THE CAMPUS
COMPUTING PROJECT

www.campuscomputing.net

PO Box 261242 Encino, CA 91426-1242 USA
Tel: 818.990.2212 Fax: 818.784.8008
cgreen@campuscomputing.net

WORKING PAPER

TECHNOLOGY AND INSTRUCTION

Compelling, Competing, and Complementary Visions for the Instructional Role of Technology in Higher Education

Kenneth C. Green

A casual stroll in almost any direction on almost any college campus today provides ample evidence of the growing presence of computing and information technology in the college curriculum and as a core component of academic life. Technology has become nearly ubiquitous on college campuses: computers in the library, students and faculty with notebook computers, web site addresses (URLs) on course syllabi and at the bottom of campus signs and wall posters. Today's college students – be they traditional undergraduates matriculating directly from high school, single parents in enrolled as part-time students in community colleges, adults returning to campus for a single course, 45-year old executive MBA students, or school teachers on campus during evenings and the weekend – come to college *to learn about* and also to *learn with* computers and information technology.

Moreover, a small but growing number of today's college students no longer come to campus. The Internet and other technologies have become a catalyst for what many on campus, in corporations, and at "dot.coms" believe will be an explosion in distance and distributed learning: more content, more courses, and more options for more learners from more providers than even the most ambitious and most entrepreneurial might have imaged just a decade ago. The competition for students is moving from physical place into cyberspace: established institutions as well as new, for-profit providers are in the early stages of developing business plans and strategic alliances that amend, extend, protect, and defend what some view as entitlement markets and others see as new market opportunities.

Not surprisingly, faculty are not immune to the potential financial lures of education in the Internet age. On the horizon is an escalating conflict over copyright and content: at some institutions, legal counsel has sent "cease and desist" letters to students employed by companies that post class notes on Web sites; at others, counsel and other campus officials are engaged in conversations with some of the more entrepreneurial faculty who see financial opportunities on the Web as little more than a modest (and logical) extension of their historical prerogative to write textbooks and do consulting.

Welcome to higher education in the wonderful world of the Internet Economy.

Current and coming technologies will throw great light on and concurrently cast large shadows over the academic enterprise. Indeed, both the academic origins as well as the explosive growth of the Internet over the past decade serve to remind us of Clark Kerr's 1963 predictions about the relationship between universities and the (then) emerging knowledge industry and today's knowledge economy:

> what the railroads did for the second half of the last century and the automobile for the first half of this century may be done by the second half of this century by the knowledge industry: that is, to serve as the focal point for national growth. And the university it at the center of the knowledge process (p. 88)

Almost forty years ago Kerr's "City of Intellect" essay in *The Uses of the University* noted the often serendipitous (and occasionally symbiotic) relationship between campuses and corporations in the nascent knowledge industries. Of course what would have been impossible to predict, even a decade ago, is how this relationship now manifests itself in the IPO mentality increasingly common among graduate students in business, computer science and engineering.

Without question the arrival and impact of new technologies, coupled with the growth of the knowledge industries, will serve as a catalyst for sustained, indeed intense debate about institutional missions, mandates, and markets as well as the goals of higher education in the 21st century. Moreover, these private discussions

Kenneth C. Green is the founder/director of The Campus Computing Project and a visiting scholar at the Claremont Graduate University in Claremont, CA. This paper was prepared for a conference on *The Changing American University: The Future of the City of Intellect,* convened by The Center for Ideas & Society at The University of California, Riverside, 17-19 February, 2000.

and campus debates will pushed by the raised voices of *sum ergo* experts – on campuses and elsewhere – who by virtue of their strong opinions, academic affiliations, and access to consensual knowledge claim to understand the impact of information technology on teaching, learning, instruction and the academic enterprise.

There appears to be little argument about the role of technology in the research mission of the university. By consensus, *more is better*, assuming, of course, that some benefactor – the state, a federal agency, a foundation, or a corporate sponsor – will pay for it now and pay again to replace it with something newer, faster, and more sophisticated two or three years later. The Internet and other computer-based technologies have served as the catalyst for significant (and at times often unanticipated) impacts as reflected by new research methodologies and enhanced scholarly communication.

In this context, *the most significant technology challenges ahead for higher education really involve the instructional mission in universities and other sectors of the academic enterprise.*

Moreover, these challenges have less to do with new products (computers, software, networks) and more to do with people – and by extension, institutional plans, policies, and politics: we know today that instructional integration (i.e., bringing technology to the classroom and into the syllabus and learning experience) and user support are the most important IT issues confronting all sectors of higher education over the next two-three years (Green, 1999a).

Consequently, in the context of the instructional mission, the debates on campus and elsewhere about the role and impact of information technology will likely focus on seven issues:

- *Convergence.* How will universities and other sectors of higher education address the converging consequences of enhanced access, lifelong learning and increased technology in the coming decades?
- *Déjà Vu.* Given great aspirations for the role of technology in instruction, what have faculty and administrators learned from the experience with and investments in television and other technologies that began a generation ago?
- *High Tech vs. High Touch.* Does technology depersonalize higher education, or save it?
- *The Productivity Conundrum.* Given the increasing external pressure for productivity, who decides which definition of productivity applies to the academic enterprise?
- *Assessment.* What models do we use and how do we address questions about assessment and outcomes that involve information technology?
- *The Dilemma of Distance Learning.* Will the exploding demand for distance and distributed education dilute the learning experience or foster increased access?
- *Faculty Visualization.* Enough about the sweeping campus *vision* statement for technology: the increasingly critical question is how individual faculty *visualize* themselves using technology in their instructional and scholarly work.

