LEADING AMERICA'S SCHOOLS

THROUGH REVOLUTIONARY TIMES*

by

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Abraham Lincoln, a man who had to make a number of short-term decisions with long-term implications, once wrote:

> "If we could first know where we are and whither we are tending, we
> could better judge what to do and how to do it."

If Lincoln was right (and I believe he was), it suggests that a better understanding of the long-term trends that will alter the public school operating environment in the decade ahead would help school board members better judge 'what they should do and how they should do it,' **both** with respect to the day-to-day, short-term issues they face as local board members, **and** with respect to their roles as leaders of education in their respective states.

Long-term Imperatives for Education

Because of the inertial forces embodied in very large systems, we are able to make accurate long range forecasts about the size and make up of society, the size and make up of the economy, and the new marketplace technology that will be commonly available to the society and the economy over the next ten to fifteen years. In fact, hundreds of reliable long range forecasts of the future size and make up of the U.S. society and economy can be found at the U.S. Bureau of Labor Statistics (BLS) website: <www.bls.gov/EMP> under "Projections." BLS' current forecasts suggest that our present labor "surplus" is a temporary consequence of the recent recession, and that shortages of qualified employees will be common in all economic sectors before the decade is over. In fact, severe shortages of skilled recruits in a number of fields – including healthcare and education – persisted throughout the down-turn.

Current labor market shortages are largely being met by expedients: e.g. mandatory overtime, unpaid hours, rehired retirees, and lowered recruitment standards, etc. In America's schools today, for example, according to the U.S. Department of Education, 28% of all K-12 teachers have neither a college major or minor in the subjects they teach. The National Commission on Education and America's Future reported that 12% of entering teachers in 2001 had no classroom experience or teacher training whatsoever!

The current shortage of qualified instructional personnel is expected to get worse. Based on projected K-12 enrollments, the BLS tells us that the numbers of teachers will need to increase by 16% between now and 2010, but the American Association of Colleges of Teacher Education expects the supply of teachers to grow no more than 6% through 2010. What's more, the BLS projects that 25% of all Elementary Teachers, 33% of all High School Teachers, and 40% of all educational administrators will reach retirement age in the next 10 years.

Public Education's Untenable Future

There are unlikely to be enough warm bodies to staff America's classrooms during the coming decade. **BUT**, the "NO CHILD LEFT BEHIND" Act stipulates that there be a "highly qualified" teacher in every classroom by 2006. In September, 2002, the Secretary of Education suggested that the shortage could be solved if schools were to hire "qualified non-teachers," but that the teachers' unions were "standing in the way." Without getting into the merits of the argument itself, as a demographer, I would observe that just 48 months ago, unemployment among college graduates was below 2%, and that any significant labor market surplus now available is largely a function of the current economic slow-down – which we all hope is a temporary phenomenon.

Moreover, recruits from non-teaching backgrounds appear to contribute disproportionately to the high annual national turnover rate among teachers, which averages 16% overall; 20% among low-income urban schools! (The BLS says that turnover rates among comparable salaried professional and technical jobs is 11%.) More than 33% of all new teachers leave the field altogether in three years; 46% in five years. **The bulk of this turnover occurs among transfers-in from non-teaching careers.**

Recruiting teachers from other careers, while it should be promoted on its own merits, cannot be an answer to education's long-term staffing problems, in light of the growing general shortage of "prime-age" (age 25 to 54) workers, especially among the supply of recruits for positions requiring college degrees. Most college graduates during the coming decade will be children of the low birth years of the Baby Bust (1965-1985), while the Baby Boom Echo will be swelling K-16 enrollments.

If we know that public education's workload will increase and that there will be insufficient numbers of qualified human resources to meet that demand, **then** we also know that we will be forced to reduce the average amount of education per child that we deliver, **UNLESS** we can substantially increase the instructional productivity of the resources that we currently devote to our classroom-based, teacher-mediated education system.

Technology to the Rescue?

A central dimension of America's economic success has always been our propensity to use new technology to do things better, faster, and cheaper. And, at this moment, the nation is about to acquire a whole new family of productivity-enhancing tools – the next generation of information technology (IT) – that will make it possible for America's schools to meet the educational challenges of the coming decade, and to fulfill their missions in spite of funding and staffing shortages, aging buildings and newly mandated testing.

