THE CAMPUS
COMPUTING PROJECT

PO Box 261242 Encino, CA 91426-1242
(818) 990-2212 Fax: (818) 784-8008
cgreen@earthlink.net

Convergence and the Consequences of Technology

Kenneth C. Green
Visiting Scholar, Claremont Graduate University (USA)
and Director, the Campus Computing Project

Earlier this summer, in the first week of August, we passed an important milestone on the road to the 21st Century -- 500 days to the Millennia.

The close of the 20th Century might be described as an *era of convergence*. Indeed, ours is an era that marks the convergence of two old Chinese proverbs – or curses – depending on your perspective:

- *May you live in interesting times;* and
- *Be careful what you wish for, as it may come true.*

These themes are particularly pronounced for those of us engaged in the higher education enterprise. We really do live in interesting times; moreover, many of the things long wished for by the campus community are beginning to come true.

A second set of converging issues come to us courtesy of Gordon Moore and Everett Rodgers. Moore, as many of you know, was one of the founders of Intel and is responsible for Moore's Law which describes the relationship between advances in computer (processing) power and declines in the cost of technology products. Rodgers is known for his pioneering and widely cited work on the diffusion of innovation. Imposing the curves from these seemingly unrelated concepts – the half life of technology products, the diffusion for innovation – highlights the accelerating pace of change in both technology industries and also across a global economy that is increasingly driven by technology.

Across the globe, the five hundred days leading to the Year 2000 find both colleges and universities, both faculty and administrators, confronting what I would call "the convergence of conference themes." All around us we see ample evidence that the often ephemeral themes and public priorities of academic and professional conferences convened over the past two decades are now part of our new realities – key components of the new world order of postsecondary education. For the campus community, three topics converge as we approach the year 2000.

- *increased access.* Across the globe, in both developed and developing nations, we see growing demand for increased access to higher education. The rising demand – and expectations – are pushed by an interactive and escalating set of demographic, political, social, and economic factors.
- *lifelong learning.* We confront a future of not one job or one career, but many. Growing numbers of adults – many with college degrees, some with many college degrees – are coming back to college and to other postsecondary providers for additional education and training. More than ever before, we recognize that a college degree is not the end of the educational journey, but just another important milestone.
- *information technology.* There is little question that that "technology" is now ubiquitous. It's not just computers, or the Internet, or the WWW. It is the aggregated presence of Information Technology resources in virtually all facets of daily life.

No doubt each of us has attended at least one academic or professional conference in the past three or five years in which at least one of these issues was the "theme" of the event.

Truth be told, in spite of endless conference sessions, journal articles, policy documents, and strategic plans, my campus travels and my conversations with faculty and administrators over the past few years suggest that, as a "enterprise," higher education remains somewhat clueless about the consequences of the coming convergence. Like public discussions of the Y2K bug, we can identify the problem, discuss it in endless detail, identify a wide range of end-game scenarios, and calculate the

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probable costs associated with a potential solution. But in the end, as I learned on the first day of my first graduate school class in public policy, implementation is the movement of cup to lip. That distance – from cup to lip – is large in the context of the convergence issues ahead for colleges and universities across the globe.

As an enterprise, the organizational behavior of academic institutions – "traditional" kinds of colleges and universities– suggests that higher education is not prepared for the coming consequences of convergence. To date most of the institutional planning has been to rely on conventional responses to unconventional challenges – challenges that involve demography and access, information technology, and lifelong and distributed learning.

For college faculty and administrators, technology is clearly the most perplexing of these issues. *Why?* Probably because technology is the most personal – the one that involves us, indeed engages us, directly and individually. Technology is the convergence issue that also poses the most significant challenge to our professional identities – identities we have worked long and hard to develop and sustain for our colleagues, our students, and ourselves. Additionally technology forces us to confront a set of issues that seem mutually exclusive: the high touch (almost hand-crafted) traditions that have an esteemed place in academic work vs. a high touch future laden with a rich array of IT resources. Some among us believe the high tech future will save education; others are certain it will destroy it. In between reside many faculty and administrators who are simply struggling to assess the appropriate role of computers and technology resources in their scholarly work and instructional activities.

