



In Pursuit of the Learning Paradigm

By Donald P. Buckley

Coupling Faculty Transformation and Institutional Change

In the early years of this new millennium, at the close of the “Decade of the Brain,”¹ our generation has the first opportunity to enable an educational transition from a reliance on metaphors about how people learn to an emphasis on pedagogies founded on an understanding of the cognitive development of learning. This is a profound change.

Our special opportunity has arisen from a unique convergence of developments: (1) concerns about poor student-learning outcomes; (2) an emerging understanding of the cognitive development of learning; and (3) the appearance of very learning-centered instructional technology.

Donald P. Buckley, an Apple Distinguished Educator and a Smithsonian Computerworld Laureate, is Associate Professor of Biology and Director of Instructional Technology for the School of Health Sciences, Quinnipiac University.

Indeed, R. B. Barr and J. Tagg have proposed that this transformation will assume the proportions of a paradigm shift—from the traditional *Instructional Paradigm*, emphasizing the delivery of content as the principal product of education, to the *Learning Paradigm*, stressing the need to ensure that the content is being delivered within powerful learning opportunities.²

To seize this opportunity, we must be willing to step out of the box to advance both faculty transformation and institutional change. Reaching the goal of the Learning Paradigm will require the integration of several critical approaches:

1. The ultimate goal is a transition to learning-centered communities, which can be achieved with *learning-centered technology*.
2. Transitioning to learning-centered technology will require *transformational faculty development*.
3. Transformational faculty development must be coupled to *institutional change*.
4. *Course-management systems* will be a critical enabling force driving the institutional change.

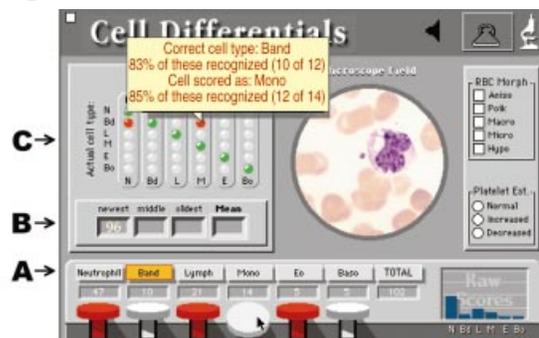
Learning-Centered Technology

The learning potential of the best instructional technology closely parallels the pedagogical goals of the Learning Paradigm: (1) fostering active learning and (2) facilitating the engagement of more cognitive processes in the construction of knowledge by (3) the integration of powerful formative assessment tools. Not all instructional technology will meet the standard needed to help promote a transition to more learner-centered communities, but we can identify the pedagogical feature set that is helpful.

Interactivity

Interactive environments can promote active learning as students make decisions about exploring and interpreting the content area. Moreover, the environment can be scaffolded to help the students to construct knowledge, to learn with understanding.

Figure 1



Varied Information Formats

Different kinds of learning opportunities are enabled by different parts of the brain, which process information in different ways. These different learning opportunities can be activated by communicating in varied information formats. The sensory-rich nature of instructional technology provides a window through which faculty can begin to explore new insights about the cognitive development of learning.

Electronic Communication

Communication tools can help promote socially situated learning environments, which can enhance the quality of learning and the development of teamwork and learning communities. These tools provide faculty with greatly expanded capabilities to support cooperative learning.

Formative Assessment

The need for summative assessment to measure student-learning outcomes and to evaluate teaching success has been much discussed, but perhaps the greater potential of instructional technology is the facilitation of *formative* assessment. Assessments can encourage mindful engagement and chunking, so that students are able to reflect on their understanding before moving on too far. However, assessment style is likely to vary with different learning goals. For heuristic purposes, consider a continuum of learning experiences, from a comprehension of foundational information at the one end to more challenging, open-ended simulations designed to promote the development of investigative skills at the other.

