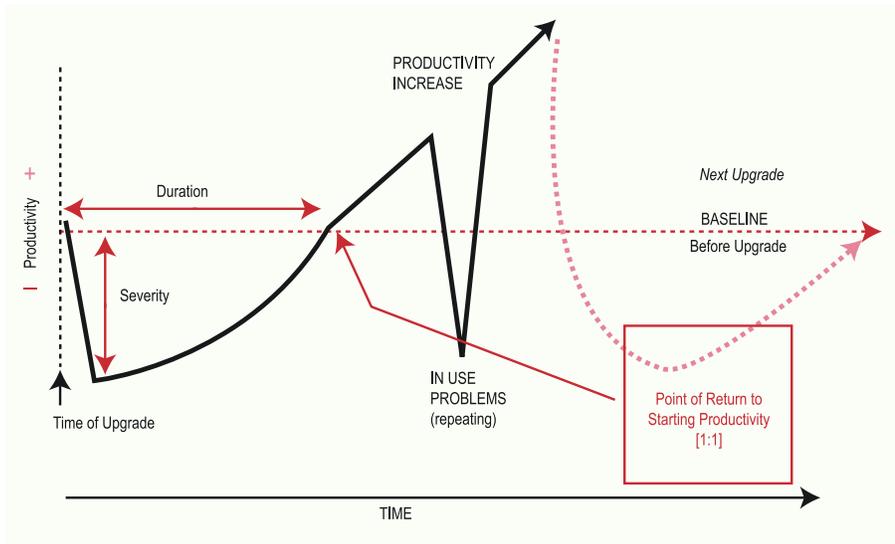
- Sharply abridging its academic offerings based on economic criteria
- Bringing the faculty to students by seeking accreditation and by locating across U.S. political jurisdictions
- Focusing on outcomes assessment, measurement, and formal continuous improvement
- Unbundling core instructional activities such as course design and delivery and assessment of student performance
- Eschewing a traditional library in favor of an all-digital library
- Applying information technology strategically to a variety of instructional and support tasks

The results of the University of Phoenix's methods have been extraordinary: growth exceeding 20 percent per year for more than two decades; and more than 120 campuses serving approximately 152,000 students, ranking it among the largest universities in the United States.

The third major event or trend to affect the course of higher education's recent history has been the emergence of what

some call the Knowledge-Driven Era. Although it is clear that the growth of higher education in the past two hundred years has been largely propelled by the recognition that industrialization requires education, it is also now clear that education and "intellectual capital" have replaced land, labor, and financial capital as the dominant source of wealth. In the short run, the emergence of the knowledge economy has placed the United States in a position of comparative advantage because of the size and quality of its postsecondary education system and because of the high participation rate of U.S. citizens in postsecondary education. In the longer run, developing nations eager to compete and win in global markets are committed to providing unprecedented educational access for their citizens. In this context, and due to the introduction of robust communications technologies, higher education has become a global market. An official poll, for example, indicates that ordinary citizens in China now spend 44 percent of savings on their children's education, compared to 38.4 percent on pensions

Figure 1. Implementation of New Software



Source: Wayne Hodgins, Autodesk, Inc. Reprinted with permission.

and 20.3 percent on housing. In 2000, 1.6 million Chinese high school graduates were admitted by colleges and universities, increasing admissions over the prior year by 47.4 percent. In the same year, a total of 2 million students passed China's rigorous standard college-admission examinations.⁶ The increasing massification of higher education continues and indeed accelerates.

Finally, and importantly, the past thirty years have witnessed the emergence of the course management system (CMS) as an integral part of higher education's instructional infrastructure. Developed simultaneously by different people at a number of institutions (most notably by Murray Goldberg, then at the University of British Columbia), instructional technologies have evolved from small and often sub-rosa tools—used by quirky faculty to streamline efforts or to illustrate points with students in new and novel ways—to dominant elements of higher education's information technology capability. This transition has occurred in less than a decade and, in most cases, in less than three years. The introduction of the enterprise-level CMS in higher education begins a new and important journey. And as is the case for other journeys of this nature, the implementation of these systems in the early part of the twenty-first century represents a first step.

