Measuring Innovation:
A Plausible Strategy for Information Technology

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Overview

Three innovations have dominated the educational arena over the last two decades: high-stakes testing, the development of national and international ranking systems, and e-learning. Although the adoption rates and impact of such innovations may be difficult to measure in their early stages, the capacity to measure the spread of an innovation becomes, in itself, a critical predictor of the innovation’s likely staying power. Conversely, resistance to such measurements becomes an indicator of the power of the forces often arrayed against such innovations. James Utterback at MIT’s Sloan School of Management was right when, in writing about the dynamics of innovation, he observed that “powerful competitors often not only resist innovative threats, but also resist efforts to understand them, preferring instead to further deepen their commitment to their older products.”

This research bulletin presents a conceptual understanding of the process of change and innovation on the one hand, and a practical way of measuring current and future trajectories on the other. It is based on research conducted for the Weatherstation Project, a longitudinal study of e-learning. In addition to Weatherstation Project findings as described in *Thwarted Innovation: What Happened to E-learning and Why,* the final report of the project, this bulletin describes the measurement strategies the project employed as well as the conceptual framework that provided the necessary definitions for e-learning.

Highlights of E-Learning as Measurable Innovation

Sparked by technological advances on the one hand and new understandings of how, when, and why people learn on the other, e-learning today is most often associated with the dot-com boom and the promise of e-commerce. For American higher education, e-learning is the most important pedagogical innovation of the past 20 years. What e-learning offers is a truly student-centered approach to education, one that has the potential of providing anywhere, anytime delivery that can be customized for each student’s personal learning style.

From the outset, e-learning attracted venture capital, high-profile press, and, not surprisingly, grandiose promises. Among the claims made to support e-learning investments, three warrant specific note.

- **Customized learning.** The marriage of new electronic technologies and recently accepted theories of learning promised to yield a revolution in pedagogy itself. Learning would be customized, self-paced, and problem based. Course instructors would be replaced by designers and facilitators—the much-promised transformation of “sage on the stage” into a “guide on the side” would at last become a reality.
Any time, anywhere learning. E-learning’s second promise derived from its ability to be delivered any time and anywhere a computer and connection to the Internet could be found. Analysts projected a surge in the demand for adult education, as more people sought to start and finish baccalaureate and post-baccalaureate programs, as well as to acquire the new skills on which an information economy depended. E-learning and distance education would become synonymous terms, as state agencies and private providers brought new programs to market. Lifelong learning would become an electronic reality.

Market-driven learning. E-learning’s third and perhaps most radical promise was that the market would provide the financing necessary for the industry to live up to its potential. The most quoted projections—those made in 2000 by Michael Moe and Henry Blodget in the Merrill Lynch white paper, “The Knowledge Web”—boldly proclaimed:

- The U.S. online market opportunity for knowledge enterprises will grow from $9.4 billion in 1999 to $53.3 billion in 2003, representing a CAGR [compound annual growth rate] of 54 percent.
- At an estimated $105 billion, the spending power of college students is huge. Not surprisingly, a growing percentage of their spending is moving online. Currently, students spend $1.5 billion online, an amount expected to almost triple to $3.9 billion by 2002.
- The U.S. market for online higher education alone will grow from $1.2 billion in 1999 to $7 billion in 2003.  

Each of these promises remains more hope than reality, making it all the more important that U.S. higher education understands what happened to e-learning and why. What made e-learning such an attractive investment to those who contributed sweat equity and those who contributed venture capital? While nearly every innovation in its early stages promises more than is delivered, why were the e-learning claims so extravagantly off the mark? Did e-learning simply flame out on takeoff? Or is it possible that, once the hoopla has died down, e-learning will follow the same trajectory as other innovations that begin with experimenters and pioneers, then expand to a group of early adopters before becoming commonplace and taken for granted?  

Given that e-learning will be judged by its capacity to win a place in an increasingly competitive higher education market, how should one gauge the size of e-learning’s share of that market—both now and prospectively?

Genesis of the Weatherstation Project

We first wrote about e-learning and the rapidly changing world of information technology in Using Information Technologies to Enhance Academic Productivity, a 1994 Educom monograph that emerged from a Wingspread-sponsored roundtable. More recently, Massy returned to this subject in Honoring the Trust: Quality and Cost Containment in Higher Education, while Zemsky began exploring key measurement issues as part of the Weatherstation Project. The Weatherstation Project, a major effort funded by the Thomson Corporation in partnership with the University of Pennsylvania, sought to
develop tools for gauging how fast and in what direction the market for e-learning was growing.

Where Are the Data?