Structured formative assessment. Traditional, structured, quiz-like tools may serve better in the study of foundational

information. Figure 1, a clinical simulation of the identification of white blood cells through the use of integral assessment tools, illustrates an example of this kind of learning system.³ These formative assessment tools can be used (1) to communicate learning goals to students more effectively (students experience variations in cell morphologies across developmental stages), (2) to provide real-time feedback during learning (section A: correcting a miscall), (3) to create incentive systems to encourage competency-based learning standards (section B: only the last quiz or the mean of the last three quizzes is recorded, rewarding students for persistence to competency), (4) to collect diagnostic clues about student and needs progress (section C: the columns are students' interpretations, the rows are the real cell types, red lights are errors), (5) and to improve the value of student-faculty interactions (at the end of the activity, the errors can be replayed to allow reflection and a discussion of challenges).

Open-ended assessment. Open-ended simulations allow more freedom than structured assessment tools, but they are also more demanding and therefore pedagogically leaky—that is, students might slip through the cracks without suitable scaffolding. Assessment is warranted even in these more open-ended systems to encourage student reflection and development of metacognitive skills, but the styles of assessment will be more performance-oriented. In many cases, open-ended simulations can be coupled to other pedagogies (e.g., case-based, problem-based, project-based styles) and to portfolio methods of assessment. Figure 2 illustrates an example from the humanities: studying the change process in famous pieces of literature.⁴ This learning system serves three roles: (1) enabling students to enter a content area from which they were cognitively barred; (2) promoting student experience in the scholarship of literary study; and (3) enhancing student experience in the author's narrative style. Ordinarily in this discipline, content is studied by reading a version of the story along with a special literary tool in the back of the book called an "editorial apparatus." The text is marked

Figure 2A

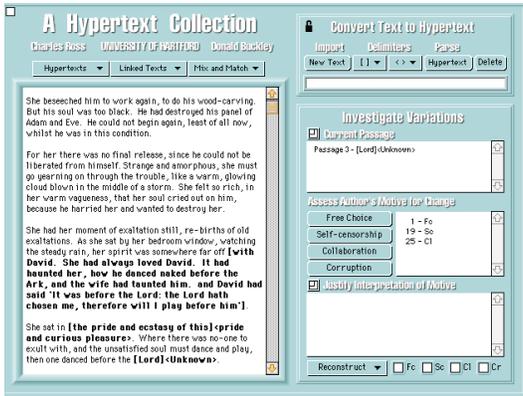
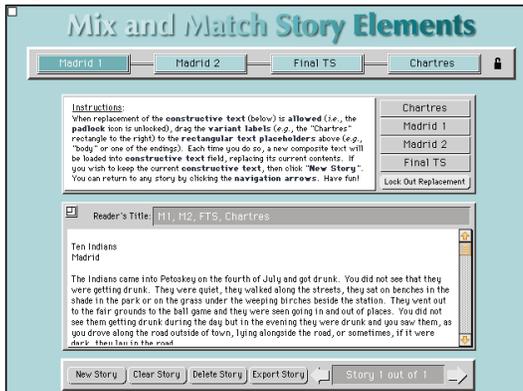


Figure 2B



to indicate passages that were changed from one version of the work to another. When encountering a variant passage, students are required to look up the alternative passage in the back of the book, commit it to memory, and then return to the text to attempt to substitute the text in their mind's eye—a daunting cognitive task. In *Hypertext Explorer* (Figure 2A), variant passages are substitutional hypertext; when a variant passage is reached, the student clicks on it and the alternative string is substituted for the first variant of the passage. Substitutional hypertext opens the content area to the student, who can now read the variants in place without having to rely on memory or imagination. For each passage, students are required to speculate about motivations for the change, writing a justification for each interpretation. When the document has been completely evaluated, the student can then click a button to reconstruct the text to reflect what the student thinks the narrative might have looked like under the influence of some subset of attributed motives, such as “free-choice” or “editorial collaboration.” Lastly, students are able to reassemble story elements from different

versions of the narrative in a drag-and-drop environment (Figure 2B). The students must then wordcraft transitions between the story elements in the style of the author.

As students navigate a learning environment, they leave a trail of decisions, which can reveal a considerable amount about their learning experience. Other assessment systems go beyond authoring and portfolio styles to monitor and analyze the decision path and the cognitive style of the student (e.g., IMMEX).⁵

Authoring tools

Authoring tools promote the construction of knowledge, facilitate the student's use of varied information formats and associated cognitive styles, and represent a major assessment approach for learning-centered and inquiry-oriented pedagogies.

