Welcome to the Communication Age

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Welcome to the Communication Age

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It's not the content, it's the communication.

— Jane Metcalf, Wired

Have you had a hard time adjusting to the Information Age? If you're an educator, have you just not quite come up to speed on all the ways to use multimedia-based computers to enhance learning in your classrooms? If you're a parent, business person, or other community member interested in the improvement of education for all learners, have you been overwhelmed by all the fancy new computerized gadgets that promise to bring the merits of the Information Age into offices, classrooms and libraries in your community?

If so, take a deep breath and let out a sigh of relief. I have comforting news for you. You don't have to worry about the Information Age any more — it's all over.

Yes, that's right, the Information Age is over, dead, kaput, finito, nada, history, finished.

What killed it? And, more importantly, what is taking its place? More on that in a bit. For now, let's look at some evidence.

In the beginning of 1993, IBM announced that their losses had taken a sharp turn for the worse, even though the company did away with about 40,000 positions in 1992 — roughly double the 20,000 it had said would be cut. When the dust settled, IBM posted an annual loss of $6.865 billion, followed by an $8 billion, or $14.10 per share, loss in the second quarter of 1993. Continued cutbacks in staff and facilities stemmed the bleeding, but the patient was wounded. IBM, the company that virtually defined the information age, was reeling.

The cause for this was not that IBM was doing a bad job. Anyone who knows the company knows the high quality of their products and staff. No, the problem was not that IBM was doing a bad job; it was doing the wrong job.

IBM's loss was just one of the canaries in the coal mine; but, unlike those poor canaries that died in the presence of an odorless poison gas, IBM is not dead. In fact, it is rebounding. IBM Chairman Louis Gerstner announced in early 1994 that IBM is reducing its emphasis on mainframes and is going to get into the (Are you ready for this?) communication business. IBM got the message: adapt or die.

In our time of rapid change, (and things are moving so quickly that the very nature of change itself is changing,) a paradigm shift is sweeping the planet, leaving in its wake the carcasses of the lethargic dinosaurs that just didn't make the transition.

All of this is terribly important for schools, because the paradigm shift I am about to describe treats all institutions the same way. Businesses are at risk; our schools are at risk; our children are at risk. Education is no longer immune to the changes that are sweeping the planet at the speed of light.

To get a sense of what is going on, let's look at some of the major paradigm shifts of history.

The Birth of a New Age

George Gilder, author of *Life After Television* and other books on the future of technology, has a perspective that may shed some light on the emergence of ages. New ages come into existence when a new tool or technique produces a thousand-fold or more increase in efficiency.

For example, it can be argued that the domestication of animals and advances in farming produced incredible efficiencies over hunting and gathering. This transition paved the way for the Agricultural Age. Prior to the development of agriculture, people spent most of their lives in pursuit of food. Once agriculture took hold, surplus was created (leading to increased trade) and people could stay in one location and build cities.

Prior to the invention of the steam engine, energy was expensive unless you lived close to a river or waterfall. Animal or human-powered treadmills were highly inefficient sources of mechanical power. Animals needed food and rest. All this changed with the development of the steam engine. The steam engine made power virtually free, and paved the way for the Industrial Age.

In the early days of computers, information storage, switching and computing were quite expensive — many dollars per bit. Today's dense integrated circuits have reduced the cost of this hardware to under a thousandth of a cent per bit, thus setting the stage for the Information Age.

Compare your computer with the ENIAC (completed in 1946). It cost a fortune, weighed 30 tons and operated at one three-hundredth the speed of a typical personal computer today — with only a tiny fraction of your computer's memory!

To get some sense of how rapidly technology has advanced, think about this: Have you ever received one of those greeting cards that play music or the sender's voice message when you open it? If you throw one of those away, you'll be discarding

more computing power than existed in the entire world prior to 1950.

The technological advances that created the Information Age have been phenomenal, and show no sign of letting up. Even so, we are at the brink of still another new era — the Communication Age.

Why? Because perceived bandwidth is becoming virtually free. Breakthroughs in the compression and transmission of data of all kinds promise to send information at blindingly fast data rates through strands of glass or through the freest medium of all — the space that surround us.

To get just a glimpse of what lies in store for us, sometime in 1995, the United States will demonstrate a network operating at a data transmission rate of 100 gigabits per second. This would allow the contents of 20 CD-ROMs to be transmitted in one second. Put another way, data transmission at this rate would allow the entire contents of a typical city library to be sent in less than 10 seconds. By the year 2000, it is possible that we will be measuring network speeds in "libraries per second". And, even at these phenomenal rates, we would still be operating 250 times slower than the intrinsic data-carrying capacity of glass fibers.