The Weatherstation Project was intended as an antidote to those first descriptions of the market for e-learning, which were often warped by missing data and overly hopeful assumptions about how quickly new products would come to market and how receptive learners and instructors were likely to be. When this project was launched in the summer of 2001, there were no readily available data that tracked students, products, or purchases. No one knew how many students or workers were taking e-learning courses in any given year, how much either businesses or colleges and universities were spending in pursuit of e-learning initiatives, or how students or employees themselves were investing their own time and money. Even less was known about the structure of the market for e-learning. How was it segmented? Who constituted the major niche players? Were e-learning’s promised economic efficiencies allowing colleges and universities to recoup their initial, often substantial investments in either hardware or software? Were the promised enrollments of remote learners materializing, and were they proving sufficient to justify continued investments in Web-based distance education?

Educational data were as lacking as market data. No standard category in the federal government’s annual Integrated Postsecondary Education Data System (IPEDS) surveys asked institutions to report the number of course credits they awarded online or the number of transfer credits they granted for online courses. No agency counted how many online courses were being offered as part of an institution’s regular curriculum at either the undergraduate or graduate/professional level. No governmental survey asked institutions to report how much they were spending on their e-learning initiatives. Nor, for that matter, were there national sales figures for e-learning software. One of the reasons the Moe and Blodget projections proved to be so transitory was that they were based on market surrogates that overestimated the actual dollar transactions involved in the e-learning market. The Knowledge Web’s 1999 figure of $1.2 billion spent on e-learning is an estimate that includes monies spent on communications, market aids, technical support, and maintenance, as well as software, professional training, and content creation. Furthermore, the 2003 projected estimate of $7 billion is largely based on what Moe and his colleagues knew about the projected growth in computers, connectivity, and use of the Internet.

What Is the Concept?

In part, at least, data are lacking because e-learning is still a concept in search of consistent definition. Currently, three broad domains define e-learning’s principal market niches.

- **E-Learning as Distance Education.** Mention e-learning, and many people still assume the reference is to distance education or education delivered on the Web. The most successful forms of e-learning, however, are the courses delivered over the Internet—courses that teach a particular subject, are part of a
degree program (most often at the graduate or professional level), and offer certification in a vocational or technical skill.

- **E-Learning as Facilitated Transactions Software.** E-learning’s second big triumph has been in the development and expansion of course management systems—Blackboard and WebCT are the best known—that both organize courses and present materials online. Mainly used within higher education, course management systems at many institutions link teachers with students, students with each other, and students to sources. Schedules and assignments are posted on the Web. Reading materials are available for download, replacing the proverbial “bulk packs” of an earlier innovation. An important, growing subset of this market involves computerized assessments—principally, the grading of tests.

- **E-Learning as Electronically Mediated Learning.** The third category of e-learning—and the one that initially attracted the greatest attention—centered on the learning materials themselves rather than their distribution. This category includes a host of products, services, and applications; computerized test preparation courses that prepare students to take the SAT, GRE, or any of a half-dozen standardized tests; complex, integrated learning packages such as Maple or Mathematica that teach elementary calculus; course objects that simulate everything from chemical reactions to social interactions to musical compositions; and tools like Macromedia’s Dreamweaver and Flash that help students build their own Web sites and multimedia presentations. This component of e-learning includes the interactive CD-ROMs as well as the Web sites that publishers of college textbooks are increasingly making an integrated aspect of their products. Despite their seemingly diffuse nature, what all these products and resources have in common is that they involve electronically mediated learning in a digital format that is interactive but not necessarily remote.

**Weatherstation: Measuring a Market-Driven Innovation**

These definitions are the first, and in many ways the most critical, tools for any effort that sets out to measure the market for e-learning. In broad brush, the Weatherstation Project tested whether we had a sufficient conceptual understanding of what e-learning was—and wasn’t—to collect meaningful data on the one hand, and on the other to understand what those data were telling us. Thus we set out to develop a set of tools that would chart e-learning’s forward progress as a major educational innovation. If we were not as sanguine as Moe and his colleagues about the coming size of the market for e-learning, we were nonetheless convinced there would in fact be a market. We believed it would include much more than course enhancements and course management systems and that it would become a large and therefore significant component of the financial structure of postsecondary education in the United States and elsewhere.

We also understood that the measurement strategies then being employed to estimate market demand for e-learning and e-learning products were persuading respected institutions and corporations to project and then invest in host of ventures—Fathom and
NYUOnline being two of the best known—that cost more than anticipated and returned much less than imagined. Our guess was that in the late 1990s, when these first big projects were initially conceived and launched, e-learning was still in its first-innovators phase—there were still relatively few innovators and almost no users who fit the classic description of early adopters. PowerPoint had yet to begin its steady advance across the educational landscape. Most course management systems were still being prototyped, while course objects were primarily curiosities more to behold than to use. The big successes—Maple in calculus and Studio Physics—were more often cited as special exceptions rather than precursors or harbingers of things to come.