Simulation

It may be that our brains are not wired in ways that allow people to routinely seek alternative explanations or evidence or to interpret the value of evidence insightfully. The part of the brain that we rely on for critical inquiry may have evolved from perceptual regions of the brain, which frequently make assumptions and draw conclusions on the fly, presumably as a means to avoid cognitive overload as we navigate through our lives. Therefore, critical inquiry is an acquired skill, and students need lots of practice. Research simulations enable students to experience the process of investigation, and with appropriate scaffolding, these environments can help students to develop robust epistemological skills earlier in their academic experiences.

Transformational Faculty Development

Despite the aggressive advocacy of teaching reform by influential leaders, agencies, and educational communities, the higher education transition to the Learning Paradigm has not progressed very far. After reviewing progress over the past twenty years, the authors of one study

concluded, “The efforts to change teaching and improve learning are essentially battles over institutional values, rewards, and behavior.”⁶

Faculty communities are a paradox. Faculty are content experts, but teaching well requires more than content knowledge. Faculty have been trained in critical inquiry, but to a large extent epistemologies are contingent on content area and do not provide much guidance about how people learn and how to teach more effectively. Most faculty were trained as researchers, with little formal training in teaching or in the cognitive development of learning. Faculty cultures often do not encourage or reward faculty development in teaching, so most faculty teach the same way that they were taught. Emerging insights about how people learn may diffuse only slowly into general practice. Teaching innovation is certainly not new, and higher education is blessed with a bounty of gifted educators, yet the history of teaching reform is replete with examples of wonderful successes that failed to transform their communities. Too often, successful projects begin and remain insular and thereby transient.

Changing faculty behavior requires transformational faculty-development experiences. Faculty development generally consists of workshops or other evangelistic experiences that do not provide a sufficient opportunity to reflect and experiment, to probe new learning principles deeply. Changing practice is a formative process. It requires engagement and recurrent development cycles in which innovative products and pedagogies are fashioned, used, and refined. Technology can act as an agent for such transformational experiences.⁷ Instructional technology has been touted as a tool to improve education. Likewise, the broad integration of technology is a major goal of most colleges and universities. However, much of the current faculty development with technology is not transformational and does not alter practice in a lasting way. Delivering a better lecture may not move a student from passive to active learning. Using technology to promote transformational, learning-centered faculty development is complicated by the fact that this technology is no more familiar to many

faculty than are the foreign teaching principles advocated in the Learning Paradigm. Yet the pedagogical potential of instructional technology is best suited to learning-centered teaching styles. Placing learning-centered technology in the hands of faculty who are underprepared to exploit its potential will produce disappointing results.

Diffusion of Innovation in Real Faculty Populations

Instructional technology learning environments can be used for a variety of purposes, including for faculty learning. However, faculty populations have structure, and this imposes challenges for institutional change processes. The faculty community includes at least four major subpopulations: (1) the “lone rangers” (entrepreneurs or innovators); (2) the early adopters; (3) the later adopters; and (4) a small proportion of resisters. A refined synthesis of E. M. Rogers’s model in *Diffusion of Innovation* suggests that we can predict some useful properties of the faculty subcommunities.⁸ The entrepreneurs and early adopters may both tend to be motivated by a vision of the pedagogical high ground, but the entrepreneurs may be risk-seekers, and the early adopters are likely to be risk-averse. The later adopters have been characterized as “careerists” who may be more motivated by reward structures that advance their professional careers. In using technology authoring experiences to drive institutional transformation to the Learning Paradigm, however, there is no one-size-fits-all experience that will suffice. Rather, a phased approach will be necessary, as well as a savvy appreciation of the different needs of different faculty constituencies.

Principles of Faculty Development with Authoring Experiences

Faculty development with technology often relies on relatively low-level training activities (like slide-show authoring), because of the common assumption that faculty won’t commit the effort required for more intensive experiences. To be sure, faculty commitments are usually heavy, and support resources are limited, but another approach is possible. Perhaps previous, nontransformational

faculty-development experiences have moderated faculty expectations and created wariness. Faculty may wonder, “Why spend the effort, if the benefits are modest?” Instead of moderating expectations with limited training experiences, we can exploit the opportunity presented by the emergence of the learning revolution and entice faculty to explore the technology-assisted pedagogical edge of the envelope “to boldly go where few [educators] have gone before.”