This list is not necessarily complete. For example, an obvious omission is strategic and financial planning for information technology: the recurring costs of technology that currently (and continually!) confront all institutions highlight the fact that the financial models governing fiscal management and financial strategy in American colleges and universities are badly broken and require massive overhaul (Green, 1998, 2000a). Perhaps the growing awareness about the recurring costs of IT investments and infrastructure, much like the recurring institutional investment in student aid, will be a catalyst for real reform in the budget models that govern not-for-profit organizations, including colleges and universities.

Also missing from this list is the much-discussed digital divide, an issue of growing public (policy) discussion. Yet in academe there is another less-discussed dimension of a digital divide: a chasm that involves technology resources and technology integration into the life of individual departments and institutions. While this chasm has its metaphorical roots in C. P. Snow's two-culture problem, it extends well beyond to include the gulf that separates technology resources across campus and across institutions (Green, "What is Information Technology in Higher Education," *in press*).

Too there is the potential for increased Oedipal aggression in the classroom as students use the Internet and the Web to challenge faculty on content, bringing into classes and office hours copies of their e-mail correspondence with the authors of articles assigned as part of the syllabus (Green, 2000b).

But these three omissions notwithstanding, the seven instructional mission issues cited above are clearly significant matters that will be debated and discussed in the weeks, months and years ahead. Although these issues involve the application and integration of information technology across all segments of the academic enterprise, these are not traditional (and therefore easily isolated) "bits and byte" matters easily delegated to the technical experts who design networks and track new technologies: rather, the

list above touches on core issues at the heart of the instructional mission ahead for virtually all institutional and departmental segments of the academic community in the 21st century.

Convergence

Convergence is the current buzzword of the Internet era. The *digeratti* speak of convergence with reference to computers, telecommunications, media, and content and more – all delivered through the Internet to desktop computers, mobile notebook computers, personal digital appliances (PDAs) and cellular phones.

Yet in academe there are other convergence factors at play – specifically the convergence of great aspirations. Unfortunately, many faculty and administrators have forgotten the old Chinese greeting or curse, "be careful what you wish for, as it many come true." In fact, three things at the top of Academe's wish list for the past three decades – increased access, lifelong learning, and information technology – are indeed coming true. Sadly, the campus community is largely unprepared for the converging consequences of these events.

Increased Access. In both developed and developing nations there is growing demand for access to higher education. In the United States, the proportion of recent high school graduates entering college has risen from just over half at the beginning of the demographic downturn of the early 1980s to almost two-thirds today. Rising demand – coupled with rising expectations – has been pushed by an escalating set of demographic, economic, and social factors.

Indeed, one of the ironies of the current economy is increased enrollment *and* high employment. This confounds the conventional wisdom that college enrollments rise with increased unemployment and decline with high employment. The declining unemployment in the US in recent years has done nothing to damper the demand for higher education among recent high school graduates.

Too, we are learning that access involves more than just the number of students on a campus or seats in a classroom. For example, in California there is evidence of growing anger among a generation of UC alumni – the first generation of beneficiaries of the 1960s Master Plan – that the increased competition for undergraduate admission to the UC campuses will preclude their children from attending the state university. These parents join other groups who, historically, have felt excluded from the UC system.

LifeLong Learning. We – and our students – confront a future of not one job or career, but many. Growing numbers of adults – many with college degrees, many without – are coming to universities, colleges and to other "postsecondary providers" for new kinds of education and certification. Individuals and employers alike have come to recognize that the bachelor's degree is not the end of the educational journey, but just another milestone.

But the new demands for lifelong learning have placed new demands for services on various segments of the higher education community. For example, consider the estimated 300,000 individuals employed in Southern California's aerospace and defense industries who lost their jobs in the mid-1990s: many already have two or three college degrees and do not want or need yet another one. Rather, they want and need specific content and certification – Java to replace Fortran; HTML to replace Cobol; accounting and other management courses to replace engineering and physics.

To date universities generally have not provided "unbundled" content; they have placed these offerings at the periphery in business schools and engineering programs via Executive Education, Extension Programs and other services. In contrast, community colleges understand the demand for unbundled content and certification: an estimated one-fourth of the individuals taking courses in community colleges in California already have a college degree (Cohen, 1998).

Information Technology. Information technology is now ubiquitous across and beyond higher education. It's not just the computers, the Internet, or the World Wide Web: it is the *aggregated presence* of these technologies in virtually all facets of daily life across so many sectors of the (American) economy that makes the difference. Higher education's clientele – students from ages 17 to 67 – now come to campus expecting to *learn about* and to *learn with* technology.

For universities and for other segments of the academic enterprise in both the United States and around the globe *access*, *lifelong learning*, and *information technology* are the very much the things we have wish for; moreover, they are very much part of the new realities of higher education in the 21st century.

Now that we have it, what do we do? Truth be told, despite an endless number of conferences, journal articles, policy documents, and strategic plans, the evidence indicates that as an "enterprise," universities (like other segments of higher education) are largely unprepared for the consequences of this convergence. We know we confront more traditional students, more adult learners, and more technology. Yet to date much (if not most) of the writing and planning that addresses these issues seems conventional, piecemeal, and dated. Like aging generals, much of the academic leadership seems to be planning for the last war, not the current one.

High Touch vs. High Tech

John Naisbitt's 1982 bestseller, *MegaTrends*, introduced most of us to what Naisbitt described as the inherent tension between *high touch* and *high tech*. Updating the classic physics lesson that "every action as a reaction," Naisbitt observed that "whenever new technology is introduced into society, there must be a counterbalancing human response – that is, *high touch* – or the technology is rejected. The more high tech, the more high touch," wrote Naisbitt in the first paragraph of the *MegaTrends* chapter titled "Forced Technology → High Tech/High Touch." Even if you never read Naisbitt's book, the power of this metaphor created an instant shorthand which has entered the common language used by many in the business, education and technology communities.