The Nature of Ages

Largely because of the writings of Alvin Toffler (*The Third Wave*) and other like-minded futurists, the notion of historical ages dating back to the creation of agriculture some 10,000 years ago has gained popularity. One common misperception resulting from this view of history is that each new age displaces the preceding age — that the Industrial Age displaced the Agricultural Age, for example.

Ages are a bit more complicated than that. New ages do not displace old ones, but they do transform them. For example, the Industrial Age provided many tools of benefit to Agriculture, and did much to improve the efficiency of farming. Many people don't realize that the first assembly line was

NOT created by Henry Ford to build cars; it was built many years before by Eli Whitney, one of the great names in agricultural equipment. The later development of the mechanized reaper allowed even greater efficiencies in food production. Modern farming takes place on a scale unthinkable prior to the Industrial Age.

By the same token, industry made widespread use of the tools of the Information Age to improve the productivity of factories. Further advances in computer use in industry expanded to include computer-assisted design and drafting, inventory control, and robotics, to name just a few. The flattening of hierarchies in organizational structures was enabled by the ability of workers at all levels of an organization to have immediate access to in-depth information on their business. In addition to making corporations more efficient, it shortened the decision cycle time, allowing corporations to be more responsive to customer needs.

One modern consequence of the transformations industry has experienced as a result of the Information Age has been the development of the "virtual corporation" in which production takes place closer and closer to the customer. Bar-coded items in stores not only simplify transactions, they provide a database that is then provided to manufacturers to help them plan new products. The feedback loop from customer to manufacturer has become so tight today, that niche products can be conceived, moved into manufacturing, and sold to consumers in a fraction of the time needed a generation ago.

And now that we have entered the Communication Age, we can expect this era to have its impact on our informational tools. Already we are seeing the remote distribution of software. Physical possession of VCR rental tapes and game cartridges, for example, will be replaced by versions of these products piped into our homes through cable or satellite downlinks. Already 60% of American homes have cable, and an additional 30% can be connected overnight. A new "digital broadcast satellite" (DBS) service will bring hundreds of

channels to any home for $700 and a spare place to set a small receiving dish the size of a serving plate.

I expect similar transformations to take place with computer software as well. One advantage of electronic distribution is that upgrades are instantaneous, and vendors don't have to worry about a pipeline of product in inventory tying up corporate resources while waiting to be sold. Of course, rapid movement to this method of software distribution could mark the end of software retailing as we know it. Apple Computer, Inc. and other companies are already distributing free CD-ROM's filled with commercial software packages that can be purchased by phoning in a credit card number in exchange for an unlocking code that provides access to the software on the disc.

Strip Malls on Disc

Computer software isn't the only commercial product available through CD-ROM distribution. Enterprising companies like The Merchant (1-800-561-3114) have placed interactive catalogs from numerous stores like Land's End, Brookstone, EarthBeat, and many more on a CD-ROM where users can browse at their leisure and accumulate orders that are then placed directly from the computer. Rather than manage a shopping center and incur the construction, insurance and maintenance costs associated with a physical site, The Merchant brings the shopping mall to your desktop where you can browse to your heart's content and place your order when you are ready to act. Your private interactive shopping mall is open 24-hours a day, 365 days a year, and shopkeepers of all sizes can take part.

While this type of shopping eliminates the social aspect of haunting the malls, it definitely provides interesting alternatives to shops that would otherwise have to outfit and staff storefronts. In comparison to physical stores, shelf space is free in cyberspace.

In the future, as high bandwidth pipes enter our homes and businesses, even the CD-ROM won't be needed. Software will

be purchased directly over the Net, completely bypassing traditional retail channels. This will open new opportunities for those who choose to anticipate and master the trend. But those who ignore the advent of the Communication Age may find themselves reduced from selling Apple Macintoshes in a computer store to selling McIntosh apples on the street corner.

The Communication Age will impact our informational tools in other ways as well. Just as software will become "softwhere", our traditional informational resources (encyclopedias, reference works, etc.) will also reside on the Net. In fact, they are already there. The problem today is that the pipeline is too skinny to get this information at the data rates we might like. All of this is changing, and changing fast. There is little question that the Communication Age will send out ripples that will change the face of information, industry and agriculture.

Education's New Challenge

The rapid arrival of this new era is catching everyone by surprise, and, for once, the private sector is grappling with the issue at the same time as education. Some well-established corporate institutions are falling apart or struggling to survive, and business plans are being frantically rewritten in order to secure some kind of future for companies whose present productivity is based on an outmoded paradigm.

For example, it doesn't take much of a crystal ball to realize that Blockbuster Video will soon be offering completely different services — or will simply cease to exist. This has nothing whatever to do with the quality of their existing service, or the excellence of their workers; it has simply to do with the fact that their current business — software rental — will be rendered obsolete when bandwidth becomes free and Blockbuster's current product line gets piped directly into homes over the Net. (Fortunately, Blockbuster understands this and is already positioning itself for the Communication Age by offering products that take advantage of telecommunications.)