This strategy requires that educators undergo faculty-development experiences that allow them to explore learning-centered and inquiry-oriented teaching styles that promote student learning with understanding. Many faculty find it enormously stimulating to create learning environments that would enable them to teach things that they felt they could not teach as well before. The success of this approach is critically dependant on the goals and quality of the faculty-development program, which in turn will depend on the needs and opportunities of the institution. However, three issues have general significance and warrant discussion here: (1) overall principles guiding successful transformational faculty-development experiences; (2) complications imposed by the complexity of faculty community structure; and (3) elucidation of a few instructional technologies that appear to be promising tools in this process. The five suggestions that follow have emerged partly from my own experience in a faculty-development program.⁹

1. *Use authoring as a transformational experience.* Much faculty development consists of simple workshops and colloquia—evangelizing experiences that don’t affect faculty behaviors. Effective change is much more likely when one must produce a product. Authoring learning-centered activities is one such transformational experience, but “au-

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thoring” should be interpreted broadly here, ranging from the creation of new learningware to the development of technology-assisted student activities that improve learning. Faculty should be encouraged to create small projects that explore very learning-centered principles. Small projects are doable and modifiable and allow faculty to focus on learning principles. Some instructional designers advocate that faculty should immediately engage in formal design practices, like storyboarding, but this experience is not about production values; it is about creating the simplest possible entry into a technology-assisted world of learning. Abstractions

and technology-learning curves should be minimized by superior support.

2. *Focus on pedagogical innovation and student learning.* This is about learning, not technology. The objective is not to create technology authors but rather to allow faculty to create significant learning opportunities that exploit the pedagogical feature set of instructional technology.

3. *Keep the technology transparent.* Most faculty are disinterested in technology per se, or even disdainful of it. It is likely that most faculty will begin such an experience without having a broad or deep understanding of the teaching potential of the technology. Many can be very motivated by the excitement of teaching better and by the prospect of focusing on an important part of their content area that is near and dear to their hearts. The training process must be able to free faculty to pursue these pedagogical and content goals without being hindered by prohibitive technology-learning curves or abstractions of the authoring environment—either of which can interfere with the faculty member’s ability to envision how technology can enhance student learning. Support staff must be proficient not only in technology support but in their ability to perceive and support the

development of learning-centered applications of technology. In this regard, instructional designers and innovative faculty mentors are extremely valuable assets.

There is a scalability issue here. One argument states that the institutional integration of instructional technology requires that faculty be made self-sufficient in order to avoid a support crisis. The problem is indisputable, but the solution is a balance between the need to create genuinely transformational experiences on a sufficient scale to transform faculty culture and the need to create a high-quality technology-support infrastructure. Inadequate consideration of the need to achieve learning-centered faculty transformation experiences may hamper the institutional transition to the Learning Paradigm.

4. *Emphasize faculty collaboration.* Transforming practice requires the creation of incentives that encourage faculty to be willing to step back from familiar and perhaps comfortable teaching styles and to take the risk to teach new ways, perhaps giving up some sense of control as they consider how to transfer the authority of learning to their students. Staff must move beyond the standard of support that targets the most-common denominator—"reasonable faculty"—to levels of support that sustain the enthusiasm of faculty who do not like risks, complexity, ambiguity, or failure. This is a social process, and the institutional path to the Learning Paradigm requires new alliances and shared risk-taking. Collaboration is key. One approach is to train faculty first in small clusters, to create a critical mass of energy and innovation, to fashion a sense of shared risk-taking and communal adventure, and to convey a public message that the participant's venture is in no small measure heroic. Individual products emerge later, with a gradual shift from group training to one-on-one facilitation between the faculty

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"trainee" and the faculty mentor and/or instructional designer. The faculty mentor or instructional designer serves as a sounding board and a coach, ensuring that the technology is as transparent to the faculty member as is needed to allow him or her to focus enthusiastically on the content area and pedagogical innovation.