Of course Naisbitt's book, like many others from that pre-Internet era, was laden with language about the coming (if still unfulfilled) role of technology in education. It is language that seems painfully familiar today. "Computers," wrote Nabritt in 1982, "offer a cost effective albeit capital intensive way of individualizing education… Computers simplify the extensive record keeping required for individualized instruction [and] familiarity with computers is now considered a strong vocational advantage, a salable skill."

But "high tech vs. high touch" is what many are most likely to remember from *MegaTrends*. Then as now, it successfully captures the tension many faculty and administrators experience firsthand given the aspirations for and introduction of technology resources into the daily activities that involve teaching, learning, instruction, and scholarship.

Indeed, in some parts of the education enterprise, both K-12 and higher education, the lines between *high touch* and *high tech* are clearly drawn. Some in the educational community view technology as the resource that will literally save education from its worst sins – rising costs, inefficient and ineffective delivery, and intangible outcomes. In contrast, others see technology as a digital demon, impersonalizing the educational and learning experience and enslaving faculty even as institutions and administrators prosper via the digital dissemination of intellectual property.

The core premise of *high touch* in higher education was articulated more than 125 years ago by Williams College alumnus James A. Garfield, later the 20th president of the United States. Historian Fredrick Rudolph writes that Garfield, "responding to a professor's complaint … that Williams College was falling the times" defended his beloved alma mater by stating that "the ideal college is Mark Hopkins [William's president] on one end of a log and a student on the other" (Rudolph, 1990, p. 243).

So well before tin cans and string became the icon of the telephone (or later, the campus computer network), the powerful image of "Mark Hopkins and the log" entered the academic lexicon as a symbol of an idealized, "high touch" college experience. Moreover, it was offered as a strong response to concerns about a campus perceived to be "falling behind the times"

Are things really so different today? Then as now, individuals concerned about education debate the consequences of "falling behind the times." Today, of course, much of this discussion is about the appropriate role of technology — as a resource for instruction and as a component of the curriculum.

Clearly what lies ahead in many parts of the education community is a continuing contest between *high touch* ("Mark Hopkins and the log") vs. *high tech* (video, television, computers, the Internet and the Web as teacher, tutor, oracle, and information gateway). For some in the academic community, these are inherently conflicting constructs; "high touch" advocates fear that the arriving technologies will undermine what many deem best about traditional instructional practices and academic experiences – the personal contact between learner and teacher and among students. For others, the arrival of "high tech" instructional represents what they view as the best hope for revitalizing education and enhancing teaching, learning, and instruction. In between are the vast majority faculty and administrators who struggle to assess the appropriate role of technology in their classrooms, their professional work, their scholarship, and the priorities of their schools and colleges.

Yet these are not mutually exclusive choices. Indeed, most faculty will opt for a third way, traveling an intuitive and personal footpath that navigates between *high touch* and *high tech* to create a highly personal, *hybrid* approach. They will find a way to integrate, at a very personal level, in their classrooms and in their professional activities, the old with the new, the best of the traditional practice with the best of what's coming.

Admittedly, this is not a new observation. For example, Allen Hirschfield's 1980 *Change* essay, "Education's Technological Revolution: An Event in Search of Leaders" speaks to one of the key IT challenges currently confronting the campus community: "getting a new method of instruction adopted widely requires thousands of faculty members to make *individual* decisions to use the new method." (p. 48; original emphasis).

In the final analysis, engagement with technology is a personal decision. Engagement involves the choices that individual faculty make about how to use

technology resources in their classrooms, their teaching, and their instructional activities. And in the final analysis, tens of thousands of college faculty will develop a their own hybrid strategy to IT that brings their students the best of both worlds – the benefits of high touch *and* high tech.

Déjà Vu?

Part of what seems to trouble many in the campus community – technology advocates, antagonists, and agnostics, as well as academic administrators – about the current claims for and continuing investments in computing and technology is a sense that we have been here before. And indeed, one not need spend too many hours in a library, let alone on the Internet, before the easy sound bites – remembrances of things past – emerge.

More than thirty years ago Stanford's Patrick Suppes, an early and well-respected innovator in the area of computer-assisted instruction, articulated a vision for computers in education that, with some minor editing, could serve today as the vision statement for both conference presentation and also campus technology plan:

> Both the processing and the uses of information are undergoing an unprecedented technological revolution. Not only are machines now able to deal with many kinds of information at high speed and in large quantities, but it is also possible to manipulate these quantities so as to benefit from them in new ways. This is perhaps nowhere truer than in the field of education. One can predict that in a few years, millions of schoolchildren will have access to what Philip of Macedon's son Alexander enjoyed as a royal prerogative: the services of a tutor as well-informed and as responsive as Aristotle. (Suppes, 1966).

Suppes' vision, published in *Scientific American* in 1966, clearly hits the high notes that drive much of the current campus discussion, engagement and investment: more powerful computers, more content, more interaction.

In contrast, consider a 1972 *Change* editorial by founding editor George Bonham about the failures of television in education:

> For better or worse, television dominates much of American life and manners…. Part of [the] lackluster record of the educational uses of television is of course due to the heretofore merciless economies of the medium. But profound pedagogic mistrust of the medium also remains a fact of life. The proof of the pudding lies in the fact that on many campuses, fancy television equipment…now lies idle and often unused…. Academic indifference to this enormously powerful medium becomes doubly incomprehensible when one remembers that the present college generation is also the first television generation. Television has shaped much of their lives and attitudes, and taught them much of what they know. (Bonham, 1972, p. 11).

