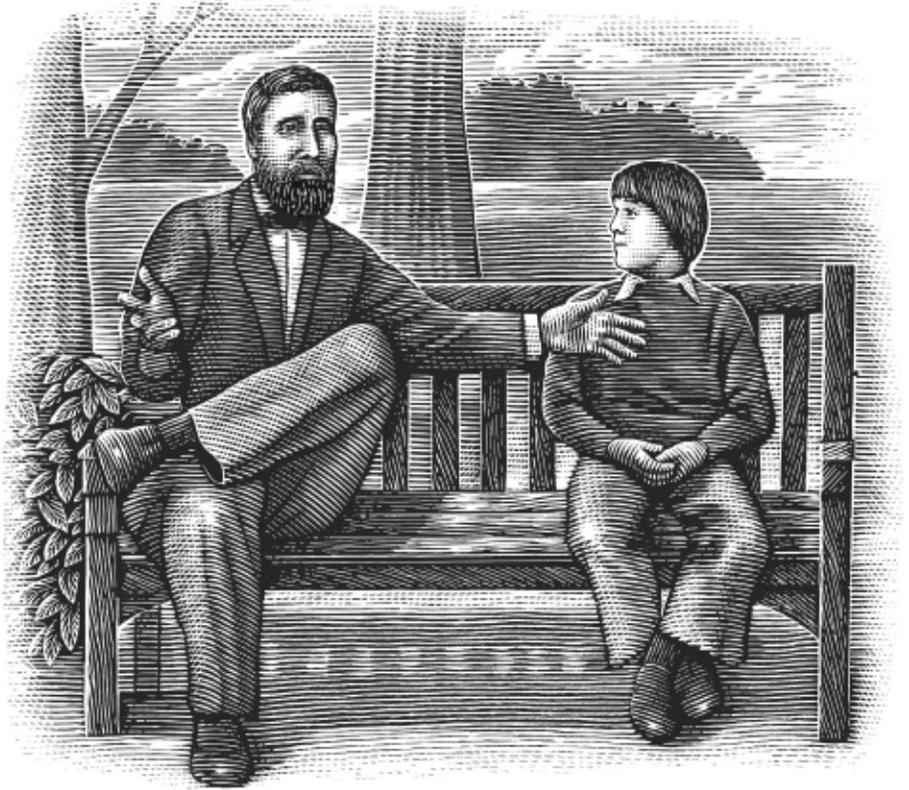*In the rush to place a computer on every desk, schools are neglecting intellectual creativity and personal growth*

The Human Touch

In 1922 Thomas Edison proclaimed, "I believe the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks." Thus began a long string of spectacularly wrong predictions regarding the capacity of various technologies to revolutionize education.

What betrayed Edison and his successors was an uncritical faith in technology itself. This faith has become a sort of ideology increasingly dominating K–12 education. In the past two decades, school systems, with generous financial and moral support from foundations and all levels of government, have made massive investments in computer technology and in creating "wired" schools. The goal is twofold: to provide children with the computer skills necessary to flourish in a high-tech world and to give them access to tools and information that will enhance their learning in subjects like mathematics and history.

However, in recent years a number of scholars have questioned the vast sums being devoted to educational technology. They rarely quibble with the need for children to learn how to use computers, but find little evidence that making technology more available leads

BY LOWELL MONKE

to higher student achievement in core subjects. As Stanford University professor Larry Cuban writes in *Oversold and Underused*, "There have been no advances (measured by higher academic achievement of urban, suburban, or rural students) over the past decade that can be confidently attributed to broader access to computers. . . . The link between test-score improvements and computer availability and use is even more contested."

While it is important to examine the relationship between technology and learning, that debate often devolves into a tit-for-tat of dueling studies and anecdotes. The problem with framing the issue merely as a question of whether technology boosts test scores is that it fails to address the interaction between technology and the values learned in school. In short, we need to ask what kind of learning tends to take place with the computer and what kind gets left out.

The Need for Firsthand Experience

A computer can inundate a child with mountains of information. However, all of this learning takes place the same way: through abstract symbols, decontextualized and cast on a two-dimensional screen. Contrast that with the way children come to know a tree—by peeling its bark, climbing its branches, sitting under its shade, jumping into its piled-up leaves. Just as important, these firsthand experiences are enveloped by feelings and associations—muscles being used, sun warming the skin, blossoms scenting the air. The computer cannot even approximate any of this.

