Comments at John Seely Brown Symposium
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INTRODUCTION

Elizabeth Daley has made a convincing case for rethinking the nature of literacy in a world increasing shaped by digital technology.

Literacy was read-only until the 20th Century. Composition is a very recent skill. Literacy used to be oral, rhetoric.

Forms of communication

From literacy in the oral tradition
To the written word
To the images of film and then television
To the computer and multimedia

The new literacy, demanding not only critical viewing but composition.

What is new with the new media?

What is the impact of the new literacy for the university?

THE FUTURE

Yet why stop here?

The media of communication are continuing to evolve, from the single dimension of text to the two-dimensional world of graphics to the three-dimensional world of simulation and role-playing. With virtual reality, it is likely that we will soon communicate with one another through simulated environments, through "telepresence," perhaps guiding our own software representations, our digital agents, to interact in a virtual world with those of our colleagues.

As William Wulf puts it, "Don't think about today's teleconference technology, but one whose fidelity is photographic and 3-D. Don't think about the awkward way in which we access information on the network, but about a system in which the entire world's library is as accessible as a laptop computer. Don't think about the clumsy interface with computers, but one that is both high fidelity and intelligent."[i] It is only a matter of time before information technology will allow human interaction with essentially any degree of fidelity we wish--3-D, multimedia, telepresence. Eventually, we will reach a threshold of fidelity sufficient to allow distance education (and most other human activities) that will be comparable to face-to-face interaction.

This is a very important point. A communications technology that increases in power by 100 to 1000-fold decade after decade will soon allow human interaction with essentially any degree of fidelity we wish--3-D, multimedia, telepresence, perhaps using neutral implants to directly link our minds into cyberspace, a merging of carbon and silicon.

Perhaps William Gibson has it right in his *Neuromancer* trilogy, with the ultimate multimedia as "sim-stim", simulated stimulated, in which neutral implants allow the simulated stimulation of all of the senses both as the medium of communication and entertainment.

But wait a minute, there are many other forms of literacy

Art, poetry, mathematics, (science itself)…

WHAT IS REALLY GOING ON?

But there is something deeper here. The university has survived other periods of technology-driven social change with its basic structure and activities intact.

But the changes driven by evolving information technology are different, since they affect the very nature of the fundamental activities of the university: creating, preserving, integrating, transmitting, and applying knowledge. More fundamentally, because information technology changes the relationship between people and knowledge, it is likely to reshape in profound ways knowledge-based institutions such as the university.

THREE EXAMPLES

Let me give you three examples:

A New Approach to Learning

What is new with the new media?

Active, not passive
Not just learning, but creating knowledge
Play becomes important
Collaborative
Multitasking
Bricolage

John Dewey to Marie Montessori to Jean Piaget to Seymour Papert!

Constructionist learning
Discovery (inquiry) based learning
Work becomes play
And Learning becomes RESEARCH!!!

Chinese proverb:

I hear and I forget.
I see and I remember.
I do and I understand.

Idit Harel (MaMaMedia)

The new media will shift us from the 3R's to the 3X's:

The fundamental new media literacy skills we must foster in children are the three Xs, exploring, expressing, and exchanging ideas with new digital media.

Today, computers and the Internet are not just about information. Rather they offer young children an expanded toolbox for creating, as well as expanded opportunities for saving and sharing ideas and projects. This, in turn, offers more opportunities for playful, meaningful learning through design and through the creative use of technology.

The best learning does not happen by guessing right or wrong. Children learn best, indeed we all learn best, through the process of learning by doing. When learners (in all ages and stages) engage in playful exploration in which they actively plan, design, and build their own projects, try out ideas, and tinker with notions—their own and those of others.

As new information and methods of learning with new media technology are emerging, it is even difficult to differentiate between teachers, parents, and students when it comes to asking who is doing the learning and who is teaching, who is in control and who is confused and overwhelmed.

A problem: We didn't grow up with technology, and so we often don't know how to do teaching or parenting with new media technology. It took thousands of years for us to understand the importance of reading and writing and literacy. It is hard to fully understand the importance of new media literacy skills that are less than a few decades old.

The Creative University

The professions that have dominated the late twentieth century—and to some degree, the late-twentieth century university—have been those that manage knowledge and wealth, professions such as law, business, and politics. Yet today there are signs that our society is increasingly valuing those activities that actually create new knowledge and wealth, professions such as art, music, architecture, and engineering. Perhaps the university of the twentieth century will also shift its intellectual focus and priority from the preservation or transmission of knowledge to the process of creation itself. After all, the tools of creation are expanding rapidly in both scope and power. Today, we have the capacity literally to create objects atom by atom. We are developing the capacity to create new life-forms through the tools of molecular biology and genetic engineering. And we are now creating new intellectual life-forms through artificial intelligence and virtual reality.