Use the "find/replace" feature on your word processor to substitute *computers* for *technology* or *television* and Bonham's terse assessment speaks directly to many of the instructional challenges (and some might say instructional disappointments) colleges and universities confront in the Internet era. The recommendations Bonham offered almost thirty years ago – set national goals for the appropriate uses of television, cooperate with Federal agencies to translate goals into public policy and practice, begin national pooling of instructional resources, and assess the economics of instruction with television – may seem strangely familiar when the newly formed Congressional Commission on Web-based Education releases a final report and supporting documents in November, 2000. *Plus ca change!*

Too, Bonham's 1972 editorial, read with near-perfect hindsight in 2000, also reminds us that there is a wonderful irony at play in college classrooms across the country these days. The "first television generation" as described by Bonham in 1972 now represents the core of the today's college faculty. In contrast, today's "traditional" college students, aged 18-22, are the children of the computer: they were born around or after 1980, the year *Time Magazine* tagged The Computer as its "Man of the Year").

Admittedly, it is almost too easy to cite George Santayana under these circumstances: "those who cannot remember the past are condemned to repeat it." No doubt many will. But the appropriate metaphor is less a circle than a cylinder. The mantra of the Internet era is that "The Internet changes everything!" Yet the reason "the Internet changes everything" is that in the Internet age, there are few precedents for *anything*. Admittedly, while there are *similarities* among the technologies represented by television and computers, the technologies – and the implementation challenges of integrating these technologies into collegiate teaching, instruction, and learning – are not identical.

The Productivity Conundrum

Often ambiguous notions of *quality* and *productivity* cast a long shadow over both public and private conversations about the role of information technology at all levels of education and in all sectors of the campus community. This is not surprising, given the great aspirations among many – teachers and college professors, school principals and college administrators,

parents and public officials – for what technology might/could/*should* do to enhance teaching and learning.

Quality, of course, has long been an ambiguous and difficult term in the public and private conversations about higher education. More than thirty years ago, Robert Persig's *Zen and the Art of Motorcycle Maintenance* echoed publicly the concern (and the complaint) of many in academe: searching for an absolute measure of quality, painfully conscious of his own experiences as both graduate student and as young faculty member, portions of Persig's journal and travelogue actually scream at us, asking "what the hell is quality?" What are the real and true attributes of quality in higher education, Persig asks? Is it only found among the elite institutions? If so, what does that suggest about learning experience at "other" colleges and universities.

How fortunate that we can turn to economists to help us resolve any potential ambiguity regarding the definition of productivity. Alas, productivity may be a new concept for most in academe, at least in the context of institutional values and priorities. But productivity is a certainly a core concept for our colleagues in economics.

Economists seem to agree that there are three components of productivity: cost, quality, and quantity. And they also seem to agree (if they agree on anything) that there are three circumstances under which productivity occurs:

a) the cost of production *declines* while quality remains constant (i.e., it costs less to produce each widget);
b) the cost of production is *stable* while quality *improves* (i.e., each widget costs the same to produce but the firm produces a much better much widget);
c) the cost of production *declines* and the quality *improves* (i.e., the firm produces better widgets and it costs less to do so).

Admittedly, most college professors do not think of themselves as "widget" producers; most do not view their departments or institutions as "widget" factories. We are academics, *ergo*, we teach and we are engaged in scholarship. Production models of and manufacturing metaphors for education are generally offensive to most college faculty.

But in the emerging new world of order of higher education, it is increasingly clear that *costs* – college costs, operating costs and "production" costs – really do matter. And in the emerging new world order of higher education, some of the new conversations about the *benefits* of technology often migrate into some discussion about the link between technology and productivity. Casting a shadow over these discussions is that under traditional economic models, investments in technology are supposed to improve productivity, which means that quality goes up and costs come down.

Certainly elements of these issues are at play today on college campuses and in public policy discussions. A recent example comes from the January 1998 report of The National Commission on the Cost of Higher Education. The Commission identified productivity as a top priority for American colleges and universities. While not explicitly citing technology as a potential solution for some of the productivity challenges confronting higher education, the language of the Commission's recommendations points in that direction:

> The Commission recommends the creation of a national effort led by institutions of higher education, the philanthropic community, and others to study and consider alternative approaches to collegiate instruction which might improve productivity and efficiency. The Commission believes significant gains in productivity and efficiency can be made through the basic way institutions deliver most instruction, i.e., faculty members meeting with groups of students at regularly scheduled times and places. It also believes that alternative approaches to collegiate instruction deserve further study. Such a study should consider ways to focus on the results of student learning regardless of time spent in the traditional classroom setting.

In this context, state initiatives such as the Michigan Virtual University and the Western Governor's University reflect, in part, an assumption that technology can be used to expand educational access and reduce educational costs: state officials hope to offer more opportunities for more potential learners by investing in bits and bytes (content and technology), rather than mortar and bricks, as a new form of infrastructure for higher education. Concurrently, faculty across all types of colleges argue that technology is part of the new infrastructure that enhances the quality of content available to their students – wandering the stacks *and* surfing the Web. Investments in technology are essential to support student and faculty access to online resources – to enhance the quality of teaching, learning, and scholarship.

So here's the conundrum: who decides which definition of productivity should apply in institutional and public policy discussions about productivity in higher education? Cost-conscious administrators and public officials might support technology because of the potential to reduce costs – often labor (i.e., faculty) and other direct operating costs. In contrast, faculty might

argue that the appropriate perspective is one that leaves funding constant but focuses on quality – technology as the catalyst that enhances how and what students learn.

Must we choose between one or the other – between definitions of productivity that focus exclusively on costs vs. quality? Unfortunately, this is where the conversation about productivity begins to get personal and also begins to look and feel like our public and private conversations about quality. Our colleagues in economics may be able to define productivity, but they cannot tell us which definition is most appropriate under what circumstances.

And it is a conundrum. Like the old Miller Lite beer commercials (tastes great; less filling) we are, perhaps, destined to argue about productivity in terms of quantity (reduced costs) vs. quality (better content and instruction). Concurrently, we each will search for evidence that supports the perspective we endorse: some will focus on the potential of technology to reduce the *costs* of education, while others will emphasize the potential of technology to enhance the *quality* of teaching, learning, and an expansive definition of scholarship.