There is a huge qualitative difference between learning about something, which requires only information, and learning from something, which requires that the learner enter into a rich and complex relationship with the subject at hand. For smaller children especially, that relationship is as physical as it is mental. Rousseau pointed out long ago that the child's first and most important teacher is his hands. Every time I walk through a store with my sons and grow tired of saying, "Don't touch that!" I am reminded of Rousseau's wisdom.

What "Information Age" values tempt us to forget is that all of the information gushing through our electronic networks is abstract; that is, it is all representations, one or more symbolic steps removed from any concrete object or personal experience. Abstract information must somehow connect to a child's concrete experiences if it is to be meaningful. If there is little personal, concrete experience with which to connect, those abstractions become inert bits of data, unlikely to mobilize genuine interest or to generate comprehension of the objects and ideas they represent. Furthermore, making meaning of new experiences—and the ideas that grow out of them—requires quiet contemplation. By pumping information at children at phenomenal speed, the computer short-circuits that process. As social critic Theodore Roszak states in *The Cult of Information*, "An excess of information may actually crowd out ideas, leaving the mind (young minds especially) distracted by sterile, disconnected facts, lost among the shapeless heaps of data."

This deluge of shapeless heaps of data caused the late social critic Marshall McLuhan to conclude that schools would have to become "recognized as civil defense against media fallout." McLuhan understood that the consumption and manipulation of symbolic, abstract information is not an adequate substitute for concrete, firsthand involvement with objects, people, nature, and community, for it ignores the child's primary educational need—to make meaning out of experience.

Simulation's Limits

Of course, computers can simulate experience. However, one of the byproducts of these simulations is the replacement of values inherent in real experience with a different set of abstract values that are compatible with the technological ideology. For example, "Oregon Trail," a computer game that helps children simulate the exploration of the American frontier, teaches students that the pioneers' success in crossing the Great Plains depended most decisively on managing their resources. This is the message implicit in the game's structure, which asks students, in order to survive, to make a series of rational, calculated decisions based on precise measurements of their resources. In other words, good pioneers were good accountants.

But this completely misses the deeper significance of this great American migration, which lies not in the computational capabilities of the pioneers but in their determination, courage, ingenuity, and faith as they overcame extreme conditions and their almost constant miscalculations. Because the computer cannot traffic in these deeply human qualities, the resilient souls of the pioneers are absent from the simulation.

Here we encounter the ambiguity of technology: its propensity to promote certain qualities while sidelining others. McLuhan called this process amplification and amputation. He used the microphone as an example. The microphone can literally amplify one's voice, but in doing so it reduces the speaker's need to exercise his own lung power. Thus one's inner capacities may atrophy.

This phenomenon is of particular concern with children,

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who are in the process of developing all kinds of inner capacities. Examples abound of technology's circumventing the developmental process: the student who uses a spell checker instead of learning to spell, the student who uses a calculator instead of learning to add—young people sacrificing internal growth for external power.

Often, however, this process is not so easily identified. An example is the widespread use of computers in preschools and elementary schools to improve sagging literacy skills. What could be wrong with that? Quite a bit, if we consider the prerequisites to reading and writing. We know that face-to-face conversation is a crucial element in the development of both oral and written communication skills. On the one hand, conversation forces children to generate their own images, which provide connections to the language they hear and eventually will read. This is one reason why reading to children and telling them stories is so important. Television and computers, on the other hand, generally require nothing more than the passive acceptance of prefabricated images.

Now consider that a study reported in *U.S. News & World Report* estimated that the current generation of children, with its legions of struggling readers, would experience one-third fewer face-to-face conversations during their school years than the generation of 30 years ago. It may well be that educators are trying to solve the problem of illiteracy by turning to the very technology that has diminished the experiences children need to become literate.

Obsolete Lessons

But students need to start using computers early in order to prepare for the high-tech future, don't they? Consider that the vast majority of students graduating from college this past spring started kindergarten in 1986, two years after the Macintosh was invented. If they used computers at all in elementary school, they were probably command-line machines with no mouse, no hard drive, and only rudimentary graphics. By the time these students graduated from college, whatever computer skills they picked up in primary school had long been rendered obsolete by the frenetic pace of technological innovation.

The general computer skills a youth needs to enter the workplace or college can easily be learned in one year of instruction during high school. During the nine years that I taught

Advanced Computer Technology for the Des Moines public schools, I discovered that the level of computer skills students brought to the class had little bearing on their success. Teaching them the computer skills was the easy part. What I was not able to provide were the rich and varied firsthand experiences students needed in order to connect the abstract symbols they had to manipulate on the screen to the world around them. Students with scant computer experience but rich ideas and life experiences were, by the end of the year, generating sophisticated relational databases, designing marketable websites, and creating music videos. Ironically, it was the students who had curtailed their time climbing the trees, rolling the dough, and conversing with friends and adults in order to become computer "wizards" who typically had the most trouble finding creative things to do with the computer.