The university may need to reorganize itself quite differently, stressing forms of pedagogy and extracurricular experiences to nurture and teach the art and skill of creation. This would probably imply a shift away from highly specialized disciplines and degree programs to programs placing more emphasis on integrating knowledge. Universities might form strategic alliances with other groups, organizations, or institutions in our society whose activities are characterized by great creativity, for example, the art world, the entertainment industry, or even Madison Avenue.

But herein lies a great challenge. While we are experienced in teaching the skills of analysis, we have far less understanding of the intellectual activities associated with creativity. In fact, the current disciplinary culture of our campuses sometimes discriminates against those who are truly creative, those who do not fit well into our stereotypes of students and faculty.

Prying Learning out of the Classroom and Putting It Into the Laboratory

Suppose we were able to use IT to essentially shift the paradigm of undergraduate learning in the research university from the lecture format of the classroom to the discovery environment of the research activity or the experiential environment of professional schools. There is ample evidence that "inquiry" or "discovery-based learning" is felt to be far more effective anyway than classroom lectures. Furthermore, this approach not only appeals directly to the research interests of faculty but it could involve the human resources represented by graduate research assistants and teaching assistants not only to provide technical support but moreover leverage the faculty member's time. Utilizing graduate student assistants and software automation, we might be able to actually scale this approach to size of the undergraduate programs at most research universities.

THE ITFRU PROJECT

As knowledge-intensive social institutions, colleges and universities will be particularly affected by the rapid evolution of digital technology. Further, if past experience is any guide, the impact of this technology on the university and the consequence changes in its activities, structure, and environment, changes are likely to be rapid, profound, and discontinuous. The future of the university will be characterized by ever greater uncertainty. True that from some perspectives, the university has changed remarkably little in values, roles, structure, and function over the past several decades--indeed, over the past several centuries, at least compared to most other social institutions. But we should not delude ourselves into thinking that higher education will be unperturbed by the transforming character of digital technology. After all, even the most pronounced exponential change starts off on a very modest slope.

In 2000 the National Academy of Science launched a project to understand better the implications of information technology for the future of the research university.[ii] The premise of the study was a simple one: The rapid evolution of digital technology will present many challenges and opportunities to higher education in general and the research university in particular. Yet there is a sense that many of the most significant issues are neither well recognized nor understood either by leaders of our universities or those who support and depend upon their activities. Over the last year the National Academy committee, which I chair, has met on numerous occasions to consider these issues, including site visits to major technology laboratories such as Bell Labs and IBM Research Labs and drawing upon the expertise of the National Research Council.

Let me mention the three primary conclusions from the early phase of this study: First, we believe the extraordinary evolutionary pace of information technology is likely to continue for the next several decades and even could accelerate on a superexponential slope. Photonic technology is evolving at twice the rate of silicon chip technology (e.g., Moore's Law), with miniaturization and wireless technology advancing even faster, implying that the rate of growth of network appliances will be incredible. For planning purposes, we can assume that within the decade we will have infinite computer power, infinite bandwidth, and ubiquitous connectivity (at least compared to current capabilities).

The event horizons for disruptive change are moving ever closer. The challenge is getting people to think about the implications of accelerating technology learning curves as well as technology cost-performance curves is very important. There are likely to be major technology surprises, comparable in significance to the appearance of the personal computer in the 1970s and the Internet browser in 1994, but at more frequent intervals. The future is becoming less certain.

The impact of information technology on the university will likely be profound, rapid, and discontinuous--just as it has been and will continue to be for the economy,

our society, and our social institutions (e.g., corporations, governments, and learning institutions). It will affect our activities (teaching, research, outreach), our organization (academic structure, faculty culture, financing and management), and the broader higher education enterprise as it evolves into a global knowledge and learning industry.

Yet, for at least the near term, meaning a decade or less, the university will continue to exist in much its present form, although meeting the challenge of emerging competitors in the marketplace will demand significant changes in how we teach, how we conduct scholarship, and how our institutions are financed. Universities must anticipate these forces, develop appropriate strategies, and make adequate investments if they are to prosper during this period.

Over the longer term, the basic character and structure of the university may be challenged by the IT-driven forces of aggregation (e.g., new alliances, restructuring of the academic marketplace into a global learning and knowledge industry) and disaggregation (e.g., restructuring of the academic disciplines, detachment of faculty and students from particular universities, decoupling of research and education).