Many (most?) readers will be justifiably skeptical at the notion that computers are about to transform education, (or any other institution, for that matter.) It has, after all, been sixty years since the first computer – ENIAC – was switched on, yet our offices are still not paperless and our commerce is still not cashless. And, most of us have lived through many more failed IT projects than successful ones. But economic historians tell us that new technologies don't become reliable, affordable and generally productive until they have matured through a half-century or so of marketplace experimentation and technical refinement. And, in the mid-1990s, as the computer reached its 50th "birthday," America's annual productivity improvement rates more than doubled. What's more, they have remained at that higher rate ever since, after having stagnated for the previous twenty-five years.

Our soaring productivity-improvement rates are not simply the result of maturing information technology. Over the past decade, the successful U.S. adopters of IT have learned exactly what they must do in order to realize significant improvements in performance from their investments in IT. On the basis of a 5-year survey of 1,167 firms in 41 industries, Prof. Eric Brynjolfsson at MIT's Center for Information Work Productivity (<www.iwproductivity.org>), has concluded that, in order to achieve measurable improvements in total factor productivity, it is necessary for an organization to invest $9.00 to $10.00 in *training*, *organizational restructuring, process reengineering* and *job redesign* for every $1.00 spent on IT hardware! Independent multi-year studies by the Harvard and Wharton business schools, Ernst and Young and the OECD have all come to similar conclusions.

Based on our 25-year scan of the business and technology press, plus our own IT consulting work, my colleague, Gregg Edwards, and I have reached very much the same formulation for successful IT systems: 10% of the costs are for hardware and software, 40% of the costs are for staff training and development and 50% of the costs are for organizational restructuring and job redesign. By comparison, available

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data indicate that public schools invest about 70¢ on training for every $1.00 spent on IT, and spend essentially NOTHING on restructuring or job-redesign.

Schools are scarcely alone in their incomplete applications of information technology. As Xerox CEO, Anne Mulcahy, candidly pointed out in an address to other IT executives in March, 2003:

> "It's no secret that technology alone is not enough. Yet many continue to buy IT – and many [of us] continue to sell IT – that way. Productivity is **not** embedded in software code! Business improvement does **not** come in a box! Technology requires changes in the way humans work, yet companies continue to inject technology without making any of the other necessary changes. Why? Because it's easier to write a check than it is to rethink the way you work!"

Classrooms and Computers: A Difficult Relationship

These observations resonate and reverberate throughout American education. It is now widely understood that adding computers to a traditional, hierarchical, authoritarian bureaucracy is as productive as adding spark plugs to a steam engine. Adding computers to a traditional, authoritarian classroom-centered educational institution has much the same effect. There is a fundamental mis-match between the multiple capabilities of our new physical technology – i.e. the computer – and the principal social technology of public education: classroom based, teacher-mediated instruction.

In a recent survey of sixty poor rural elementary schools in South Carolina, James Guthrie, a professor of public policy and education at Vanderbilt University, counted more than 10,000 computers in 2,000 classrooms. While he found large numbers of students practicing low-level keyboard skills in computer "labs," he only saw **two** students actually use a computer in a classroom. Subsequent surveys in Colorado and Tennessee produced similar results. *Teacher-mediated classrooms do not foster computer-mediated learning*!

If we are to use IT to improve the productivity of American public education, it must be understood that we will have to re-conceive our traditional teacher-mediated model of instruction. Indeed, if we are serious about 'leaving no child behind,' we will need to abandon our nearly universal dependence on classroom-based teaching in any case, in light of what researchers have discovered regarding individual learning styles over the past twenty years. Without getting into the rich diversity of formulations by which various scholars differentiate among the learning styles of individuals, clinical research strongly suggests that:

• Roughly 25% of the general population learn most effectively in a passive auditory mode, sitting in a classroom and listening to a lecture. (Center for the Study of Learning and Teaching Styles, St. Johns University, Jamaica, NY, 718-990-6335, www.learningstyles.net).

- About 30% of us are primarily visual learners, who acquire competence best by reading books, by working with charts, graphs and diagrams, or by watching instructional videos.

- But 45% of us – mostly males – are principally "tactile-kinesthetic learners," who are best able to master abstract facts and intellectual skills in the context of practical, real world tasks and circumstances.