These debates promise to make for engaging faculty meetings and to offer some interesting academic theatre. But it is questionable if these debates really contribute to good institutional or public policy. Be assured, however, that these issues, joined at the hip, will cast a significant and continuing shadow over our public and private conversations about the appropriate role of technology across all levels of education in the coming years.

Instructional Outcomes: The Continuing Quest for Significance

Perhaps the most distressing aspects of the current campus conversations about and investments in information technology center on assessment and outcome issues. Reduced to the most direct concerns of parents, faculty and public officials, the key question is "does technology really make a difference?" Do students really "learn more" or "learn better" with the use of technology tools and technology-based instructional interventions? In essence, what we really want to know is if technology helps to improve learning – or if not learning, then at least standardized test scores: if so, by how much. .

Using traditional assessment models, it is clear that over time and even to this moment the research literature is ambiguous, at best, about the impact of various technologies on learning outcomes. A pre-computer tome, *The History of Instructional Technology*, published in 1968, sets the stage for future assessments about the impact of IT on learning: "The general conclusion from among all this research was that no significant difference was found among the treatment comparisons and, when significant differences were obtained they seldom agreed with other findings on the same problem." (Sattler, 1968, ch. 15). It is an assessment generally affirmed in a major review of the (largely non-computer) literature published by Richard Clark in 1984 and more recent summaries that include some studies of computer-based instruction (Russell, 1993; Van Dusen, 1997).

Indeed, an early foray into the contentious debate about the "no significant differences findings" involving technology appears as a chapter titled "Will Information Technologies Help Learning?" published as part of the 1973 Carnegie Commission report, *Colleges in Context*:

> Were it not that the "no significant difference" findings fly in the face of common sense and other myths, one might dismiss technology as irrelevant to learning. But who can deny the impact of printing technology on learning? … No-significant difference findings confirm the fact that research on schooling is inadequate. They do not belittle the impact of technology on learning. The differences sought are generally differences in performance on tests of a subject's capacity to reproduce accurately information supplied by a teacher or teaching instrument in a formal school setting (Oettinger and Zapol, 1973 p. 296-297)
>
> The absence of significance differences has a very significant positive implication, namely that learning as now measured is largely independent of the details of means and hence that issues of technology and policy on one hand and of learning methods on the other must be resolved on other grounds. *No significant difference findings leave wide open alternatives to the accepted ways of schooling, alternatives that might, according to some public preference, reduce costs, increase individualization, or offer some other dominating personal or social benefit without, at the very least, making any difference as far as measurable learning performance is concerned*. (*ibid*, p. 298; original emphasis)

A decade later, just as microcomputers were beginning to arrive on campus and the notion of the "computer revolution in higher education" had become the topic of easy predictions and conference plenary sessions, Richard Clark's essay in *The Review of Educational Research* offered another assessment of "no significant effects" for the impact of instructional media:

> The best evidence is that media are more vehicles that deliver instruction but do not influence student

> achievement any more than the truck that delivers our groceries cause a change in nutrition…. Only the content of the vehicle can influence achievement. (Clark, 1983, p. 445).

One decade later, following admittedly primitive but nonetheless much broader experience using desktop computers, a 1993 review offers a somewhat similar conclusion:

> No matter how it is produced, how it is delivered, whether or not it is interactive, low-tech or high-tech, students learn equally well with each technology and learn as well as their on-campus, face-to-face counterparts even though students would rather be on campus with the instructor if that were a real choice (Russell, 1993, p. 2).

Consequently it is not surprising that *high-touch* advocates cite the continuing "no significant differences" literature to question institutional investments. *High-tech* enthusiasts point to primitive assessment tools, noting the current mandates by accrediting agencies and others to focus on outcomes as well as the absence of proven and widely deployed methodologies to do so. Advocates also point to the changing nature of the technologies that are increasingly interactive and that provide more (and they argue richer) content.

But here, as elsewhere, we have too often ignored past voices and wisdom. Three decades ago, then Harvard professor Patrick Daniel Moynihan told a House subcommittee in 1971 that "things [in education] are far more complicated than we thought. The rather simple input-output relations which – naively no doubt, but honestly – we assumed to obtain in education simply, on examination, do not hold up" (Moynihan, 1971). Moynihan's topic was not computers but rather *The Coleman Report* and related educational research, This insight, accurate then, remains informative for our current assessment efforts.

Thirty years later, we remain, to use Moynihan's words, both honest *and* naï ve. Yet there is good work that deserves wider reading. Indeed, some of the best work on the impacts of technology in the learning experience was done almost a decade ago by Robert Kozma and Jerome Johnson at the University of Michigan. Although their work precedes the Internet and World Wide Web by several years, it nonetheless remains valid and valuable in the Internet era.

Kozma and Johnson present compelling evidence, drawn from case studies that focus on several of disciplines at a number of campuses, about the role of information technology as a catalyst for (or enabler of) the qualitative enhancement of the learning experience. They identify seven ways, summarized below, that computing and information technology can be used in the transformation of teaching, learning, instruction, and the curriculum:

1. "*From reception to engagement.* The dominant model of learning in higher education has the student passively absorbing knowledge disseminated by professors and textbooks…. With technology, students are moving away from passive reception of information to active engagement in the construction of knowledge."
2. *"From classroom to the real world.*. Too often students walk out of class ill-equipped to apply their new knowledge to real-world situations and contexts. Conversely, too frequently the classroom examines ideas of the context of gritty real-world considerations. Technology, however, is breaking down the walls between classroom and the real world."
3. *"From text to multiple representations.* Linguistic expression, whether text or speech, has a reserved place in the academy. Technology is expanding our ability to express understand, and use ideas in other symbol systems."
4. "*From coverage to mastery.* Expanding on their classic instructional use. Computers can teach and drill students on a variety of rules and concepts essential to performance in a disciplinary area."
5. *"From isolation to interconnection.* Technology has helped us to move from a view of learning as an individual act done in isolation toward learning as a collaborative activity…. And we have also moved from the consideration of ideas in isolation to an examination of their meaning in the context of other ideas and events."
6. *"From products to process.* With technology, we are moving past a concern with the products of academic work to the processes that create knowledge. Students… learn how to use tools that facilitate the process of scholarship."
7. *"From mechanics to understanding in the laboratory.* The scientific laboratory is one of the most expensive arenas in the academy. It is also limited as a learning experience. So much time is required to replicate classic experiments… that there is little time left to explore alternative hypotheses as real scientists do" (Kozma and Johnson, 1991, pp. 16-18).