Although information technology will present many complex challenges and opportunities to university leaders, we suggest that procrastination and inaction are the most dangerous courses of all during a time of rapid technological change. After all, attempting to cling to the status quo is a decision in itself, perhaps of momentous consequence. To be sure, there are certain ancient values and traditions of the university that should be maintained and protected, such as academic freedom, a rational spirit of inquiry, and liberal learning. But, just as it has in earlier times, the university will have to transform itself once again to serve a radically changing world if it is to sustain these important values and roles.

Although we feel confident that information technology will continue its rapid evolution for the foreseeable future, it is far more difficult to predict the impact of this technology on human behavior and upon social institutions such as the university. It is important that higher education develop mechanisms to sense the changes that are being driven by information technology and to understand where these forces may drive the university. Because of the profound yet unpredictable impact of this technology, it is important that institutional strategies include : 1) the opportunity for experimentation, 2) the formation of alliances both with other academic institutions as well as with for-profit and government organizations, and 3) the development of sufficient in-house expertise among the faculty and staff to track technological trends and assess various courses of action.

In summary, for the near term (meaning a decade or less), it is likely that most colleges and universities will retain their current form, albeit with some evolution in pedagogical and scholarly activities and in organization and financing. This is the period we have addressed in this book. While change will occur, and while it is likely to be both profound and unpredictable, it will at least be understandable.

But what about the longer term, perhaps a generation from now? After all, if the pace dictated by Moore's Law continues to characterize the evolution of information technology, over the next several decades we would see the power of this technology (and related technologies such as biotechnology and nanotechnology) increase by factors of one-thousand, one-million, one-billion, and so on, likely reshaping our society and most social institutions into unrecognizable forms. The speculation concerning these longer term possibilities we must leave to futurists (and perhaps science fiction writers).

MICHIGAN'S STRATEGY

Oh, yes, what about Michigan's strategy?

What is the role of the UM in this social transformation?

We do have certain advantages:

A quite unique combination of size, complexity, quality
We are a complex ecology, hence are perhaps more able to evolve.
And, of course, we have quite a heritage of leadership in this arena,

From the development of time-sharing in the 1960s
To the management of the Internet in the 1980s (and now Internet2)
To the School of Information and the Media Union in the early 1990s

So what should we do?

Experimentation

We must recognize the profound nature of the rapidly changing world faced by higher education. This requires a somewhat different approach to transformation. We came to the conclusion that in a world of such rapid and profound change, as we faced a future of such uncertainty, the most realistic near-term approach was to explore possible futures of the university through experimentation and discovery. That is, rather than continue to contemplate possibilities for the future through abstract study and debate, it seemed a more productive course to build several prototypes of future learning institutions as working experiments. In this way we could actively explore possible paths to the future.

More specifically, all of these efforts were driven by the grass-roots interests, abilities, and enthusiasm of faculty and students. While such an exploratory approach was disconcerting to some and frustrating to others, fortunately there were many on our campus and beyond who viewed this phase as an exciting adventure. And all of these initiatives were important in understanding better the possible futures facing our university. All have had influence on the evolution of our university.

Our approach as leaders of the institution was to encourage strongly a "let every flower bloom" philosophy, to respond to faculty and student proposals with "Wow! That sounds great! Let's see if we can work together to make it happen! And don't worry about the risk. If you don't fail from time to time, it is because you aren't aiming high enough!" We tried to ban the word "NO" from our administrators.

The digital age poses many challenges and opportunities for the contemporary university. Evolving information technology is freeing the activities of the research university-its teaching, scholarship, and service to society--from the constraints of space, time, monopoly, and perhaps even reality itself. While the university campus as a physical place serving a community of learners is likely to remain at least for the near term, the nature of its activities, organization, management, and funding are likely to change quite rapidly and dramatically. While the challenges will be significant, so too will be the opportunities to enhance the important role of these institutions in our society.

It is our collective challenge to develop a strategic framework capable of understanding and shaping the impact that this extraordinary technology will have on our institutions. We are on the threshold of a revolution that is making the world's accumulated information and knowledge accessible to individuals everywhere, a technology that will link us together into new learning communities never before possible or even imaginable. This has breathtaking implications for education, research, and learning and, of course, for the university in the digital age. It is a profoundly democratic revolution that should involve us all.

5. William A. Wulf, "Warning: Information Technology Will Transform the University," *Issues in Science and Technology,* (summer 1995), 46–52.

[ii] *The Impact of Information Technology on the Future of the Research University*, James J. Duderstadt and William Wulf, Ed. (Washington, D.C.: National Academy Press, 2002)