Collaboration involves one more issue. The reflective experience of explaining what students are like and how we want them to learn can be very revealing. Collaboration creates a social activity that helps us to step out of our intellectual mold. It helps us to break free from the blinders of routine. Thus faculty should not be trained in disciplinary clusters, since there

is more value in explaining one's goals and methods to colleagues outside one's discipline. Departments may not provide the kind of environment in which intellectual communities can flourish around teaching.

5. *Recruit faculty.* Faculty are busy people, and faculty-reward structures often undervalue teaching, especially immersion in faculty development for teaching. Moreover, faculty populations are heterogeneous. Faculty cultures and pedagogies vary across disciplines and across innovator/adopter classes. The institutional transition to the Learning Paradigm does not require that every individual faculty member sign on, but a community dynamic must emerge in which institutional cultures and mission statements advocate for learning-centered faculty practices. With such a large and complex target population, changes won't happen all at once.

The first condition for successful recruitment is for the administration and at least the teaching-reform community to share a vision and a commitment to driving institutional movement toward learning-centered practices. The administration can articulate goals, corroborate those

statements with investments of resources, and create reward structures that encourage innovation and the scholarship of teaching. In the end, though, intrinsic motivations have to be created within the faculty community so that faculty value teaching in ways that encourage students to learn with understanding.

Aggressive outreach can be an important tool in promoting the intrinsic motivation to get involved. Demonstrations of sample technology learning environments (authored by faculty) should be given to any audience interested. These presentations should emphasize (1) the potential to foster active learning, (2) opportunities to encourage motivation and the mindful engagement of students, (3) new insights about the cognitive development of learning that the technology could facilitate, (4) the use of communication tools to promote cooperative learning, and (5) the power of formative assessment tools to provide students with feedback and encouragement and to collect diagnostic clues about individual learning needs. Most important in our own faculty-development program, we used products that we had created (not off-the-shelf products) to demonstrate the pedagogical features that we were advocating. Our learning products and activities were the convincing arguments, not the theory. Faculty were captivated by demonstrations of how learning environments could be customized to serve specific learning goals. Most faculty reported being able to envision learning challenges that could be addressed in exciting ways with this technology.

Aggressive outreach is important for another reason. The early success of an institutional change process is critically dependent on recruiting the right participants, yet predicting who these individuals are can be challenging. Many promising candidates already have busy agendas. In our faculty-development program, we discovered that it was better to throw out a broad net to find and retrieve "eager beavers"—those with intrinsic motivation—and to then bestow the care required to make them successful.

Support became critical. It was imperative to demonstrate that we would not allow participants to fail if they perse-

vered and that participants were supported to such a lavish standard that they were guaranteed an intellectual adventure. The willingness of later and even early adopters to take risks was contingent on the trust that we built. Part of this trust related to the creation of a long-term relationship that we fashioned with participants. This ongoing support ensured that faculty could undergo development cycles of authoring, use refinement, and dissemination. Formative development experiences create the richest opportunities for transformational change. We reinforced this perception through a series of workshops and events that highlighted the accomplishments of the faculty trainees. The program staff, the teaching-reform community, and the administration used these events to celebrate the achievements and stature of the faculty participants. Heroes and heroines take risks to reach important goals, and we strove to commemorate the role that these faculty played in elevating the scholarship of teaching.

An Institutional Change Model

Figure 3 illustrates the progression of phases in an institutional change model, from the traditional state in which teaching innovation with technology is mostly restricted to the *lone rangers*, to the *boutique* and *systemic* phases, which constitute the institutional transition. The boutique phase serves the smaller numbers of early adopters and is characterized by lavish care to make sure that these faculty enjoy a transformational experience. It is in the boutique phase that the program establishes its reputation and creates a demand for training by later adopters (reward-seekers). The expansion of the program and the change in constituency (later adopters) during the systemic phase require an adjustment of the training, increasing the relative importance of

Figure 3



scalability while still producing transformational faculty experiences. In each phase, vital faculty mentors will be drawn from the previous cohorts to serve as mentors for later participants. Note, for example, that the boutique community continues to function during the systemic phase, but with an additional role. Each institution will have its own idiosyncrasies and will therefore warrant implementations that are somewhat individualistic. The leaders and innovators