Classroom Teaching vs. Contextual Learning

Contextual learning can take many forms, including laboratory assignments, apprentice and internship programs, community projects, team learning; computer games and simulations. In many parts of Europe, apprenticeship programs are a prominent feature of the public education system and, in the past decade, they have been successfully instituted by public schools in Oregon, Pennsylvania and Wisconsin. And, roughly one-third of U.S. public schools have instituted formal community service learning programs.

Contextual learning of all kinds has been shown to boost academic achievement and to reduce drop-out rates in school systems around the U.S. Employers benefit from participating in school-to-work programs as well, experiencing substantially lower employee turnover and higher productivity than employers who do not participate in such programs.

In spite of the proven multiple benefits of contextual learning, Americans remain remarkably devoted to classroom teaching as our principal – even sole – mode of instruction. This helps to explain why the vast majority of charter schools in the U.S. are essentially indistinguishable from their public school counterparts, offering predominantly classroom-based instruction and producing no statistically significant improvements in student achievement over the public schools they have supplanted. Many supporters of charter schools – and of vouchers – believe that the only thing wrong with public schools is their mis-management by educrats and the obdurance of the teachers' unions. In the view of these reformers, if we could get rid of those two negative influences, the traditional 20th Century public school would be a perfectly satisfactory means of delivering education in the 21st Century. Except, of course, it won't, since:

- Classroom-based instruction only engages roughly half of all students in learning; and

- we are unlikely to have sufficient numbers of qualified teachers to fully staff a purely classroom-based school system, in any event.

If American education is truly going to "leave no child behind," it will be necessary for public schools to substantially increase their instructional productivity in general,

and to better serve contextual learners in particular. To address these challenges, educators will have at their disposal an arsenal of pedagogically-potent new IT capabilities. The question is, will they use it?

Coming Soon, to a Future Near You!

The four following applications of information technology are already in the marketplace. The first two innovations – broadband Internet access and open source software – offer educational institutions the means to substantially reduce their over-head costs while improving the quality of their administrative support for teachers and students. The second two innovations – wireless Internet access and groupware – will make it possible to re-invent classroom instruction.

1. BROADBAND (HIGH SPEED) INTERNET ACCESS

The great majority of large private and public institutions, including over 90% of all public schools, have broadband – or high speed – access to the Internet. Broadband looms large in the future of all education, since it permits real-time "streaming" of video images, which experience has shown is essential for professional quality "distant" learning via the Internet.

Distant Learning: Today, over 50,000 U.S. public school students take some or all of their courses on-line, and virtual classes using broadband Web access are getting high marks from students, and from their teachers and testers. With broadband, instructional materials download instantly; dialogue occurs in real time, Web searches are much faster, sounds are transmitted faithfully, and visuals can be made 3-dimensional. From now on, it is reasonable to assume that, if a particular subject-matter is not available at a local school, it will be possible to arrange appropriate high quality on-line courses.

Given the current rapid rate of growth – and quality improvement – in on-line instructional offerings, it is entirely reasonable to assume that, by 2005-2006, students in "failing" middle and secondary schools under NCLB will be provided with broadband access to quality distant learning – like that provided by Florida On-Line High School – as an alternative to physically transferring the students to a better school. As a comprehensive distant learning curriculum emerges, public school systems will increasingly be better able to serve home-bound learners and to support home schooling. In fact, on-line education will emerge as a serious competitor to public schools in less than 5 years.

Frictionless Commerce: While the high speed Internet is enriching the teaching/learning functions of public education, it will also be reducing its administrative overhead by eliminating paperwork. Specifically, electronic transactions are so much cheaper to process and record than paper or cash transactions that banks are employing user fees to coerce their customers to adopt on-line bill payment. This, in turn, will encourage the use of the Internet for all transactions, including procurement. The average overhead cost of a paper-based

public school purchase order is estimated to be $125.00. Two on-line school purchasing networks – Epylon.com and Simplexis.com – claim to reduce that cost to $25.00. Total conversion to electronic purchasing would save public education nationwide **over** $8 billion annually – enough to hire 150,000 new teachers – simply by shifting school procurement activities to the Internet.

Distributed Computing: The broadband Internet can move such high volumes of data at such rapid speeds that it has permitted the creation of two new forms of data processing: Grid Computing and Information Utilities. Both offer significant opportunities for schools to reduce IT costs.