This work teases out some of the complex variables at play in the current environment. This work also stands as a reminder that we need more sophisticated models for assessing learning outcomes. As recently suggested by Robert Silverman, editor emeritus of *The*

Journal of Higher Education, the model that has provided the conceptual basis for much of the research activity about higher education (and by extension, almost all of education) including learning outcomes, is no longer viable:

> The industrial model no longer should have currency in the way we think, or in many social institutions and their cultural practices. Were this to be true for the research literature in higher education. And it better be the case if the ground of our research questions relate effectively to the larger social and cultural parameters with which higher education engages. Simply put – we need to raise research questions that not only allow us to know, but which focus on creating/adopting/and engaging in macro thematics, understand the complexity of our environments and contexts, and foster a deeply appreciative relationships among persons. (Silverman, 1998, p. 6)

What emerges is a clear and growing sense that we need better models, methodologies, and data to pursue these assessments. Consider that despite massive corporate investments in information technology during much of the 1980s and early 1990s, the evidence for the impact of these investments on productivity over the past two decades was ambiguous, at best. Only in the past two years have researchers begun to tease out a technology factor in the rising productivity in the American economy. So too, it will take time, better data, and more sophisticated strategies for assessment to help us in academe better understand the impact of technology on teaching and learning.

The Dilemma of Distance
And Distributed Learning

The evolution of American higher education has been an organic process: over time new institutions emerged to assume new roles and functions, reflecting the changing nature of American society and the nation's changing demands for higher education. Much like the evolution of cells in an organism, the core cells often split, then assume specialized functions. And this model largely describes the history of the American college and university. At each step along the way over the past 360 years, new kinds of colleges – specialized cells – have emerged as derivatives of an existing (often dominant) enterprise, expanding the definition, the mission, and the clientele of the educational and social institution we know as American higher education. Without question we have come a long way from the day, circa 1636, when ten young men took a longboat across the Charles River from Boston to Cambridge to become the first students at the college that would become Harvard.

This abridged history lesson reminds us that American higher education evolves – and continues to so. As we enter the 21st Century we are again witnessing a significant *evolutionary* event in American higher education, one that has consequences for all institutional sectors of the academic enterprise. This event is the emergence of distance learning and distributed education, a phenomenon fostered to a large degree by the three convergence issues cited above: increased access, lifelong learning, and information technology.

Distance learning is not new to the academic enterprise: its roots are found in the agricultural extension programs begun by the land grant universities in the years following the Civil War. Moreover, today many institutions engage in various forms of distance learning – ranging from extension programs in metropolitan areas (e.g., UCLA) to degree programs serving farm families in the Midwest (St. Mary's-of-the-Woods College in Indiana).

Technology transforms traditional notions of *distance* education into various formats for *distributed* learning. Definitional boundaries shift, as do the locales and demographic characteristics of the learners. The population involved in distanced and distributed learning now ranges from residential students talking extra classes on-line to adults who do "class work" from homes, hotel rooms and corporate offices.

Too, the potential market for distributed learning is expanding. For example, some colleges may wish to purchase distributed learning courses developed by other institutions (or commercial providers) to supplement current offerings. These institutional arrangements may solve the problem of the "last German professor" at a liberal arts college or may provide a new course on electronic commerce for the undergraduate business students attending a small, rural state university.

But the real tension in distance and distributed learning is not about the institutional arrangements to share curriculum. Rather, it involves the real market for distance and distributed learning among the rising tide of adults as lifelong learners who want courses, certificates, and degrees – as well as *convenience* – as part of their educational experience. Moreover, the tension is fostered by an assumption of potentially easy money on the part of some state and campus officials and also the entrepreneurs in seemingly an exploding number of for-profit firms entering the distance/distributed/online learning market. Indeed, there is this growing *eureka!* mentality on campuses and among many Internet start-ups that the distance and distributed learning market will be easy and very

(very?!) profitable. The specter of potential profits excites some and concerns others (Green, 1997).

However, the infusion of information technology into distance learning – primarily the Internet and the Web, but other technologies as well, creates a new set dilemmas for many academic programs and institutions. The instructional mission of higher education historically centers on *content*, *context*, and *certification* (Green, 1999c). Understandably, many in the campus community are concerned that *convenience* supplants context in the expanding world of distance and distributed learning.

Consider, too, the widely cited *New Yorker* cartoon: "On the Internet no one knows you are a beagle." If so, then how then does one differentiate the *context* of an Internet educational experience from Harvard, Chicago, Michigan, Berkeley, or the University of Phoenix? Absent logos and color schemes (part of what the technology community calls the "user interface") where's the *context* of a college education delivered over the Web? What happens when state systems build instructional cartels for distance learning, assigning individual campuses in the state responsibility for developing the online offering in astronomy, psychology, and economics?

Concerns about context are also colored by the (unfounded, some might say uninformed) assumptions of many public officials that on-line education will be add sufficient (and inexpensive) capacity to serve the growing demand for higher education. Stated simply, it will notcome easily and it will not come cheaply (Green, 1997).