Figure 4A

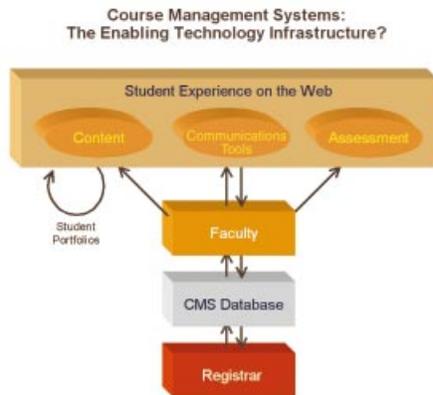
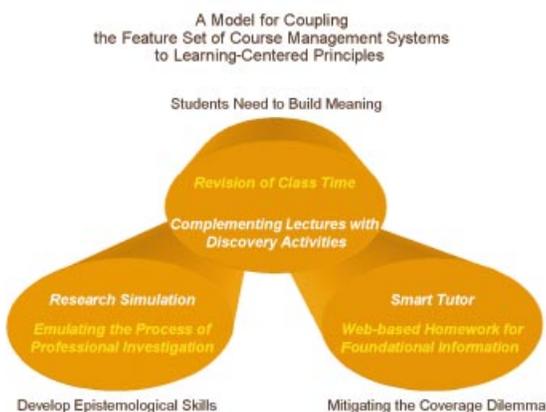


Figure 4B



emerging from the boutique phase will collaborate with the IT planners in crafting the special paths of that institution's systemic phase.

Course Management Systems: The Enabling Technology?

What kind of technology will provide the transformational experience sought here? Only a few years ago, interactive multimedia tools seemed to be the only promising authoring environments, because of the need for a programming language to create interactivities and, especially, simulation capabilities and to produce integral formative assessment tools. This approach was quite successful (e.g., see Figures 1 and 2, which are products of this process), although it was extremely support-intensive and therefore suffered from low scalability. This scalability problem limited the suitability of transformational authoring to small institutions or to the boutique phase of larger institutions. However, two developments

enable the extension of the transformational authoring model. First, publishers and educational communities are offering collections of learning modules (e.g., MERLOT, a collection of learning objects endorsed by NLII/EDUCAUSE and sponsored by the NSF Digital Library Project <<http://www.merlot.org>>). These modules reduce the need for faculty to create their own learning systems. Their authoring efforts can be spent developing pedagogies and activities that exploit the available learning modules.

Second, course management systems (CMS) provide a new kind of authoring opportunity, coupled with a framework to integrate instructional technologies over a whole course. The general structure of a course management system is illustrated in Figure 4A. The most salient features are the three classes of tools that faculty can use to support student experiences: (1) Web-based content delivery; (2)

communications tools; and (3) assessment systems. CMS authoring is fairly user-friendly and this greatly aids in facilitating faculty's authoring experiences in the boutique phase and especially in the systemic phase. However, the structure diagrammed in Figure 4A does not convey a clear overview of the learning potential of these environments because is too tool-centric. Content-delivery tools may foster the transition from pure lecture to learning activities that enhance learning-centered pedagogies like case-based, problem-based experiences, and communications tools such as threaded discussions greatly expand the capability to advance social components of learning, whereas the availability of online assessment tools will enable the development of routine formative assessment systems. Yet the most powerful implementations will combine appropriate sets of tools and focus on the more-integrated teaching styles that are required for students to learn with un-

derstanding. Figure 4B illustrates a triad model to guide faculty perception of the pedagogical possibilities of CMS. The three components are largely self-explanatory, but a few comments are warranted. The research and the classroom activity pieces focus on higher-order goals: the development of critical inquiry skills and the construction of knowledge to promote learning with understanding. Both kinds of experience can exploit the three CMS student-interaction systems. For example, the content-delivery tools can be used to mount interactive research simulations, which can be enhanced by communications tools that support teamwork, and students' presentations of their work would be a major part of their assessment. Similarly, the construction of knowledge requires that students grapple with the content in experiences that allow them to develop expertise, learning with understanding.¹⁰ The content-delivery system can help the faculty member offer rich media to communicate context and to engage student interest and cognitive assets, but it also facilitates the instructor's ability to step away from the stage and assume the role of facilitator. Both foundational and investigative assessment styles can help promote student metacognition, and the communication tools can foster cooperative learning as members of the student team interact to develop their project out of class. However, in content-rich disciplines, a major obstacle to the implementation of these powerful but time-intensive pedagogies is the *coverage dilemma*. Even if faculty agree to the advisability of learning-centered approaches, finding the time requires a reconsideration of coverage. Teaching "a mile wide and an inch deep" has already been identified as one of the major barriers to learning with understanding.