Admittedly, we can always (and easily) point to computer problems, software bugs, network crashes, user support problems, the absence of infrastructure, Moore's Law, Bill Gates, the high costs and short-half life of computers and IT resources, and a host of other issues that "cause" technology problems in academe and for individual faculty, students, administrators, and staff. Yet ultimately the key factors affecting the ways faculty use technology resources are not determined by institutional policies or the campus IT infrastructure; rather the challenges of integrating IT into scholarship, instruction, teaching, and ultimately learning are ultimately dependent on the individual behaviors, investments, and commitments of individual faculty.

Of course we in education have long held great aspirations for the potential role of computers and other technologies in education. Indeed, on the basis of early experiments with what today we would describe as very primitive mainframe technology, early innovators such as Stanford's Patrick Suppes were making bold predictions about the future of computers and education:

> 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 more 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.[1]

Of course, with some minor editing to update the language, Suppes' assessment, offered in the pages of *Science* in October, 1967 – 31 years ago – could easily serve introductory paragraph of countless conference speeches on information technology or the topic sentence for campus plans and position papers.

Today, fueled by more than four decades of aspirations and a dozen years of sustained (if often *ad hoc*) experimentation, information technology has finally emerged as a permanent, respected, and increasingly essential component of the college experience. Walk any direction on almost any type of college campus today and it is easy to see ample evidence of the presence of computers and information technology. Computing and information technology are finally (if slowly) moving into the mainstream of the instructional experience in many classes and on most campuses.

Yet have we really witnessed a "computer revolution" or experienced the "technology trans-formation" of higher education?

Significant questions remain about the potential promise and probable limits of IT-based instruction in postsecondary education. Faculty, administrators, technical support personnel, college trustees, and state authorities, as well as the corporate patrons of higher education, continue to wrestle with an array of issues that cluster into questions about thee key issues:

- *content*. how can technology expand access to and improve the quality information resources that might be incorporated into teaching, learning, instruction and scholarship?
- *delivery*. how might technology be used to enhance the delivery of instruction in both traditional and non-traditional contexts, for both traditional and non-traditional learners; and
- *infrastructure*. what kind of infrastructure (hardware, software, networks, technical support,

[1] Suppes, Patrick. The Role of Computers in Education. *Scientific American* (October, 1967).

user support and training) is required to make technology accessible, available, and effective in postsecondary education.

Moreover, against the backdrop of rising expectations and dynamic technologies remain some significant questions about the potential (and appropriate) role of technology in collegiate teaching, learning, and instruction. Does the broad (or even the focused) application of information technology – content in the syllabus or in the library, technology as the delivery vehicle for instruction – account for a significant, cost-effective benefit in the educational experience and in learning outcomes.

These issues also converge in the area of student expectations and the professional identity of the professorate. As noted above, some in the campus community, including many attending the Pretoria conference today – view technology as the catalyst which will save education – a resource that with usher in a new age of learning and scholarship. Others view technology as the bane of academic life.

It is still premature to talk about a technology-driven *transformation* of educational institutions: elementary and secondary schools, community colleges, business schools, and (even) elite research universities are still in the early stages of adopting and incorporating various kinds of information technology into their instructional functions. And it is hyperbole to discuss a technological revolution in education, which implies a sudden and dramatic departure from past practices – practices that reflect, in part, academic traditions that are centuries old.

Data from the annual Campus Computing Survey confirm that technology, as a function and as a resource, has in fact entered the pedagogical mainstream in college and universities.[2] But we need to acknowledge that information technology has not yet radically transformed classrooms, the instructional activities of most faculty, or the learning experience of most students. Moreover, while we know that technology changes the learning experience, we do not have hard evidence documenting enhanced academic achievement and learning outcomes. Consequently, we can (and should) debate, at length, fundamental questions of *application* (how we use the technology) and *impact* (what difference does it make in what and how students learn).