Vision and Visualization

Some of the campus conversation about technology often focuses on *vision* – what is the campus vision for the role of information technology in research, scholarship, teaching, and instruction, Indeed, campus vision statements are proliferating on the Web as colleges and universities have used the millennium event as a catalyst for "Acme University 2000 Plans" which outline and update institution mission and mandates (and also provide a foundation for new capital campaigns!). Yet too often these are little more than vacuous vision statements that do little to more than make passing (if redundant) references to the growing role of technology at Acme University: typically these statements fail to provide a real institutional vision – plus the accompanying strategic, instructional and financial plan – for information technology.

What accompanies institutional vision is individual visualization. Indeed, *visualization* (much like infrastructure) is a key factor in the IT implementation process. Visualization ultimately enables individual faculty to bring technology into their scholarly work and instructional activities.

Visualization? As consumers we routinely engage in visualization every time we walk into a clothing store. We look at the clothes and perhaps touch the fabrics. We imagine ourselves wearing a particular clothing item – a suit or jacket, a dress, skirt or pair of pants; a certain colored or patterned shirt or blouse; a tie or sweater – in specific settings and as part of the items we might identify as "our wardrobe." And as we visualize, we ask ourselves a series of questions: how do I look in dark gray or tan? can I wear stripes or bold prints? will this compliment other items in my closet? is it too fashion forward or perhaps a too conservative? I've never bought/always bought stuff like this before; how will my spouse/children/friends and colleagues/ others react when they see me wearing this? Is it me? Is it *really* me?

In the context of the continuing campus conversations about technology in the college classroom, it is a safe guess that large numbers of faculty began their adventures in cyberspace by first visualizing themselves sitting in front of a computer, then later visualizing their efforts using IT in the syllabus and the classroom.

Of course many of today's college faculty – baby boomers who were to become academics – had little exposure to computers during their undergraduate and graduate training in the 1960s and early 1970s. For both humanists and qualitative social scientists, technology skills clearly were not part of the academic portfolio developed during graduate training. If anything, many of us often (and easily!) visualized the ways we could *avoid* computers: we were not "computer types" we told ourselves. We could not see ourselves using computers on a routine and regular basis.

The dramatic changes in computers and information technology (IT) over the past 20 years now means that many of us in academe have come to use computers and depend on IT resources in ways we could not have imagined during our graduate training two and three decades ago.

For the early adopters and those who followed, the first steps into the new, allegedly "user friendly" world of personal computers in the early 1980s often involved a visualization experience – seeing yourself sitting in front of an Apple II, IBM PC or Macintosh, navigating the keyboard and successfully avoiding the keystroke sequence that would crash the machine, erase your work, or blow up some metropolitan area.

However the visualization experience also had other ramifications. It meant that suddenly thousands of academics who never thought of themselves as

"techies" were now acquiring technical skills and doing computer "stuff." In the years following the arrival of the first microcomputers on college campuses, growing numbers of "tweeds" – primarily but not exclusively academics in the humanities and the social sciences – slowly became "techies." And often they did it without much formal IT training or institutional assistance. Rather, the early adopters usually muddled through, investing lots of time to learn more about the hardware, software and computer networks that seemed to offer great potential for their scholarly work and instructional efforts.

But for many others, visualization as the first step into cyberspace has not been successful. Many faculty have found it very difficult to visualize themselves using various kinds of technologies, in particular IT in the classroom and as an instructional resource: "That's something the techies do, something that Paul or George or Susan does. But I'm not a techie and it's not something that I can do easily or comfortably. After all, I'm not like Paul, George, or Susan. I don't have their IT interests or skills; I don't teach the way they do."

Alas, the *inability* of many faculty to identify with early adopters says much about the IT challenge ahead for many individual faculty and also for many academic programs and individual institutions.

Somewhere in the continuing discussion about integrating IT into the curriculum and the classroom, the undocumented "consensual wisdom" began to suggest that successful IT implementation really depends on a small, "critical mass" of faculty who will serve as role models for their peers. But the diffusion and innovation literature, plus our individual experience, together inform us that this small "critical mass" of early adopters really is different from the rest of us. The rest of us have trouble visualizing ourselves working as they do, using IT resources the way the "techies" do. The "techies" may well be our friends and departmental colleagues; but often they are not the individuals we use to benchmark our own IT skills and preferences.

So the consensual wisdom about critical mass seems wrong. Rather than a critical mass of early adopters, it is IT infrastructure that really fosters IT innovation and IT integration for the rest of us. It's when my real peers – Allison, Andrew, and Jim, *people like me* – begin to use IT that the rest of us notice and begin to benchmark their behavior and IT skills against our own.

For the Allisons, Andrews, and Jims of the academic world, IT also infrastructure plays a critical role. Infrastructure involves hardware and software, computer networks, user support and continuing training, library resources, and more. It also involves recognition and reward – expanding the algorithm used in faculty review and promotion to incorporate (but not require) a technology component (Green, 1999a, 1999b).

While we need the early adopters, their presence alone does not assure IT innovation and instructional integration in academic programs and institutions. The rest of us must be able to visualize ourselves using IT in our scholarly and instructional activities. And here our true peers are not the early adopters and IT advocates, but the people "like us" who struggle with IT – operationally, pedagogically and perhaps even philosophically – almost every day. As the rest of us visualize our own adventures in cyberspace we need to know that our departments and our campuses are building and sustaining the IT infrastructure – hardware, software, networks, user support, online resources and recognition – that will support both our efforts and our aspirations.