Course Management Systems as Enterprise Systems

In late 2002, the EDUCAUSE Center for Applied Research (ECAR) conducted research on enterprise systems in higher education, focusing on the big three administrative systems: student, financial, and human resources.⁷ Among the many findings of the study is the observation that implementers of these systems initially experience a loss of functionality and a degradation of performance as employees grapple to come to terms with the new technologies and processes that these systems force. Trow describes this as technology's propensity to “cut its own channels.”⁸ The ECAR study concludes that as new systems are assimilated into everyday practice and as the users of these systems gain mastery of the technology, productivity gains are simultaneously reported and the institutional dialogue shifts from one dominantly about stabilization to one increasingly about improvement or even transformation. This process is repeated again, though with less productivity loss, with upgrades.

In the context of course management systems, recent ECAR research suggests a similar socialization curve. The implementation of new software is often accompanied by a short-term loss in productivity as new tools, methods, and processes are assimilated (see Figure 1).

Teaching and learning are inherently and historically social activities and, as such, are even more subject to dislocations associated with new techniques and technologies. If the incorporation of information technology into the social mix is the “new work” of teaching and learning, Shoshana Zuboff advises us: “The new work depends upon a radically different approach to the distribution of knowledge and authority, according to principles of equal access and equal opportunity.”⁹ In this light, the idea of introducing course management systems into a community of scholars with more than a millennium of tradition is a radical and even disquieting proposition.

Hardware and Software

Richard Ekman and Richard Quandt emphasize that the mere existence of hardware and software does not give direction to the future implementation of technology.¹⁰ They are of course correct. The CMS has shifted from being based on the bottoms-up energy of a small cadre of inventive faculty to being the embodiment of a top-down institutional strategy. Very likely, as with traditional ERP systems, expectations of these investments are unclear, since the motivations for their acquisition are often unstated or ambiguous. The users of these systems are often not the people who select them. The change-management aspects of course management systems are significant. Course management systems automate and standardize those elements of the higher education mission that have been the subject of refinement and protection for nearly a millennium. The dominion of the instructor over the classroom is a long-established principle of academic governance, and although the CMS does not dictate either a discipline or a pedagogy, it does possess a structure that threatens faculty hegemony.

Importantly, the structure of the CMS is simultaneously an area of great strength and one of possible resistance or even rejection. The strength lies in the potential of the CMS to interoperate with its helmsman (the faculty member) in an inquiry into the nature of effective pedagogy. One of the ironies of higher education's evolution and history is that whereas universities have fostered the

production of great insights into learning, members of the academy have been free to largely ignore these insights in favor of learning from the apprenticeship or even from trial-and-error experience in the classroom. Course management systems carry with them the potential to guide instructors through course plans that are anchored in the learning theories of B. F. Skinner, Jean Piaget, Robert Gagne, Benjamin Bloom, David Kolb, Abraham Maslow, and others. This structure creates the potential to adapt the teaching to the needs and learning styles of the learner. The developers, sponsors, and early adopters of these systems see, for the first time, the potential to customize and tailor instruction *without sacrificing the scale of delivery*. This is a critical aspect, since the history of higher education largely involves balancing tradeoffs between instructional intimacy (and presumably quality) and access.

In the early period, users of these systems work hard to adapt the systems to their own structure and predispositions. Colloquially speaking, most “pave the cowpaths.” Not only do many faculty struggle to force the system to conform to their view of how classroom experience is to be structured, but they also struggle with the new technology. Often, to economize on effort and time and to minimize frustration, many of these instructors abandon large parts of a system’s functionality in a quietly desperate attempt to master at least part of what is new.

But as practitioners gain experience with course management systems, it is likely (as is the case with ERP systems) that they will venture to use more and more of the features, eventually achieving comfort with, if not mastery over, large elements of the systems’ capabilities. The challenging question for educators and for those who manage these enterprise investments is whether or not and when faculty attention can shift from preoccupation with the adaptation of existing course structures and the mastery of difficult and newly evolving technology to a thoughtful experimentation with customizable pedagogies. Anecdotal evidence suggests that precocious and adventuresome teachers are actively experimenting with new techniques to use the CMS to restructure instruction for more effective results. Em-

pirically, Carol Twigg has demonstrated that course management systems used within new course structures can materially and positively influence both teachers’ and learners’ productivity at no cost to learning outcomes.¹¹

A Long Way to the Holodeck

In the Star Trek movies and television shows, instructional activities in the starships take place in the holodeck, an immersive 3-D simulated environment designed to foster what Kolb described as experiential learning (see Figure 2).

To take steps toward the holodeck, course management systems will need to become more robust and flexible and to enable, in customizable form, students and faculty to choose among pedagogies embedded in their structure. They must become the fabric of the educational experience, in much the same way that chalk, blackboards, paper, textbooks, uncomfortable chairs, touch-screen monitors, erasers, and presentation software have become part of the historical fabric. This will likely happen.