The aspirations articulated by Suppes – a decade before the first microcomputers, almost three decades before the explosion in IT promoted by the World Wide Web – remain current across all sectors of education today. However, even twenty years after the arrival of the first microcomputers on college campuses, and fifteen years following the bold pronouncements of a computer revolution in higher education, we know that the "cup to lip factor" – the implementation challenge reflected in Suppe's great aspirations – remains significant. With perfect hind-sight, we can say today that the 1980s were not the period of the great computer revolution in higher education; rather, it was the beginning of the slow migration of computing and information technology into the postsecondary experience – into teaching, learning, and scholarship.

In education, the much discussed *Transformation*, (capital T), if it occurs, will take time, certainly another decade. Curriculum enhancement and innovation, however, will be a continuing and incremental process, remaining largely dependent the interaction between individual initiative (the way individual faculty design the syllabus and structure their classes) *and* institutional infrastructure (the hardware, software, and support services available to students and faculty).

Casting a large shadow over these efforts are the issues of productivity and technology. We in academe have a hard time talking about productivity because we have little agreement about measures and outcomes. For faculty, the link between technology and productivity is personal and primarily qualitative: the technology improves my work, increases my efficiency, and allows me to do more things for myself. Technology also enriches the content of my class and the curriculum: for example, it brings to students new information resources (satellite images of Jupiter; digital images of cancer cells; content and images from the distance libraries) that are not readily available on campus or in print. These are all reasonable measures of productivity. At the same time, these are also very personal and very *qualitative* measures.

In contrast, university chancellors, college presidents, deans, policy-makers and even many faculty understandably feel increasing pressure to look at the *quantitative* side of technology-productivity relationship: does technology allow us to increase production and outputs (for example, enrollments and class offerings) with enhanced quality and with no increase in costs (or perhaps even some cost reduction)? This is , in part, the lure of distance education: increased access, increased "productivity," increased revenue, and seemingly low operating costs.

The dynamic nature of technology reflects, in one sense, the pace of change in the global economy — a rate of change that often poses major challenges to all types of colleges. Yet despite the pace of change on the outside, academic institutions, from community colleges to research universities, move slowly: we take

[2] Green, Kenneth C. *Campus Computing, 1997.* (Encino, CA, Campus Computing), 1997. Summary information about the Campus Computing Project is available on the WWW: http://ericir.syr.edu/projects/Campus_computing.

months and often years to review and revise curricula; we spend months on personnel decisions that corporations routinely handle in days and weeks; and we fail to make the internal training, retraining, and infrastructure investments in personnel and facilities that are routine expenditures in both small businesses and large corporations. To stay current and competitive and to best serve our clientele — specifically our students — institutions, programs, and internal processes will have to recognize and accommodate change faster and better than has been our past practice.

In this context, technology offers important lessons about change for academic institutions. Moore's Law offers a significant statement about the pace of change in a technology-driven environment: nothing is static, everything is dynamic, and change is the only constant. This applies to information and facts, to various skills, and also to technology products and services. In academe and elsewhere, technology has been a *catalyst* for change. In academe and elsewhere, technology has become a *metaphor* for change.

Perhaps the best preparation for a world where change is the only constant is found in the advice that the best teachers, professors, and mentors pass along to their prized students. By word and by deed, they (we?) stress the importance of core knowledge, interpersonal and technical skills, and perhaps most important, a capacity for self-renewal.

As individuals and as institutions, we in higher education must attend to the challenge of self-renewal — for programs and curricula and also for the individual portfolios that faculty and administrators bring to their professional activities. The issue is not that technology will necessarily change everything — in the realm of higher education or elsewhere. Rather the real issue is that technology is a metaphor for change and the pace of change — the compression created when Moore's Law meets the Diffusion Curve. The challenge is for us is to attend and respond to the pace of change in the world around us, to create an institutional and individual capacity for self-renewal that recognizes – indeed, under the best circumstances, anticipates – and accommodates change.