Digital Light or Digital Shadows

What lies ahead for universities and other sectors of higher education? What consequences will technology have on the instructional missions and mandates of universities and other segments of the higher education enterprise? An extreme view of the future has been offered by management sage Peter Drucker:

> universities won't survive… higher education is in deep crisis. Already we are beginning to deliver more lectures and off-campus via satellite or two-way video at a fraction of the cost [of traditional courses]. The college campus won't survive as a residential institution. Today's [college] buildings are hopeless unsuited and totally unneeded (Drucker, 1997)

Of course invitations for conversation about the "current crisis" in higher education will always draw strong response. Whether the current crisis, as cited by Drucker, is deeper than others (past, present, perceived) is open to debate. We can also debate what role, if any, technology plays in this actual or perceived crisis.

Yet universities and residential colleges will not vanish in the next two, three or even four decades. With all due respect to Prof. Drucker, the simple proof, of course, is probably to ask where he wants his great-grandchildren to attend college when they spend the trust-fund money. My guess is that he would likely cite the kinds of institutions where he held faculty appointments – institutions like Bennington, New York University and the Claremont Colleges, as opposed to Western Governor's University, UNext, or Jones.

Similarly, it is increasingly apparent that colleges and universities have little to fear from Disney and Microsoft or other technology and entertainment/

infotainment firms that have been demonized as potential providers of college courses and degrees. Although once identified as potential competitors, these firms (and others) will continue to offer and certify certain kinds of training. Certainly campus-corporate alliances in the distance and distributed market will be an important part of the broad educational landscape in the coming years. But it seems highly unlikely that technology will provide the core tools or key distribution channels that will make these firms serious competitors in the evolving world of higher education.

That said, it is clear, however, that technology will play a major role in the university of the 21st century, as it will in other segments of the academic enterprise. On the research side, new technologies will offer great opportunities to explore new fields and also to return to established canon with new tools and perspectives. But as noted above, few are concerned about the impact of information technology on research and scholarship. Here is virtually all might agree that more is better (just show us how to pay for it).

It is the impact of technology on the instructional mission of the university and technology as a catalyst for new markets for university education that captures growing attention and concern. We can only speculate how much the mantra of the Internet economy ("the Internet changes everything") applies,. What we do know is that the reason the Internet changes everything *– because there are few or no precedents for anything –* certainly applies in our discussions about the potential impacts of information technology on the instructional mission and mandate of the university in the 21st century.

References

Bonham, George W. Television: the unfulfilled promise. *Change*, February 1972, 11-13.

Clark, Richard, Reconsidering research on learning from media. *Review of Educational Research* (**53**, 4), 1983

Cohen, Arthur M. *The Shaping of American Higher Education.* San Francisco: Jossey-Bass, 1998.

Drucker, Peter. Still the youngest mind. *Forbes*, 10 March 1997

Gillespie, Robert A., and Dicaro, Deborah A. *Computing and Higher Education: An Accidental Revolution.* A report prepared for the National Science Foundation. Seattle, WA: The University of Washington, 1981. Available through the ERIC System: ED205068.

Green, Kenneth C. *Campus Computing, 1999: The National Survey of Computing and Information Technology in American Higher Education.* Encino, CA: Campus Computing, 1999a.

Green, Kenneth C. First to the ball room, late to the dance floor. In R. Katz and D. Oblinger, (editors) *The "E" is for Everything: E-Commerce, E-Business, and E-Learning in the Future of Higher Education.* San Francisco: Jossey-Bass, 2000a.

Green, Kenneth C. On content and contentiousness. *Converge*, August, 2000b.

Green, Kenneth C. Review, promotion, and the pogo problem," *Converge*, July 1999b

Green, Kenneth C. What is information technology in higher education? In C. Frances, F. Jewett and Associates, *Information Technology and the Costs of Instruction in Higher Education in press.*

Green, Kenneth C. When wishes come true. *Change*, March/April, 1999c.

Green, Kenneth C. Drawn to the light, burned by the flame? Money, technology and distance education. *ED Journal*, May 1997.

Green, Kenneth C. and Jenkins, Robin IT financial planning 101. *NACUBO Business Officer*, March 1998.

Hirschfield, Allen F. Education's technological revolution: an event in search of leaders. *Change*, November/December 1980, 51-52.

Kerr, Clark. *The Uses of the University*. Cambridge: Harvard University Press, 1963, 1982

Kozma, Robert and Johnson, Jerome. The technological revolution comes to the classroom. *Change*, January/February, 1991.

Moynihan, Daniel Patrick. Testimony before the select education subcommittee of the Committee on Education and Labor, US House of Representatives, 18 Feb 1971.

Naisbitt, John. *MegaTrends.* New York: Warner Books, 1982.

National Commission on the Costs of Higher Education, *Straight Talk About College Costs and Prices. Final Report*, January 28, 1998

Ottinger, Anthony G. and Zapol, Nikkii. Will information technologies help learning? In Kaysen, Carl (ed.) *Content and Context: Essays on College Education.* A report prepared for the Carnegie Commission on Higher Education. New York: McGraw-Hill, 1973.

Persig, Robert. *Zen and the Art of Motorcycle Maintenance*. New York: Bantam Books, 1968.

Rudolph, Frederck. *The American Colleges and University: A History.* Athens, GA: Univ. of Georgia Press, 1962.

Russell, Thomas L. "The 'No Significant Difference' Phenomenon as Reported in Research Reports, Summaries, and Papers. (Raleigh: North Carolina State University Office of Instructional Telecommunications), 1993

Sattler, Paul. *The History of Instructional Technology.* New York: McGraw-Hill, 1968.

Silverman, Robert J. *Distance Postsecondary Education: Research Implications*. Division J invitational plenary address, American Educ. Research Association, 1998.

Suppes, Patrick. The uses of computers in education. *Scientific American*, October 1966.

Van Dusen, Gerald, *The Virtual Campus: Technology and Reform in Higher Education.* ASHE- ERIC Higher Education Report Volume 25, No. 5. Washington, DC: The George Washington University, 1997