Surveying the Terrain

Today the dominant measurement strategy is the one-time survey that asks university administrators and the heads of corporate training departments about their current use of e-learning, broadly defined. The most recent and best funded (and in many ways most interesting and revealing) of these efforts is *Sizing the Opportunity: The Quality and Extent of Online Education in the United States, 2002 and 2003*.

Sponsored by the Sloan Foundation and conducted by the Sloan Center for On Line Education colocated at Babson College and the Franklin W. Olin College of Education, *Sizing the Opportunity* asks and affirmatively answers, Will students, institutions, and faculty embrace online education as a delivery method? Just as important, the authors of *Sizing the Opportunity* found that the “quality of online education [will] match that of face-to-face instruction.”

Nearly all such surveys are snapshots reporting frequencies at a single point in time. Almost all have low response rates—in the case of *Sizing the Opportunity*, 32.8 percent. The result is a survey with a substantially biased sample—an acceptable outcome if the analysts use that bias to estimate how the nonrespondents probably differed from those who did respond. In the case of *Sizing the Opportunity*, our best guess is that provosts, deans, and academic vice presidents who either filled out the survey themselves or, as was more likely, had their IT directors or CIOs fill it out, were primarily from institutions that had made substantial investments in online and other forms of e-learning. The result was a finding that reflected administrative attitudes, and in some cases hopes, from institutions that were more likely to have formal programs of online education and the larger technical staffs that come with such programs.

Weatherstation Project Methodology

When we launched the Weatherstation Project, we chose to query a variety of respondents whose attitudes and experiences were likely to change over time. Focusing on the dynamics of innovation, we wanted to collect data that we and others could use to chart how the market for e-learning was changing over time—and by extrapolation how it was likely to evolve in the future. We were struck from the outset by a sense of irony: the disappointment in the fall of 2001 pervading the market for e-learning was as misplaced as the euphoria that once led the industry’s optimists to celebrate e-learning as an invincible revolution in the first place. E-learning was alive and well. Money was being spent, smart classrooms were being built everywhere, and collegiate faculty and corporate trainers were successfully integrating electronically mediated learning into thousands of courses focusing on both traditional and nontraditional subjects. That said,
it was also the case that e-learning was evolving in ways few predicted and with economic consequences that even its most ardent supporters were struggling to understand.

Campus Weatherstations and the Interview Process

The Weatherstation Project initially established 12 observation posts (the metaphorical Weatherstations in the project's title): six on college campuses and six within for-profit corporations. On each of the six campuses at which we established Weatherstations, our intent was to create three panels consisting of 15 faculty, 15 administrators, and 15 students who would agree to report quarterly on their attitudes toward, expectations of, and uses of e-learning.

The process began with an interview, either in person or over the telephone, that explained the nature of the project and asked panel members a set of standardized questions about their own use of e-learning; their sense of e-learning's likely rate of growth; its principal benefits; the forms of support it was receiving on campus; the products and services actually being used; and any new developments or hot prospects they had spotted. After their initial interview, respondents were sent an e-mail asking them to visit a Web site to see how the project team had coded their answers to the interview's questions. Using the interactive features of the Web site, respondents were able to change their answers to reflect their current experiences with e-learning.

Each quarter thereafter, respondents were sent follow-up e-mails, again with a customized Web address, asking them to check previous answers and tell us, using the Web site, how their attitudes and experiences had changed. We also regularly reported the project's preliminary findings to respondents. We recognized that such reporting ran the risk of influencing their subsequent answers to the quarterly probes, but we considered the risk to be acceptable, given that the reporting increased the likelihood that panelists would continue to respond to our e-mail probes.

In sum, the measurement strategy embedded in our use of campus Weatherstations resembled that of the Nielsen ratings, which track TV viewing through a sample of households. In the Weatherstation Project, the sample of institutions reflected both the experimental nature of the project—just six campus Weatherstations—and our desire to have as broad a mix of institutions as possible.

All of the participating institutions had reputations for having well-developed strategies for deploying learning technologies and chief information officers on whom we could rely to help us recruit and motivate survey respondents. We are under no illusions about the biased nature of our sample: it reflects institutions we knew in advance to be investing, often substantially, in e-learning. We also know that the respondents themselves were neither a random nor a representative sample of their administrative or faculty colleagues. The members of the faculty, for the most part, were early adopters; none could be called a diehard. The administrators recruited for the project's panels were largely mid- to upper-level technical staff responsible for supporting faculty in their experiments with and expanded use of learning technologies.
In one important respect, our sample of institutions is representative of the larger population of degree-granting institutions of postsecondary education in the United States. Among the six are a community college, a public comprehensive university, a public land-grant university, a major public research university, a private liberal arts college, and a major private research university. Four of these institutions serve the Name-Brand/Medallion segment of the market for undergraduate education, one serves the Core market, and one serves the User-Friendly/Convenience market.  