Certainly, many of these highly skilled young people (almost exclusively young men) find opportunities to work on computer and software design at prestigious universities and corporations. But such jobs represent a minuscule percentage of the occupations in this nation. And in any case, the task of early education is not merely to prepare students for making a living; it is to help them learn how to make a life. For that purpose, the computer wizards in my class seemed particularly ill prepared.

So why is it that schools persist in believing they must expose children to computers early? I think it is for the same reason that we take our children to church, to Fourth of July parades, and indeed to rituals of all types: to initiate them into a culture—in this case, the culture of high technology. The purpose is to infuse them with a set of values that supports the high-tech culture that has spread so rapidly across our society. And this, as we shall see, is perhaps the most disturbing trend of all.

The Ecological Impact of Technology

As the promise of a computer revolution in education fades, I often hear promoters fall back on what I'll term the neutrality argument: "Computers are just tools; it's what you do with them that matters." In some sense this is no more than a tautology: Of course it matters *how* we use computers in schools. What matters more, however, is that we use them *at all*. Every tool demands that we somehow change our environment or values in order to accommodate its use. For instance, the building of highways to accommodate the automobile hastened the flight to the suburbs and the decline of inner cities. And over the past 50 years we have radically altered our social landscape to accommodate the television set. In his seminal book *Autonomous Technology*, Langdon Winner dubbed this characteristic "reverse adaptation."

Consider the school personnel who already understand, intuitively, how this principle works: the music teacher whose program has been cut in order to fund computer labs; the principal who has had to beef up security in order to protect

high-priced technology; the superintendent who has had to craft an "acceptable use" agreement that governs children's use of the Internet (and for the first time in our history renounces the school's responsibility for the material children are exposed to while in school). What the computers-are-just-tools argument ignores is the ecological nature of powerful technologies—that is, their introduction into an environment reconstitutes all of the relationships in that environment, some for better and some for worse. Clinging to the belief that computers have no effect on us allows us to turn a blind eye to the sacrifices that schools have made to accommodate them.

Not only do computers send structural ripples throughout a school system, but they also subtly alter the way we think about education. The old saw, "To a man with a hammer everything looks like a nail," has many corollaries (the walls of my home once testified to one of my favorites: to a four-year-old with a crayon, everything looks like drawing paper). One that fits here is, "To an educator with a computer, everything looks like information." And the more prominent we make computers in schools (and in our own lives), the more we see the rapid accumulation, manipulation, and sharing of information as central to the learning process—edging out the contemplation and expression of ideas and the gradual development of meaningful connections to the world.
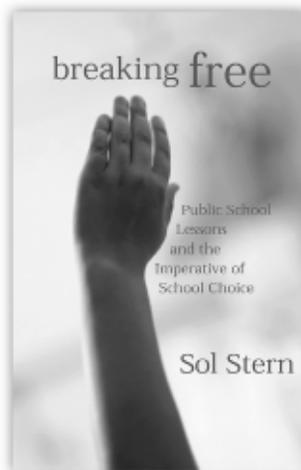
In reconstituting learning as the acquisition of information, the computer also shifts our values. The computer embodies a particular value system, a technological thought world first articulated by Francis Bacon and René Descartes four hundred years ago, that turns our attention outward toward asserting control over our environment (that is essentially what technologies do—extend our power to control from a distance). As it has gradually come to dominate Western thinking, this ideology has entered our educational institutions. Its growing dominance is witnessed in the language that abounds in education: talk of empowerment, student control of learning, standards, assessment tools, and productivity. Almost gone from the conversation are those inner concerns—wisdom, truth, character, imagination, creativity, and meaning—that once formed the core values of education. Outcomes have replaced insights as the yardstick of learning, while standardized tests are replacing human judgment as the means of assessment. No tool supports this technological shift more than computers.

In the Wrong Hands

There are some grave consequences in pushing technological values too far and too soon. Soon after my high-school computer lab was hooked up to the Internet, I realized that my students suddenly had more power to do more damage to more people than any teenagers in history. Had they been carefully prepared to assume responsibility for that power through the arduous process of developing self-discipline, ethical and moral strength, compassion, and connection with the community around them? Hardly. They and their teachers had been too busy putting that power to use.