Becoming part of the fabric depends, to an even greater extent, on students and faculty making these systems a priority within their teaching and learning objectives. It can be disheartening to note that among students’ most common activities related to these systems is retrieving missing passwords, presumably forgotten

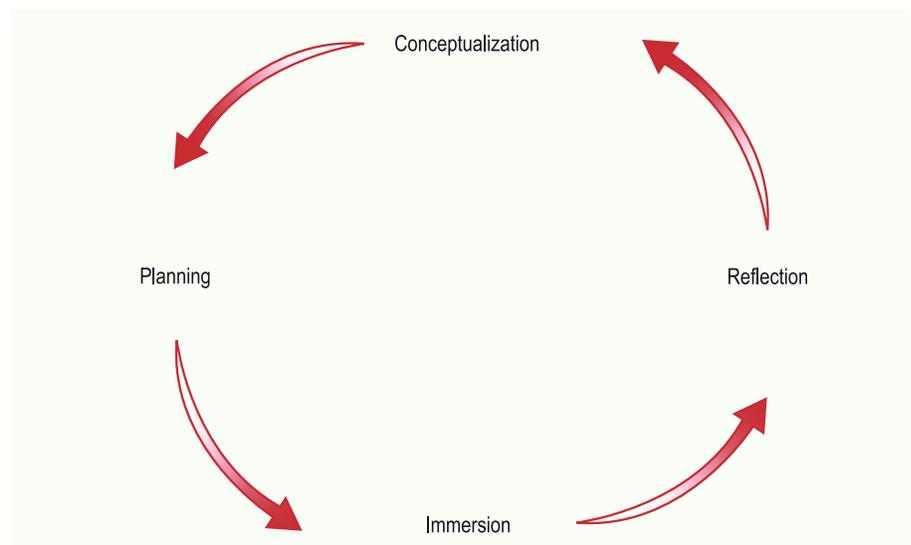
due to infrequent use. Yet we have only begun to socialize these technologies and have not yet rendered them seamless, relevant, rich, and interesting. Similar complaints have been made about the classroom experience, in spite of a millennium of use!

In 2000, MIT President Charles M. Vest described higher education as being at “the proverbial fork in the road.” On the technology path, “cognitive science, virtual environments, and new modes of interacting will all come into play in powerful ways.”¹² The goal of this new synthesis, according to Vest, is quite simply to bring a high-quality learning experience to students wherever and whenever they need it.

Conclusions

Course management systems are an essential step in the evolution of the academy, and their development and use, over time, will promote both access to post-secondary instruction and learning itself. Like all other technology sagas in the history of higher education, the introduction of course management systems has ushered in a new round of struggle between the propensities of technologies to define their own paths and faculty’s appropriate desires to subordinate the technologies to the values and traditions of the academy. From this struggle, the academy renews itself, ensuring both relevancy to new students and grounding in

Figure 2. Experiential Learning



Source: David A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Englewood Cliffs, N.J.: Prentice Hall, 1984).

sustainable values. This tension or dialectic suggests certain conclusions.

The path to the holodeck will be incremental. Colleges and universities are communities of skeptics. Progress in the adoption of course management systems will be constrained by skepticism. Colleges and universities are also communities of explorers, and the adoption of course management systems will be furthered by the curious. President Vest described the path toward e-learning as “somewhat chaotic, intellectually entrepreneurial evolution, as opposed to overwhelming revolution.”¹³

Course management systems will change power relationships. The glib observations about a shift from the “sage on the stage” to the “guide on the side” are true. Zuboff is right to warn that these new systems will alter the distribution of knowledge and authority, according to principles of equal access and equal opportunity. Knowledge of or intuition about this propensity likely underpins some faculty concerns about “loss of control.”

Even in the Star Trek galaxy, there is still an

Academy. Higher education eras overlap, pedagogies overlap, and missions overlap. Course management system and e-learning zealots proclaim the arrival of higher education’s messiah while detractors decry these systems as the work of devils. The history of higher education is a history of endurance through adaptation; in organic fashion, each new stimulus or challenge to the academy led to the production of new shoots and new growth. Only rarely have new technologies fundamentally threatened old root systems. Face-to-face education is very unlikely to be replaced by emerging online forms of education. Rather, new forms, methods, and techniques will be experimented with, and those that enhance the educational experience will prosper and be integrated into both virtual and face-to-face offerings.