This is an important point. In the traditional free market economy, companies competed on service and quality within a fixed product domain. Blockbuster competed with Wherehouse in video rentals, for example. Now the rules of the game have completely changed, and mastery in the old game has become meaningless. Blockbuster is competing with the phone companies and cable television operators — entities that wouldn't show up on a traditional list of competitors in software rental. This means that companies like AT&T will soon be competing with Blockbuster!

AT&T announced a modem for Sega Genesis video games called "The Edge" early in 1993. With this attachment, two game players could connect with each other over the telephone for the purpose of playing games. AT&T pretty much had the concept to themselves until mid-1994 when Blockbuster Entertainment and Davis Video combined forces to create Catapault Entertainment, a new company that will also sell modems designed to link video game players over ordinary telephone lines. These modems will be sold as add-ons for the many millions of Sega Genesis and Super Nintendo game systems found in our homes. The Blockbuster service operates over a gaming network to connect players with each other, as well as to provide gaming tips and other relevant information.

Applied to education, the message is similarly clear: The quality of our current schools, curriculum, staff, and resources is not the issue. The issue, quite simply, is how we transform education to meet the needs of today's students. Make no mistake, education will change whether we drive that change or not. In that area, education is in the same boat as Blockbuster Video. Unless we quickly move to take proactive control of the change process, our educational institutions may become irrelevant to the education of our youth. If that happens, they will simply disappear.

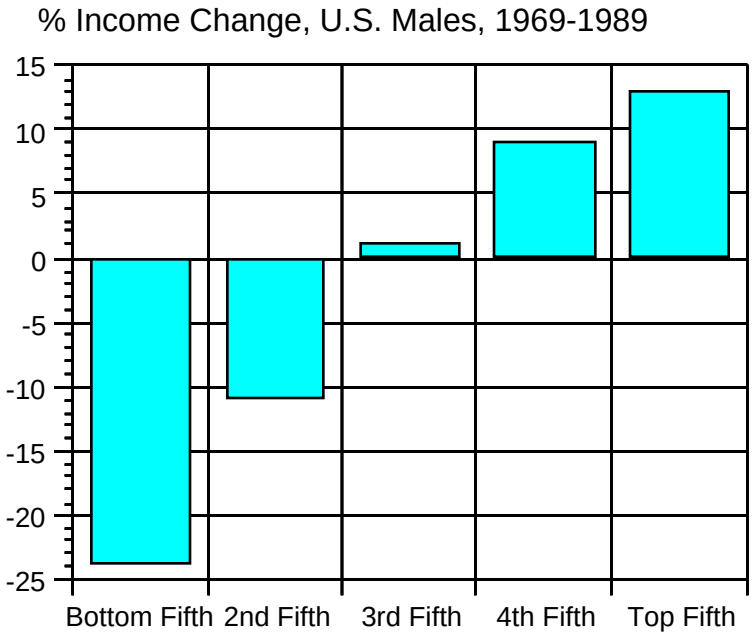
Historically, we've had it fairly easy. Our educational institutions, in general, met the needs of the agrarian and industrial economies, reflecting a period when people learned enough in school to secure a job in one field that they would

keep until retirement. Job transitions were typically made within one industry, and on-the-job training generally paved the way for advancement. Today's world, involving five or six career changes in a lifetime, is quite a different place.

Numerous reports such as the SCANS materials from the United States Department of Labor, the Magaziner report, *America's Choice: High Skills or Low Wages*, and Robert Reich's *Work of Nations* all point to the same challenge: People who are flexible, lifelong learners with a tolerance for ambiguity and a sense of self-direction can develop the high skills needed to secure high-paying jobs that build our economy. Those who lack these skills are locked into low paying jobs or, worse yet, no jobs at all.

As Labor Secretary Reich states, when our current economic recovery is examined, our citizens are on one of two staircases: one leading up, and another leading down. The only people on the "up" staircase are those with high skills.

If you doubt this, look at the graph below compiled from U. S. Census Bureau data.



Workers at the lowest end of the wage (and skill) spectrum have seen their incomes decline by about 25% in the two decades from 1969 to 1989. Furthermore, many of the low paying jobs are disappearing altogether, never to return. The situation for women in this same time period differs in that women's wages rose in all categories, although the gap between low and high wages increased by about the same amount as that for men.

Highly skilled workers, on the other hand, are seeing their incomes rise. While it is true that even highly skilled workers are finding jobs in large corporations to be quite unstable, their skill base insures that they can find employment elsewhere or, increasingly, start new ventures on their own. An educational system that addresses the reality implicit in this graph is quite different from the one that met the needs of past generations of students.