Two False Starts

A roughly similar strategy was to be employed at the six corporate Weatherstations, though only a single individual (usually a chief training officer) was to respond to quarterly Weatherstation inquiries. However, the rapid slide into recession that coincided with the launching of the project played havoc with this measurement strategy. At first, the participating trainers proved reluctant to report on the degree to which their use of e-learning was declining as their budgets were being reduced and consolidated. Then, the training officers with whom we had built relationships began to disappear—the victims of corporate reorganizations and downsizings.

Ultimately we abandoned our attempt to track the corporate market for e-learning using a Weatherstation model and turned instead to a series of indirect, Web-based measures. We also abandoned our attempt to establish student panels. No matter what we tried, we could not achieve consistent participation by a group of students over an extended period of time. In fact, we often failed to gather a sufficient number of students on a participating campus to allow us even to conduct the initial interviews. We are not alone in having failed to take account of student opinion and experience—a lacuna that has warped most estimates of the campus-based demand for e-learning.

What It Means to Higher Education

The Weatherstation Project was an experiment in measurement—a search for a reliable strategy for charting the evolution of the market for e-learning. The campus Weatherstations were our principal innovation—and largest success. Once established, the faculty and administrative panels proved to be stable, engaged, and interested in the project’s outcomes. Response rates were uniformly high. Respondents took care to report where they wanted—and, just as importantly, where they did not want—to change their responses. We can also report that the set of questions and probes successfully captured the range of experiences that respondents were having as they experimented with e-learning. We wish, however, that we had asked a specific query about their use of PowerPoint.

One of the byproducts of our testing of the campus Weatherstation strategy was a set of first findings presented in detail in our final report, *Thwarted Innovation: What Happened to E-learning and Why*. The underlying message in those findings is it’s high time for e-learning to get real—in a dual sense. Those who promote, fund, and ultimately depend on e-learning need to talk less and succeed more. And those early adopters need to
understand that their success depends as much on a supportive educational context as it does as on the power of the technologies they promote and employ.

Equally important is the message that higher education must be mindful that tracking innovations related to evolving information technologies requires a broad set of tools and methodologies. Neither Wall Street’s market-driven predictors nor academe’s traditional survey-based point-in-time research methodologies is sufficient for understanding the potential impacts of innovation. If our institutions are to remain—or become—competitive for tomorrow’s students, they must learn how to adequately serve the needs of today’s students. Thwarted or not, e-learning is an innovation whose trajectory will be part of all of our futures.

Once a significant number of institutions, including a fair share of market leaders, have determined they need to improve the quality of their educational programs and that e-learning can serve as a means to that end, they will find themselves addressing questions of costs and efficiencies. What adopting institutions will require is a methodology that allows the calculation of the economic contributions and the costs of on-campus e-learning, as well as how those contributions and costs compare to those of more traditional forms of on-campus instruction. Campuses may choose to set up Weatherstations or “listening posts,” or they might find other methodologies to track student and faculty adoption of innovative strategies. The most effective methodologies will be those that enable the institution to track changes over time.

We count ourselves among the pragmatists. We believe the story of e-learning is still unfolding—no one really knows what tomorrow will bring, although we suspect that computer-based learning technologies will continue to serve as a major catalyst of innovation. The underlying information technologies on which e-learning depends are themselves too ubiquitous—and the people attracted to having them serve as learning platforms too smart—for us not to take seriously the prospect that major changes will flow from their efforts.

**Key Questions to Ask**

- What changes will the academy need to make to realize the full potential of e-learning and electronically mediated instruction?
- What methodologies can be used to calculate the costs and efficiencies of e-learning as compared to traditional on-campus instruction?
- How can institutions assess what students really want from e-learning offerings?
Where to Learn More


Endnotes


4. Peter Stokes reported in The Greentree Gazette (March 2004, p. 26), “This academic year more than 900,000 students are enrolled in fully online degree programs at both non-profit and for-profit institutions, generating over $4.5 billion in tuition revenue, according to Eduventures' research. That's a 30 percent increase over last year's total, and nonprofit institutions today serve just under 80 percent of those fully online students. But the share garnered by for-profit postsecondary institutions is growing rapidly—jumping from 15 percent in 2002–2003 to 20 percent this academic year—and threatening to encroach on the nonprofits' tuition opportunity.”


8. Ibid., p. 6.
Definitions of these markets are based on five-year graduation rates, an aggregate measure of the kinds of students an institution attracts, their commitment to completing a college education, and their willingness to pay. For a complete description of these market segments, see “The Landscape—Resurveying the Terrain, Refining the Taxonomy for the Postsecondary Market,” Change, Vol. 33, Issue 2, March/April 2001, pp. 53–56.

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