

Technologies of Liberation

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Winston Churchill once remarked that the empires of the future are empires of the mind. His words echo across the planet as we embrace the knowledge-value revolution embodied in today's communication age.

The buzzword of today's economy is "information," and, increasingly, this information is being transmitted at the speed of light to virtually all parts of the planet through the medium of the Internet. The growth of computer-mediated communication using the Internet has been spectacular. The Net itself is doubling in size every year, and the most recent tool for exploring this vast informational realm, the World-Wide-Web, is doubling in size every 90 days. The Web barely existed three years ago; now millions of people all over the planet use the Web daily for education, commerce, and pleasure.

It is tempting to see the Web as a powerful educational tool simply because of its capacity to deliver information on demand 24 hours a day, every day of the year. In fact, I believe that the Web has tremendous value in education, but for reasons that transcend its content.

The Web represents a transformation in the economy of information and ideas. Old economic models were based on the concept of scarcity. The laws of supply and demand, and the historic wealth of nations have been based on the idea that it is the scarcity of something that determines its value. The Internet changes everything. The zeroes and ones of the binary codes sent through strands of glass the diameter of a human hair carry far more than information — they embody a vision in which each "zero" is a window on infinity, and each "one" represents the power to unify society for the betterment of the entire planet.

Everything is turned upside down in this new world — scarcity is replaced by abundance: the law of supply and demand is replaced by Metcalfe's law of the telecosm which states that the power of a network increases by the square of the number of users. This curious phenomenon means that, as each new participant joins the global dialog, our combined resources increase. When

applied to education, we can see deeper reasons why every learner in the planet must have equitable access to the Net.

In the United States we are blessed with high-speed communications backbones connecting many (but by no means all) schools with libraries, museums, research centers, and other educational institutions around the world. The impact of this communications revolution was acknowledged in a speech by Vice President Gore when he stated: "I've often spoken about my vision of a child in my hometown of Carthage, Tennessee being able to plug into the Library of Congress."

This vision of a child in a small town being able to explore a huge library (105 million volumes) is incredible. And yet, the Library of Congress is already digitizing its public domain works and making them available for anyone in the world to access. The popularity of this on-line access is so great that usage is growing exponentially. In October, 1996 nearly 3 million documents were downloaded from this one resource!

Unlike libraries whose collections consist of physical volumes, there is no limit to the number of documents that can be "checked out" at any one time. While some libraries keep several volumes of popular works, electronic documents can be replicated as they are needed, so the concept of books as a conserved resource no longer applies as libraries make the transition from collections of atoms to collections of bits.

Rich electronic collections exist not only for historical information, but for the latest breakthroughs in science — breakthroughs that will take years to show up in textbooks. And, when they do, these textbooks will be out of date 18 months after they are published!

Our young people understand the power of personal computers connected to the Web. Today's students are not from Generation X, they are from Generation.com. If they have them, they will sneak their computers into the classroom and hide them behind their textbooks. This task will become much easier as the price and size of powerful Web-based computing devices shrinks to accommodate both the wallets and palms of today's youth.

And what of the traditional teacher who confronts today's child navigating through primary sources of information foreign to the book-bound educator? Clearly, this confrontation between two paradigms will take place many times in the coming years. It is a confrontation born of a powershift — a confrontation in which the teacher may still be operating in the old economy of scarcity while the student embraces the abundance of the Web.

Educators can take solace in the words of Thomas Jefferson when he said, "He who lights his taper at mine does not diminish my flame." It is the capacity

to ignite and sustain this flame that marks the qualities needed in today's teachers. Our task is to move from the traditional instructionist model to the newer constructivist model of education. From a systemic perspective, these models are quite different. Make no mistake: If we bring technology to the learners of the world without helping teachers change our underlying model of education we do a disservice to students and educators alike!

The instructionist model acknowledges a vast realm of generally untouchable content that is distilled by textbook publishers for classroom use. The teacher mediates between the textbook and the student, placing the learner as far away from the original sources as possible.

In the constructivist paradigm, the relationships are different. The vast realm of content exists as before, only it is equally accessible to educator and learner alike through the medium of the Net. Teachers and students work together to explore these informational resources. The teacher's task is not to provide content as much as to provide context — to help students make meaning from the information they find. As students perform this task, they document their work in the projects they create. These multimedia projects can then be placed on the Web, for other students to explore at other times and places.

While this model not only supports student learning, it also models the kinds of activities needed by highly skilled workers in the 21st century.

This vision has its challenges, however. Major among these is the existence of a digital divide — a gap in which the rich become informationally rich, and the poor become informationally poor. This gap exists between countries, and between socio-economic strata within each country. For example, in the United States, from the period between 1969 and 1989, the real income of low skilled workers dropped by 24% while that of highly skilled workers increased by 13%. If we look at computer penetration in US homes, the average is about 40% today. Yet, when broken down by family income, households with \$10,000 or less income have few computers (about 10%), while about 70% of those in the higher brackets (\$70,000 or above) have them.

On a global scale, the situation is even worse. While most countries have Internet access, there are many in central Africa that do not. And, even some Internet-ready countries (like Brazil) have very slow communication backbones. (In Brazil's case, the fastest line in the country is 2 million bits/sec.) Unless one has worked outside the developed world, it is hard to grasp that most people on the planet have no telecommunications access at all. And yet, the people know the power of information, and the power of education. Even in the favelas of Rio one can see satellite dishes sprouting like aluminum daisies as the poor residents of these areas feed their hunger for information.

Our challenge is to address the global information infrastructure needs in ways that touch anyone wishing to develop skills at any age. This means that we must work to insure that every school, every library, every meeting place in every corner of the world has access to the informational tools of the next century. The key to peace, economic growth, and the preservation of the planet, is an educated populace.

This does not mean that technology can do the job alone. Well-prepared teachers are needed to guide all learners as they come to master the tools of this new age. If we provide technology without meaningful staff development, we will have wasted our money.

The American poetess, Edna St. Vincent Millay, once wrote:

Upon this gifted age,
In its darkest hour,
Rains from the sky
A meteoric shower of facts.
They lie unquestioned,
Uncombined.
Wisdom enough to leech us of our ill
Is daily spun,
Yet there exists no loom
To weave it into fabric.

When these lines were written the computer had not yet been invented. Today the looms exist — they are the powerful computers we can provide our students. The fabric exists as well — we call it the Web. The question remains as to what we will have our students make from this fabric.

I believe the role of educators in this new age is to help students make magic carpets — magic carpets of the mind with which they can explore the infinite world of ideas at the speed of thought.

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Dr. David Thornburg is the Director of the Thornburg Center. Through his center he explores the impact of emerging technologies on education worldwide. His focus is on the connection between technology and pedagogy in support of high levels of learning in all students at any age.

In addition to his work in North America, he has been consulting in Brazil for the last six years. He provides speeches, workshops and consultation for groups ranging from local schools to federal governments. He has received

numerous awards for his work, and is the author of several books on the use of technology in education.

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