Doing Different Things vs. Doing Things Differently…

Historically, technological innovations of the Information Age moved into classrooms slowly, and many of these tools were used to perpetuate a curriculum wedded to the past.

In visiting computer labs across the country, I've seen students with access to lots of technology, but armed with this information alone I can't tell if the technology is being used to replicate workbooks, or to develop the kinds of skills and practices needed to thrive in the future. The presence of technology by itself is no indicator of its effective use.

The grace period is over. No longer can we allow outdated institutions to proceed at a snail's pace into a future zooming ahead at the speed of light — the gap is already stretched to the limit, and the thread connecting many current schools to society's needs is about to break. This has profound implications for technology use in education. Any attempt to think of these tools as "productivity enhancers" will fail if we use them to enhance the productivity of the existing system. What merit is there in increasing the efficiency with which we can pump even more students into the world without the kinds of skills and attitudes they need to thrive in the coming years?

Fortunately, the technology of the Communication Age dovetails with the needs of America's students. Every competency and skill described in any of the documents referenced above fits naturally in an educational setting in which technology is used to help self-directed learners acquire and model the skills they need.

Communication Age Needs for Education

In order for technology to have the impact it should on education, there are four key issues to be addressed. Building on the popularity of the information highway (or, more recently, the "infobahn"), *every* learner and educator must have:

- **Equitable access to on-ramps:**

(anywhere, any time access to the Net)

- **Interesting destinations:**
  (worthwhile places to explore, e.g., all the great museums, libraries, and research centers of the world)

- **Access to vehicles:**
  (universal access to the computers needed to traverse the infobahn at home, at school, and in libraries)

- **Driver's education:**
  (understanding of how the tools of the Communication Age can be used to build the future, not replicate the past and the skills to incorporate modern technologies into a reinvented curriculum in which learning is self-directed and lifelong)

Changes

The very nature of change itself is changing. Any long-term plan that does not allow for radical modification is doomed to failure. We need to shorten the time frame for bringing the benefit of innovations to all students, whether these innovations arise from the domains of pedagogy, curriculum, or technology.

For example, even though the utility of telephones has been proven since 1876, most classrooms in our country lack this simple technology. This abomination must be rectified immediately. Informational highways are meaningless to those who lack access to on-ramps. And yet one can see why telephones have not spread into classrooms. First, they are expensive. Second, their use is hard to monitor and project. The first issue can be rectified by having the Public Utilities Commission in each region of our country produce a new tariff for schools — a tariff that makes phone lines affordable for schools, yet guarantees long term profitability to the service provider.

Once phone lines are installed, the classroom must have adequate technology to allow these phone lines to act as

informational gateways for our young people. In the next chapter we show that powerful technology can be provided for every student and educator for a mere 2% of our educational budget. We need to invest only two pennies of our educational dollar to provide access to powerful technology to EVERY learner and educator.

The mere existence of technology does nothing to insure its effective use, however. Staff development and participation in the reinvention of our educational system is essential for long-term success. A portion of the two cents mentioned above would provide enough money for ongoing staff development. More importantly, educators need to see themselves as full-time professionals — paid to work year-round (with a few weeks for vacation). Students might be present for 180 or so of those days, but the rest of the time educators would be reinventing themselves. This shift in mindset presents a far greater challenge than finding the money to pay for it.

Working & Learning in the Communication Age

While I am painfully aware that those who live by the crystal ball shall eat crushed glass, I can't resist sharing perspectives on the emergent trends of the Communication Age and speculating on their potential impact on education. If there is an underlying message that permeates these trends, and retains validity even if we are mistaken in the details, it is this: Our challenge is not to do old things differently, it is to do different things. In the past, technological innovations in education have either been put on a shelf and forgotten, or they have been used to make small adjustments to the existing curriculum. Yes, some innovative schools have created radical transformations, but these noble steps have yet to foment revolution in education at large.

Our task is clear: As frightening as it may be, we need to completely revamp educational practice in light of societal transformations that have accumulated since the common schools in the 1830's. I am convinced that educators have the basic skills needed to create this transformation, and that they will apply their skills toward that end once we provide the

support they need to do the job properly. The Communication Age has shrunk the world to pocket size — there is no place to hide. Short of time travel back to the 1950's, change-resistant people in both the public and private sector have no options: change is inevitable.

If we truly engage in the challenge of transforming education with the assistance of the technological tools we have invented, then we will have gone a long way toward building a future in which we can all thrive. Our challenge, quite simply, is to use our tools to prepare people for their future, not for our past.

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This article is excerpted from Dr. Thornburg's newest book, Education in the Communication Age. For more information on the book and accompanying CD-ROM, contact The Thornburg Center at 415-508-0314, or direct e-mail to DThornburg@aol.com