We must help our young people develop the considerable moral and ethical strength needed to resist abusing the enormous power these machines give them. Those qualities take a great deal of time and effort to develop in a child, but they ought to be as much a prerequisite to using powerful computer tools as is learning how to type. Trying to teach a student to use the power of computer technology appropriately without those moral and ethical traits is like trying to grow a tree without roots.

Rather than nurture those roots, we hand our smallest children machines and then gush about the power and control they display over that rarefied environment. From the earliest years we teach our children that if they have a problem, we have an external tool that will fix it (computers are not the only tools; Ritalin, for example, is a powerful technology that has been scandalously overprescribed to "fix" behavior problems). After years of this training, when our teenagers find themselves confused, angry, depressed, or overwhelmed, we wonder why so many of them don't reach out to the community for help or dig deep within themselves to find the internal strength to persevere, but rather reach for the most powerful (and often deadly) tool they can find to "fix" their problems. Our attempts to use powerful machines to accelerate or remediate learning are part of a pattern that sacrifices the growth of our children's inner resources and deep connectedness to community for the ability to extend their power outward into the world. The world pays a high price for the trade-off.

The response that I often hear to this criticism—that we just need to balance computer use in school with more "hands-on" activities (and maybe a little character education)—sounds reasonable. Certainly schools should help young people develop balanced lives. But the call for balance within schools ignores the massive commitment of resources required to make computers work at all and the resultant need to keep them constantly in use to justify that expense. Furthermore, that view of balance completely discounts the enormous imbalance of children's lives outside of school. Children typically spend nearly half their waking life outside of school sitting in front of screens. Their world is saturated with the artificial, the abstract, the mechanical. Whereas the intellectual focus of schools in the rural society of the 19th century compensated for a childhood steeped in nature and concrete activity, balance today requires a reversal of roles, with schools compensating for the overly abstract, symbolic, and artificial environment that children experience outside of school.

Technology with a Human Purpose

None of this is to say that we should banish computers from all levels of K–12 education. As young people move into subject areas like advanced mathematics and chemistry that rely on highly abstract concepts, computers have much to offer. Young people will also need computer skills when they graduate. But computer-based learning needs to grow out of years of concrete experience and a fundamental appreciation for the world apart from the machine, a world in which nature and human beings are able to speak for and through themselves to the child. Experiences with the computer need to grow out of early reliance on simple tools that depend on and develop the skills of the child rather than complex tools, which have so many

skills already built in. By concentrating high technology in the upper grades, we honor the natural developmental stages of childhood. And there is a bonus: the release of massive amounts of resources currently tied up in expensive machinery that can be redirected toward helping young children develop the inner resources needed to put that machinery to good use when they become adults.

There remains a problem, however. When Bacon began pushing the technological ideology, Western civilization was full of meaning and wretchedly short on the material means of survival. Today we face the reverse situation: a society saturated in material comforts but almost devoid of meaning. Schools that see their job as preparing young people to meet the demands of a technology-driven world merely embrace and advance the idea that human needs are no longer our highest priority, that we must adapt to meet the demands of our machines. We may deliver our children into the world with tremendous technical power, but it is rarely with a well-developed sense of human purpose to guide its use.

If we are to alter that relationship, we will have to think of technological literacy in a new way. Perhaps we could call it technology awareness. Whatever its name, that kind of study, rather than technology training, is what needs to be integrated into the school curriculum. I am currently working with the Alliance for Childhood on a set of developmental guidelines to help educators create technology-awareness programs that help young people think about, not just with, technology. This is not the place to go into the details of those guidelines. What I want to emphasize here is that they share one fundamental feature: They situate technology within a set of human values rather than out in front of those values. They do not start by asking what children need to do to adapt to a machine world, but rather, which technologies can best serve human purposes at every educational level and how we can prepare children to make wise decisions about their use in the future.

The most daunting problems facing our society—drugs, violence, racism, poverty, the dissolution of family and community, and certainly war—are all matters of human purpose and meaning. Filling schools with computers will not help find the answers to why the freest nation in the world has the highest percentage of citizens behind bars or why the wealthiest nation in history condemns a sixth of its children to poverty.

So it seems that we are faced with a remarkable irony: that in an age of increasing artificiality, children first need to sink their hands deeply into what is real; that in an age of light-speed communication, it is crucial that children take the time to develop their own inner voice; that in an age of incredibly powerful machines we must first teach our children how to use the incredible powers that lie deep within themselves.

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