Grid Computing – As organizations have acquired growing numbers of increasingly powerful desktop computers, the average percentage of each computer's capacity that is actually utilized has declined. Industry experts variously estimate that most businesses only use from between 10% to 60% of their total computing capacity. To help colleges and universities tap into their underutilized campus computers, the National Science Foundation funded the development of public domain computer software – called *Globus Toolkit* – which automatically mobilizes an organization's unused computing capacity over the Internet as needed for research, operational overloads or administrative services.

A number of IT firms (IBM, H-P, Platform and Microsoft), offer – or plan to offer – grid computing services. Large public school systems, with thousands of underutilized computers, can use grid computing to absorb the growing data processing demands of increasing enrollments without acquiring additional central computing capacity. In particular, by pooling their surplus computing capacity, most school systems should be able to handle the substantial new data processing requirements posed by NCLB testing and record keeping. School districts could also lease out their unutilized computing capacity to other local public institutions or to commercial customers over the Net.

Information Utilities – Large computer firms, including IBM, H-P and Sun, are using Globus software as a means to provide clientele comprehensive computing services over the Internet. Clients of these "information utilities" pay a flat monthly fee for all of the computing services they had previously provided for themselves. Customers report saving 20% to 55% over their in-house operations. Industry experts project that information utilities will provide 15% of the nation's total computer services in 5 years. Small and medium sized enterprises, hard pressed to keep up with rapidly-evolving technology and unable to attract and retain quality IT personnel in a tight labor market, are expected to be the principal subscribers to information utilities. Similar logic is likely to lead small and medium sized school districts to outsource their computer operations – both academic and administrative – to information utilities.

2. LINUX (OPEN SOURCE SOFTWARE) –

Linux, one of a family of *open source* computer programming systems whose software applications and basic code are freely available on-line, was created and is maintained by a self-organizing community of volunteer programmers worldwide as a superior free alternative to the high priced proprietary programs – primarily Microsoft and Unix – that currently control 95% of all business software applications. Linux has repeatedly proven to be not only cheaper, but faster, less error-prone and more secure than comparable proprietary programs. As a result, seventy-five countries, including the U.K., France and Germany, have adopted pro-open source procurement policies for all public sector software, including schools. In order to keep some developing nations from converting to open source programs, the IT press reports that Microsoft has discounted its prices by 95% to 100%.

Clearly, one major benefit of the "SoftWars" will be lower prices from the proprietary vendors; Sun is now offering its proprietary Unix software free to public schools. But an even bigger benefit is reduced expenditures for enhanced services. E-tailing giant Amazon reports that it cut its quarterly IT costs over 30% ($20 million) in just 18 months by switching to Linux. A worldwide consortium of educators has established an on-line network to promote and support the adoption of Linux by public schools <www.schoolforge.com>.

3. WI-FI: WIRELESS INTERNET ACCESS –

As a matter of practice (if not school policy), most teachers will not assign homework to students that involves the Internet so long as there are students in the class who do not have Internet access at home. More than one-third of all U.S. households still have no Internet hook up. Moreover, only 28% of all U.S. households have been willing or able to spend $40 to $50 per month that it has cost for the high-speed service essential for effective on-line learning. And an estimated one-third of U.S. homes – mostly in rural or inner-city residential areas – are more than three miles away from a high speed switching center, and thus have no access to the broadband Internet at all.

Now that WalMart is selling PC's with "Lindows" open source software for $199.00, the sole remaining systemic source of a "digital divide" between information "haves" and "have-nots" in America is the high cost and limited reach of high speed Web access. In 2000, we began to bridge this gap in our info-structure with an unprepossessing technology called Wi-Fi (for WIde FIdelity). Originally tariffed as a device to wirelessly connect all the computers in an office, Wi-Fi has now been tweaked by engineers to transmit high speed Internet signals over five miles on public-use (free!) radio broadcast frequencies. Wi-Fi is being installed by individual businesses – such as Starbucks and McDonalds – plus airports, public parks, college campuses and in a growing number of central business districts. A beefed-up version of Wi-Fi, called WiMax, will enter the market in 2006; it has a range of 30 miles.