The third component of this triad CMS learning model is a Web-based homework system. Although this could be considered a component of the "classroom activities," the integration of a routine formative assessment system could mitigate the coverage dilemma. These assessment systems would focus on foundational information, and they would provide real-time feedback to students,

would create incentive systems to encourage competency-based learning standards, and would collate important information about students' progress and learning needs. By moving much of the responsibility of learning foundational information into the student's time with a competency-based learning standard, faculty can free classroom time for higher-order learning goals such as case-based, problem-based, and project-based experiences that help students to experience the process of investigation and to learn with understanding.

Conclusion

Higher education has entered a transition from the Instructional Paradigm to the Learning Paradigm. This transition is the result of a variety of pressures that have created a climate of pedagogical self-examination. Emerging from this process are powerful new teaching styles founded on learning-centered principles and improved insights into the cognitive development of learning. At the same time, educational technology is looming as a pre-

eminent force behind these new teaching styles. But we face obstacles in the path to full transition. The pedagogical potential of instructional technology is mismatched with current faculty practice, and institutions must implement profoundly different ways of doing business. Effective institutional transition requires faculty-development systems that are transformational enough to produce changes in practice but scalable enough to achieve systemic change. If we are to capture the honor of being the generation that takes higher education to the Learning Paradigm, to teaching styles based on an understanding of how people really learn, then we must use enabling, learning-centered technologies such as course-management systems to successfully couple faculty transformation with institutional change processes. *e*

Notes

1. On the "Decade of the Brain," see <<http://www.loc.gov/loc/brain/>>.
2. R. B. Barr and J. Tagg, "From Teaching to Learning: A New Paradigm for Undergraduate Education," *Change* 27, no. 6 (1995): 12-25.
3. Figure 1 is from D. Buckley, M. Cohen, W. Cole-

man, and R. Stewart, "Interactive Multimedia Learning Environments: Tools to Foster Transition to the Learning Paradigm," in P. De Bra and John L. Leggett, eds., *Proceedings of WebNet '99: World Conference on the WWW and Internet, Honolulu, Hawaii, October 24-30, 1999* (Charlottesville, Va.: Association for the Advancement of Computing in Education, 1999).

4. Figure 2 is from D. Buckley and C. Ross, "Hypertext Editing in the Classroom," in *ibid.*
5. J. Underdahl, J. Palacio-Cayetano, and R. Stevens, "Practice Makes Perfect: Assessing and Enhancing Knowledge and Problem-Solving Skills with IMMEX Software," *Learning & Leading with Technology*, April 2001, 26-31.
6. M. Lazerson, U. Wegener, and N. Shumanis, "What Makes a Revolution? Teaching and Learning in Higher Education, 1980-2000," *Change* 32, no. 3 (2000): 19.
7. D. Buckley and E. Klonoski, "Advanced Educational Computing: A Tool to Foster Student-Centered Learning," final report to FIPSE, University of Hartford, Hartford, Conn., 1997; C. Barone and P. R. Hagner, eds., *Technology-Enhanced Teaching and Learning: Leading and Supporting the Transformation on Your Campus* (San Francisco: Jossey-Bass, 2001).
8. E. M. Rogers, *Diffusion of Innovation* (New York: Free Press, 1995); P. R. Hagner and C. A. Schecbeck, "Engaging the Faculty," in Barone and Hagner, *Technology-Enhanced Teaching and Learning*.
9. Buckley and Klonoski, "Advanced Educational Computing."
10. J. Bransford, A. L. Brown, and R. R. Cocking, eds., *How People Learn: Brain, Mind, Experience, and School*, expanded ed. (Washington, D.C.: National Research Council, 2000).