Course management systems will cut new channels and create new issues and new opportunities. Clifford Lynch has suggested that course management systems not only will create challenges in expected areas related to the ownership of intellectual

property in course materials but also will raise new issues related to the ownership rights and privacy of students who contribute materials to online courses via these systems.¹⁴ The CMS inherently blurs the distinctions between teachers and learners as learning communities form. The traditional hierarchies of the guild and craft may not withstand the democratizing influences of these systems.

Over time, learning outcomes will improve. Despite the newness of course management systems and the lack of clear model practice in their deployment, management, support, and assessment, the evidence is clear that these technologies do not erode the educational experience or outcomes.¹⁵ Increasingly, there is credible evidence that course management systems—when implemented within a cohesive programmatic and management framework—can enhance grade performance, improve student performance in course assessments, reduce drop-withdraw-failure rates, and demonstrably foster active student participation in course activities.¹⁶

The future is exciting. The implementation of course management systems in higher education is truly a small first step in what is likely to become a significant reshaping and renewal of one of higher education's most cherished and important activities. As software providers introduce greater sophistication and functionality and as faculty and students become more proficient in their use of the technology, what may become possible is "a major global upgrade of education."¹⁷ Commercial software developers, faculty, and students are today working on new tools that promise to lower the economic, pedagogical, linguistic, and technical barriers to full global online participation in a high-quality postsecondary education. Course management systems promise to forever alter the quality/access trade-offs that have dogged higher education since its inception. At the same time, these technologies will make it possible to retain places and environments in which our most cherished traditions can prosper. *e*

Notes

1. Arthur E. Levine, "The Future of Colleges: Nine Inevitable Changes," *Chronicle of Higher Education*, October 27, 2000, B10.
2. Martin Trow, "The Development of Information Technology in American Higher Education," *Daedalus* 126, no. 4 (fall 1997): 293-314.
3. Clark Kerr, *The Uses of the University*, 5th ed. (Cambridge, Mass.: Harvard University Press, 2001).
4. The modern practice of using teaching assistants conforms closely to the hierarchical guild roles of apprentices who took instruction from journeymen working under the guidance of the masters of the craft.
5. American Association of Community Colleges, "About Community Colleges: Historical Information," <http://www.aacc.nche.edu/Content/NavigationMenu/AboutCommunityColleges/HistoricalInformation/Historical_Information.htm> (accessed May 6, 2003).
6. See the China World News Web site: <http://www.websitesaboutchina.com/educ/education_2_1.htm> (accessed May 6, 2003).
7. Robert B. Kvavik and Richard N. Katz, *The Promise and Performance of Enterprise Systems for Higher Education*, ECAR Research Study, vol. 4 (2002).
8. Trow, "The Development of Information Technology."
9. Shoshana Zuboff, "The Emperor's New Information Economy," in W. J. Orlikowski, G. Walsham, M. R. Jones, and J. I. DeGross, eds., *Information Technology and Changes in Organizational Work* (London: Chapman and Hall, 1996), 14.
10. Richard Eckman and Richard Quandt, "Scholarly Communication, Academic Libraries, and Technology," *Change*, January-February 1995, 40.
11. Carol A. Twigg, *Improving Learning and Reducing Costs: Lessons Learned from Round I of the Pew Grant Program in Course Redesign* (Troy, N.Y.: Center for Academic Transformation, Rensselaer Polytechnic Institute, 2003) <<http://www.center.rpi.edu/PewGrant/Rd1intro.pdf>> (accessed May 6, 2003).
12. Charles M. Vest, "Disturbing the Educational Universe: Universities in the Digital Age—Dinosaurs or Prometheans?" Report of the President for the Academic Year 2000-01, <<http://web.mit.edu/president/communications/rpt00-01.html>> (accessed May 6, 2003).
13. Ibid.
14. Clifford Lynch, *The Afterlives of Courses on the Network: Information Management Issues for Learning Management Systems*, ECAR Research Bulletin no. 23, November 26, 2002.
15. Thomas L. Russell, *The No Significant Difference Phenomenon* (Montgomery, Ala.: International Distance Education Certification Center, 2002). A more cautious view may be found in R. Phipps and J. Merisotis, *What's the Difference? A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education* (Washington, D.C.: Institute for Higher Education Policy, 1999) <<http://www.ihep.com/Pubs/PDF/Difference.pdf>> (accessed May 6, 2003).
16. Twigg, *Improving Learning and Reducing Costs*, 2.
17. A Ugandan educator, quoted in Vest, "Disturbing the Educational Universe."