Since 90+% of public school buildings already have high speed Web access, they need to spend only a few hundred dollars on a Wi-Fi transponder ($2,500.00 for WiMax), to be able to broadcast that access to their neighborhoods or communities. By providing its students with low-cost access to high quality broadband Internet service, a school will concomitantly be making that access available to their students' families, their studentless neighbors and local businesses and volunteer organizations. Wi-Fi will not only permit the fuller integration of computers and the Internet into public education, it will strengthen the relationship between schools and their communities, because the schools will have bridged the digital divide that had separated those communities from the future.

4. GROUPWARE: PUTTING IT ALL TOGETHER

As its name suggests, "groupware" is software designed to facilitate on-line collaboration. Two types of groupware have achieved mass market status since 2000: Peer-to-Peer file sharing (P2P), and Instant Messaging (IM).

Peer-to-Peer file sharing (P2P) software was originally created to permit dispersed teams of scientists and engineers to contribute to individual research and programming projects. Freely downloadable on the Internet, P2P software permits users to up- and down-load information back and forth between designated files in each others' computers. P2P is so easy to use that tens of millions of school children have employed file-sharing software to download $billions worth of pop music from each other. For schools/communities that use Wi-Fi to give all their students low cost/high speed access to the Web, P2P file sharing will immediately offer teachers a range of off-the-shelf applications to overlay on their traditional, paper-based classroom activities, including class assignments, reference sources, homework, project work, portfolios, etc.

Instant Messaging (IM) software is the most popular form of groupware. Its principal merit is that it allows members of a group to quickly see who else in the group is currently on-line, and to send text messages that appear immediately on the recipients' computer screens. IMs can be sent to single individuals or to many, and the speed and certainty of transmission make an IM chat session as spontaneous as a real classroom discussion. Full-service IM systems also feature video-conferencing, group Web-surfing, and common use collaboration space, or white boards. (A comparative review of the seven most popular Instant Messaging systems appeared in the June 26, 2003, issue of *Network Computing* magazine.) Using IM software, teachers can easily create a separate on-line "group" for each of their classes. Students can form groups of their own to support a team project and teachers could assign project-specific resources to the project's IM group to include access to special archives, outside experts, etc. Using IM, schools can better support home-bound or offsite students and mentors on intern or apprenticeship assignments, or students working on community projects.

One aspect of instant messaging must be of particular concern to educators. Whether or not public schools incorporate IM into their formal teaching/learning processes, we can be certain that the students will. Young people are already comfortable using IM. (Students in Europe and the U.S. have already been disciplined for using IM to share answers during tests.) Unless schools and teachers establish their presence in the world of instant messaging, cyberspace will be dominated by student peer culture, while public schools will be left out of the loop and faculty will be made less relevant. The cultural anthropologists are already reporting that cell phones and IM are dramatically increasing the considerable power of peer culture. By making IM an integral part of formal education, public schools will extend the legitimate authority of "in loco parentis" on line, bringing some order to the anarchy of cyberspace.

"The wise leader exploits the inevitable." *Sun Tzu*

Technologic progress has now placed at the disposal of America's educators powerful new low-cost off-the-shelf tools with which schools can make learning more engaging and knowledge much more accessible. This is no time to be trying to re-vivify 20th Century schools. Nor is it time to be flogging faculty and administrators to deliver 21st Century graduates without investing in 21st Century technology and the training needed to give teachers a mastery of that technology. This is the time to be re-inventing American education – class-by-class, school-by-school – from the bottom up, in what Thomas Jefferson called the "civic laboratories" of our state and local governments.

Given the impending labor supply/work skills realities facing all U.S. enterprises, this is clearly the moment to explore how our new information technologies can be used to permit closer collaboration between educators and employers, and to connect classroom learning with community life to more actively engage students in learning. At this revolutionary moment in our future, entire communities must become involved in life-long learning – young and old alike – and public schools must become educational centers with civic circumferences.

Meanwhile, to the degree that politics is the art of the possible, it is time for the state leaders of education from across the country to mobilize around the mounting nationwide dismay over the dysfunctional consequences of the NCLB testing regimen, and organize a movement to *reform the reform*. At this watershed moment, we will go further faster by creating the future than we will by trying to reinforce the past. The single overarching reality that should preoccupy the leadership of American public education today is that we will not have sufficient resources to provide "success for every 21st Century student" using 19th Century schools and teaching practices. If we are to avoid the rationing of education – and thus, rationing success – we will have to re-invent public schools in the civic laboratories of our local communities, and we need to start now!